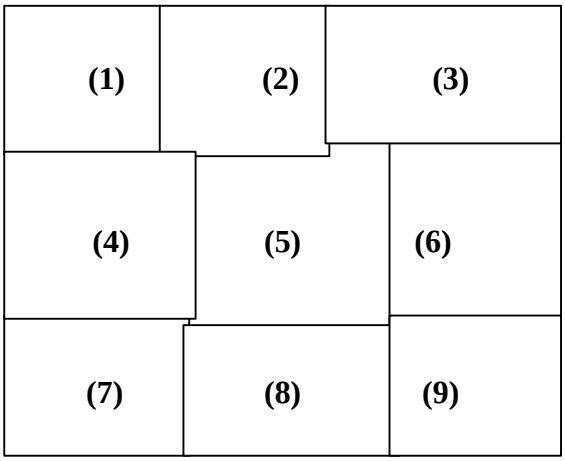
DEPARTMENT OF DEFENSE NUCLEAR/BIOLOGICAL/CHEMICAL (NBC) DEFENSE

ANNUAL REPORT TO CONGRESS MARCH 1999



Cover images:

(1) Crew spraying decontaminant solution on vehicle
(2) M31 Biological Integrated Detection System (BIDS) - Non-Developmental Item (NDI)
(3) Chemical Biological Protective Shelter (CBPS)
(4) Member of the 51st Security Forces Squadron, talks to other search team members via radio while conducting a search during exercise Beverly Midnight 99-1
(5) Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD) mounted on Unmanned Aerial Vehicle
(6) Researcher in overpressured protective suit in biosafety level 4 (BL-4) laboratory at the U.S. Army Research Institute of Infectious Diseases (USAMRIID)
(7) Prototype Portal Shield biological detector
(8) Simulated biological and chemical dosage distribution patterns
(9) Sailor receiving shot of the anthrax vaccine

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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 provided the essential authority to ensure the elimination of unnecessarily redundant programs, focusing funds on DoD and program priorities, and enhancing readiness.*

The objective of the Department of Defense (DoD) Chemical and Biological Defense Program (CBDP) is to enable our forces to survive, fight, and win in a chemically or biologically contaminated warfare environment. The DoD CBDP provides development and procurement of systems to enhance the ability of U.S. forces to deter and defend against CB agents during regional contingencies. The probability of U.S. forces encountering CB agents during worldwide conflicts remains high. An effective defense reduces the probability of a CB attack, and if an attack occurs, it enables U.S. forces to survive, continue operations, and win. Scientific, technological, and resource limitations remain in preventing U.S. forces from having complete full dimensional protection and meeting all requirements for two nearly simultaneous Major Theater Wars. The unique physical, toxicological, destructive, and other properties of each threat requires that operational and technological responses be tailored to the threat. Nevertheless, significant progress has been made in overcoming these limitations since the establishment of the DoD CBDP. Still, U.S. forces remain the best protected forces in the world for surviving and conducting operations in chemically or biologically contaminated environments.

During the past year, DoD took several steps to ensure the protection of U.S. forces against both immediate and future chemical and biological threats. This report details DoD's current and planned capabilities. However, highlights from the past year include initiating immunization of all U.S. forces with the licensed anthrax vaccine—a deadly biological warfare agent, deployment of advanced biological detection equipment during Operation Desert Thunder, and continued enhancement of DoD CBDP funds to protect against validated and emerging threats through the far-term future.

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, the DoD CBDP will continue 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.

The program continues to implement congressional direction to improve jointness and reflects an integrated DoD developed program. This year's program continues funding to support the highest priority counterproliferation initiatives. During the past year, the Department reviewed its capabilities to protect against the asymmetric threats from chemical and biological weapons. As a result of the review, funding was identified to enhance and accelerate high-payoff technologies and advanced CB defense systems. The FY00–01 President's Budget Submission includes $380 million in increased research and development funding for biological warfare defense and vaccines over the FY 2000-05 Future Years Defense Program (FYDP), as well as additional FY 1999 Emergency Supplemental funding to procure CB defense equipment for the Guard and Reserves to support the Consequence Management mission. Moreover, the Department continues to procure new CB defense equipment for our forces, due in large measure to the May 1997 *Report of the Quadrennial Defense Review* (QDR) recommendation to increase planned spending on counterproliferation by $1 billion over the FY 1999–2003 program period, of which $732 million was allocated to the DoD CBDP.

The DoD CBDP invests in technologies to provide improved capabilities that have minimal adverse impact on our warfighting potential. Joint and Service unique programs provide capabilities to support the framework of the three commodity areas of CB defense: Contamination Avoidance (detection, identification, warning/reporting, reconnaissance), Protection (individual, collective, medical support), and Decontamination. All of these capabilities integrated together as a system-of-systems are essential to avoid contamination and to sustain operational tempo on an asymmetric battlefield. Moreover, sound Joint doctrine and realistic training remain fundamental to our defense against chemical and biological weapons. In summary, the DoD CBDP is focusing on a jointly integrated, balanced approach to obtaining needed capabilities for our forces within affordability constraints.

OVERVIEW OF REPORT

The ***INTRODUCTION*** provides a background of the rationale and purpose of the DoD Chemical and Biological Defense Program (CBDP). This section summarizes the key counter-proliferation priorities and the current chemical and biological warfare threats to U.S. forces. Intelligence documents tailored to the threat are essential for developing and updating requirements for chemical and biological defense programs. Each chemical and biological defense research, development, and acquisition effort funded within the program responds to a defined or validated threat. Variations among chemical and biological agents and each agent's unique physical, toxicological, destructive, and other properties such as means of delivery require that operational and technological responses be tailored to the threat. Intelligence efforts continue to emphasize collection and analysis of nations' "dual-use" 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 CBDP 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, including integration of medical and non-medical chemical and biological defense programs. *50 USC 1522 has been a critical tool for ensuring the elimination of redundant programs, focusing funds on program priorities, and enhancing readiness.* This chapter outlines the changes within the oversight and management structure that have occurred as a result of the Defense Reform Initiative and the establishment of the Defense Threat Reduction Agency.

CHAPTER 2 provides information on non-medical NBC defense requirements and 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 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 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 model of Joint Chemical Defense Equipment Consumption Rates (JCHEMRATES IV). Additional information is derived from 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 P.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. This chapter also provides information on the move of the Chemical School from Fort McClellan, Alabama to Fort Leonard Wood, Missouri.

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 CBDP. One of the successes of the DoD NBC Defense Program has been the consolidation of all DoD NBC Defense RDT&E and procurement program funds under defense-wide program elements, rather than throughout numerous Service accounts. ***Annex F*** provides a reference to NBC defense related sites on the internet. ***Annex G*** provides a statement regarding chemical and biological defense programs involving human subjects as required by 50 USC 1523. As detailed in the annex, no such testing has been conducted in over two decades and none is planned. ***Annex H*** provides the text of the Congressional language requiring this report. ***Annex I*** provides a list of the many acronyms and abbreviations that are used throughout this report.

Table of Contents

Page

EXECUTIVE SUMMARY ..... *i*
INTRODUCTION ..... *xi*

CHAPTERS

1 DOD CHEMICAL AND BIOLOGICAL DEFENSE PROGRAM MANAGEMENT AND OVERSIGHT 1-1
1.1 Management Implementation Efforts 1-1
1.1.1 Management Reviews 1-1
1.1.2 Coordination and Integration of the Program 1-1
1.2 Organizational Relationships 1-2
1.3 Technology Base Review and Assessment 1-4
1.4 DARPA Biological Warfare Defense Program Management 1-5
1.5 Funds Management 1-5
1.6 NBC Defense Program Management Assessment 1-7

2 NON-MEDICAL NBC WARFARE DEFENSE REQUIREMENTS AND R&D PROGRAM STATUS 2-1
2.1 Introduction 2-1
2.2 NBC Defense Mission Area Requirements and RDA Summary 2-3
2.3 Contamination Avoidance (Detection, Identification and Warning) 2-3
2.3.1 Contamination Avoidance Science and Technology Efforts 2-3
2.3.1.1 Goals and Timeframes 2-3
2.3.1.2 Potential Payoffs and Transition Opportunities 2-4
2.3.1.3 Major Technical Challenges 2-4
2.3.2 Contamination Avoidance Modernization Strategy 2-5
2.3.3 Joint Service Contamination Avoidance Programs 2-7
2.3.4 Warning and Reporting 2-9
2.3.5 Other Contamination Avoidance Programs 2-9
2.3.6 Defense Advanced Research Projects Agency (DARPA) Programs 2-10
2.4 Protection 2-11
2.4.1 Protection Science and Technology Efforts 2-11
2.4.1.1 Individual Protection Goals and Timeframes 2-11
2.4.1.2 Collective Protection Goals and Timeframes 2-11
2.4.1.3 Potential Payoffs and Transition Opportunities 2-12
2.4.1.4 Major Technical Challenges 2-12
2.4.2 Protection Modernization Strategy 2-12
2.4.3 Joint Service Protection Programs 2-16
2.4.4 Other Protection Programs 2-19
2.5 Decontamination 2-20
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 2-21
2.5.2 Decontamination Modernization Strategy 2-21
2.5.3 Joint Service Decontamination Programs 2-23
2.5.4 Other Decontamination Programs 2-23
2.6 Non-Medical CB Defense Requirements Assessment 2-24

3 MEDICAL NBC WARFARE DEFENSE REQUIREMENTS AND R&D PROGRAM STATUS 3-1
3.1 Requirements 3-1
3.1.1 Introduction 3-1
3.1.2 Challenges in the Medical NBC Warfare Defense Programs 3-2
3.1.3 Reducing Reliance on Research Animals 3-4
3.1.4 Medical Program Organization 3-4
3.2 Medical Chemical Defense Research Program 3-5
3.2.1 Goals 3-5
3.2.2 Objectives 3-6
3.2.3 Threats, Countermeasures, Technical Barriers, Status, and Accomplishments 3-7
3.3 Medical Biological Defense Research Program 3-7
3.3.1 Goals 3-7
3.3.2 Objectives 3-7
3.3.3 Threats, Countermeasures, and Technical Barriers 3-10
3.3.4 DARPA Programs 3-11
3.4 Medical Nuclear (Radiological) Defense Research Program 3-12
3.4.1 Goals 3-12
3.4.2 Objectives 3-13
3.4.3 Threats, Countermeasures, Technical Barriers, and Accomplishments 3-13
3.5 Medical NBC Research Projection 3-15
3.6 Medical R&D Requirements Assessment 3-16

4 NBC WARFARE DEFENSE LOGISTICS STATUS 4-1
4.1 Introduction 4-1
4.2 NBC Defense Logistics Management 4-3
4.3 Quantities, Characteristics, and Capabilities 4-5
4.4 Logistics Status 4-5
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 4-14
Appendix 2: Fielded NBC Defense Items – Issues and Concerns 4-29
1. Contamination Avoidance 4-29
2. Individual Protection 4-30
3. Collective Protection 4-32
4. Decontamination 4-34

5. Medical 4-35

5 NBC DEFENSE READINESS AND TRAINING 5-1
5.1 Introduction 5-1
5.2 Joint NBC Defense Doctrine 5-1
5.2.1 Joint NBC Defense Doctrine Program Management 5-2
5.2.2 Joint NBC Defense Doctrine Development Program 5-2
5.2.3 Army Medical Doctrine Development Program 5-2
5.2.4 Air Force Medical Doctrine Development Program 5-3
5.2.5 Marine Corps Doctrine 5-3
5.3 Standards/Proficiency and Currency 5-4
5.3.1 Army 5-4
5.3.2 Air Force 5-9
5.3.3 Navy 5-11
5.3.4 Marine Corps 5-12
5.4 NBC Defense Professional Training 5-14
5.4.1 Joint NBC Defense Professional Training 5-14
5.4.2 Army NBC Defense Professional Training 5-15
5.4.3 Air Force NBC Defense Professional Training 5-17
5.4.4 Navy CBR Defense Professional Training 5-18
5.4.5 Marine Corps NBC Defense Professional Training 5-19
5.5 Training in a Toxic Chemical Environment 5-21
5.6 Integration of Realism/Wargames/Exercises 5-22
5.6.1 Simulations and Wargames 5-22
5.6.2 Joint NBC Training/Joint and Combined Exercises 5-23
5.7 Initiatives 5-26
5.7.1 Joint 5-26
5.7.2 Army 5-27
5.7.3 Air Force 5-28
5.7.4 Navy 5-29
5.7.5 Marine Corps 5-30
5.7.6 Emergency Response: Army Medical Response 5-31
5.8 Readiness Reporting System 5-35
5.9 NBC Defense Training and Readiness Assessment 5-35

6 STATUS OF DOD EFFORTS TO IMPLEMENT THE CHEMICAL WEAPONS CONVENTION 6-1
6.1 Introduction 6-1
6.2 Department of Defense Implementation of the CWC 6-1
6.3 Safety Orientation for Inspectors 6-2
6.4 Preparation of Defense Installations 6-2
6.5 Defense Treaty Inspection Readiness Program 6-3
6.6 Article X Assistance and Other Assistance 6-3
6.7 Verification Technology 6-3

ANNEXES **Page**

A Contamination Avoidance Programs A-1
1. Fielded and Production Items A-1
2. RDTE Items A-10
B Non-Medical Protection Programs B-1
1. Fielded and Production Items B-1
2. RDTE Items B-14
C Decontamination Programs C-1
1. Fielded and Production Items C-1
2. RDTE Items C-4
D Joint Medical Chemical, Biological, and Nuclear Defense Research Programs D-1
D.1 Medical Chemical Defense Research Program D-1
D.2 Medical Biological Defense Research Program D-10
D.3 Medical Nuclear (Radiological) Defense Research Program D-26
E Joint Nuclear, Biological, and Chemical, Defense Program Summary E-1
F Nuclear, Biological, and Chemical Defense Internet Sites F-1
G Statement Regarding Chemical and Biological Defense Programs Involving Human Subjects F-1
H Congressional Reporting Requirement: 50 USC 1523 ..... G-1
I Acronyms and Abbreviations I-1

TABLES AND FIGURES

TABLES **Page**

I-1 Required CINC Counterproliferation Capabilities ..... *xi*
2-1 Prioritized Joint Future Operational Capabilities 2-2
2-2 Contamination Avoidance Science and Technology Strategy 2-4
2-3 Contamination Avoidance Modernization Strategy 2-5
2-4 Contamination Avoidance RDA Efforts 2-6
2-5 Protection Science and Technology Strategy 2-12
2-6 Protection Modernization Strategy 2-14
2-7 Protection RDA Efforts 2-15
2-8 Decontamination Science and Technology Strategy 2-20
2-9 Decontamination Modernization Strategy 2-22
2-10 Decontamination RDA Efforts 2-22
2-11 Selected JSLIST Operational Requirements 2-25
3-1 Medical Biological Defense Countermeasures and Diagnostic Techniques 3-11
3-2 Medical Nuclear Defense Countermeasures 3-14
3-3 Medical NBC Defense Programs and Modernization Strategy 3-15
4-1 Logistic Risk Assessments: 50 NBC Defense Items 4-9
4-2a Army Logistics Readiness Data - Nonconsumables 4-15
4-2b Army Logistics Readiness Data - Consumables 4-16
4-3a Air Force Logistics Readiness Data - Nonconsumables 4-18
4-3b Air Force Logistics Readiness Data - Consumables 4-19
4-4a Navy Logistics Readiness Data - Nonconsumables 4-21
4-4b Navy Logistics Readiness Data - Consumables 4-22
4-5a Marine Corps Logistics Readiness Data - Nonconsumables 4-24
4-5b Marine Corps Logistics Readiness Data - Consumables 4-25
4-6 Defense Logistics Agency Logistics Readiness Data - Consumables 4-27
5-1 Selected NATO Groups 5-3

FIGURES

1-1 Chemical and Biological Defense Program Management and Oversight Structure (At the Beginning of Calendar Year 1998) 1-2
1-2 Chemical and Biological Defense Management and Oversight Structure 1-3
1-3 Chemical and Biological Defense Funds Management Process 1-6
3-1 Integration of FDA and DoD Milestone Requirements 3-3
4-1 War Reserve Requirements and Planning 4-4
4-2 Logistic Risk Assessments: 50 NBC Defense Items 4-7
5-1 USMC Individual NBC Training 5-13
5-2 USMC Collective Training, NBC Requirements 5-14
5-3 U.S. Army Entry Training 5-16
5-4 U.S. Army Officer Advanced Training 5-17
5-5 USMC Individual Training (Enlisted NBC Specialists) 5-20
5-6 USMC Individual Training (Training for NBC Officers) 5-21
5-7 Chemical/Biological Incident Response Force (CBIRF) Role in Training 5-30

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Introduction

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 sixth 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 October 1998 report, *A National Security for a New Century*, 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. Capabilities which are supported by the NBC defense program are highlighted in **bold**.

Table I-1. Required CINC Counterproliferation Capabilities

1. **Provide individual protection to forces and assist allies/coalition partners**
2. Intercept conventional delivery of WMD and control collateral effects
3. **Provide collective protection to forces and assist allies/coalition partners**
4. **Mitigate the effects of WMD use**
5. **Detect** and monitor development, production, deployment, **employment of WMD**
6. Communicate the ability/will to employ interdiction/response capabilities
7. Determine vulnerabilities in WMD development, production, transfer, deployment, and employment
8. Conduct off-site attack to destroy, disable, and deny WMD targets
9. Establish and maintain relations with allies, and potential adversaries to discourage development, production, and use of WMD
10. Seize, destroy, disable, and deny transport of WMD
11. Communicate the ability/will to employ defensive capabilities
12. Determine vulnerabilities in decision making process related to WMD
13. Conduct information warfare to destroy, disable, and deny WMD

* 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.

14. Support treaties, export controls, and political/diplomatic efforts
15. Provide alternatives to the pursuit of WMD
16. Provide intelligence collection capabilities in support of USG non-proliferation efforts
17. Conduct on-site attack to seize, destroy, disable, and deny WMD targets
18. Provide personnel, training, materiel, equipment to support security assistance
19. Destroy, disable, and deny actor's non-WMD resources and capabilities

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 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 continue improving our NBC defensive capabilities. These continuing improvements also contribute to our overall deterrence by demonstrating to an adversary that use of NBC weapons provides no military advantage. 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 chemical and biological weapons (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 development of 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. THE CURRENT CHEMICAL AND BIOLOGICAL WARFARE THREAT

Northeast Asia

North Korea has been pursuing research and development related to biological warfare since the 1960s. Pyongyang's resources presently include a rudimentary (by Western standards) biotechnology infrastructure that is sufficient to support the production of limited quantities of toxins, as well as viral and bacterial biological warfare agents. In the early 1990s, an open press release by a foreign government referred to applied military biotechnology work at numerous North Korean medical institutes and universities dealing with pathogens such as anthrax, cholera, and plague. North Korea possesses a sufficient munitions-production infrastructure to accomplish weaponization of BW agents. North Korea acceded to the Biological Weapons Convention (BWC) in 1987.

By comparison, North Korea's chemical warfare program is believed to be mature and includes the capability, since 1989, to indigenously produce bulk quantities of nerve, blister, choking and blood chemical agents as well as a variety of different filled munitions systems. North Korea is believed to possess a sizable stockpile of chemical weapons, which could be employed in offensive military operations against the South. 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, due to intrusive inspection and verification requirements mandated by the agreement.

China possesses an advanced biotechnology infrastructure as well as the requisite munitions production capabilities necessary to develop, produce and weaponize biological agents. Although China has consistently claimed that it has never researched or produced biological weapons, it is nonetheless believed likely that it retains a biological warfare capability begun before acceding to the BWC.

China is believed to have an advanced chemical warfare program that includes research and development, production and weaponization capabilities. Its current inventory is believed to include the full range of traditional chemical agents. It also has a wide variety of delivery systems for chemical agents to include 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. China has signed and ratified the CWC.

South Asia

India has a well-developed biotechnology infrastructure that includes numerous pharmaceutical production facilities bio-containment laboratories (including BL-3) for working with lethal pathogens. It also has qualified scientists with expertise in infectious diseases. Some of India's facilities are being used to support research and development for BW defense purposes. These facilities constitute a substantial capability for offensive purposes as well. India is a signatory to the BWC of 1972.

India also has an advanced commercial chemical industry, and produces the bulk of its own chemicals for domestic consumption. New Delhi ratified the CWC in 1996. In its required declarations, it acknowledged the existence of a chemical warfare program. New Delhi has pledged that all facilities related to its CW program would be open for inspection.

Pakistan has a capable but less well-developed biotechnology infrastructure than India. Its facilities, while fewer in number, could nonetheless support work on lethal biological pathogens. Moreover, Pakistan is believed to have the resources and capabilities necessary to support a limited offensive biological warfare research and development effort. Like India, Pakistan is a signatory to 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 systems which 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 now believed to generally be in the advanced 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. Iran is a signatory to the BWC of 1972.

Iran initiated a chemical weapons program in the early stages of the Iran-Iraq war after it was attacked with chemical weapons. The program has received heightened attention since the early 1990s with an expansion in both the chemical production infrastructure as well as its munitions arsenal. Iran currently possesses munitions containing blister, blood, and choking agents and may have nerve agents as well. It has the capability to deliver CW agents using artillery shells and aerial bombs. Iran has ratified the CWC under which it is obligated to open suspected sites to international inspection and eliminate its CW program.

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 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. United Nations Special Commission (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, 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 that included a variety of nerve agents, such as tabun (GA), sarin (GB), and GF, as well as the blister agent mustard, available for offensive use. Iraq also undertook a program, begun in 1985 and continuing uninterrupted until December 1990, to produce the advanced nerve agent VX. Recent UNSCOM findings indicate that Iraq had weaponized VX in Al Hussein missile warheads. Although Iraq's chemical warfare program suffered extensive damage during the Gulf War and subsequently from UNSCOM activity, Iraq retains a limited capability to re-constitute key parts of its chemical warfare program. Moreover, UNSCOM is still unable to verify elements of Iraqi declarations such as the disposal of chemical precursors, as well as the destruction of all chemical munitions. The comprehensive nature of Iraq's previous chemical warfare activity and the consistent pattern of denial and deception employed by Iraqi authorities indicate a high-level intent to rebuild this capacity, should Iraq be given the opportunity.

Syria has a limited biotechnology infrastructure but 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, but not ratified, 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 of 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 and is unlikely to do so in the near future.

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 has experienced major setbacks to its chemical warfare program, first as a result of intense public scrutiny focused on its Rabta facility in the late 1980s and more recently on its Tarhuna underground facility. Nevertheless, Libya retains a small inventory of chemical weapons, as well as the a CW agent production capability. Prior to closing its Rabta plant in 1990, Libya succeeded in producing up to 100 tons of blister and nerve agent at the site. Although the site was re-opened in 1995, ostensibly as a pharmaceutical plant, the facility is still believed

capable of producing CW agents. CW-related activities at the Tarhuna site are believed to be suspended. Libya has not ratified the CWC and is not likely to do so in the near future.

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 nonmilitary 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 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 warheads. Actual agents include a variety of nerve and blister agents. Additionally, some Russian chemical weapons incorporate agent mixtures, while others have added thickening materials in order 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 considered on the CWC's schedule of chemicals.

PROLIFERATION

The United States faces a number of regional proliferation challenges. Many of these are detailed in the November 1997 report published by the Office of the Secretary of Defense, *Proliferation: Threat and Response*. In the Middle East, 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. Iran is also pursuing a program to

purchase dual-use biotech equipment from other countries, ostensibly for civilian uses. Russia is a key source of biotechnology for Iran. Russia is an especially attractive target for Iranians seeking technical information on BW agent production processes.

Proliferation of chemical and biological warfare 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.

Australia Group

The proliferation of chemical and biological warfare 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.

OUTLOOK

In the next 10 years, the threat from the proliferation of CBW weapons will certainly increase. This will result from the development of chemical and biological agents that are more difficult to detect and from the adoption of more capable delivery systems.* We expect that more states with existing programs will master the production processes for complete weapons and will be less dependent on outside suppliers. States will be more proficient at incorporating chemical or biological agents into delivery systems and will be focusing on battlefield training as well as employment strategy and doctrine. Therefore, the threshold of some states to consider using these capabilities may be lowered.

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* An assessment of potentially new biological agents that may challenge U.S. forces is in a DoD report to Congress entitled *Advances in Biotechnology and Genetic Engineering: Implications for the Development of New Biological Warfare Agents*, June 1996.

DoD does not expect significant increases in the number of government-sponsored offensive CBW programs. Nevertheless, the United States and its allies must be alert to this possibility as well as to the apparent growing interest in CBW on the part of sub-national groups such as terrorist organizations. Any nation with the political will and a minimal industrial base could produce CBW agents suitable for use in warfare. Efficient weaponization of these agents, however, does require design and production skills usually found in countries which possess a munitions development infrastructure or access to such skills from cooperative sources. On the other hand, crude agent dispersal devices could be fabricated by almost any nation or group. Such weapons might be capable of inflicting only limited numbers of casualties; nevertheless, they could have significant operational repercussions due to the psychological impact created by fears of CBW agent exposure.

Chapter 1

DoD Chemical and Biological Defense Program Management and Oversight

1.1 MANAGEMENT IMPLEMENTATION EFFORTS

The Department of Defense (DoD) implemented a 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 continues to refine organizations and processes to ensure close and continuous coordination between the Chemical Biological Warfare Defense program and the Medical Chemical Biological Defense program.

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 in accordance with public law. 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 decisions.

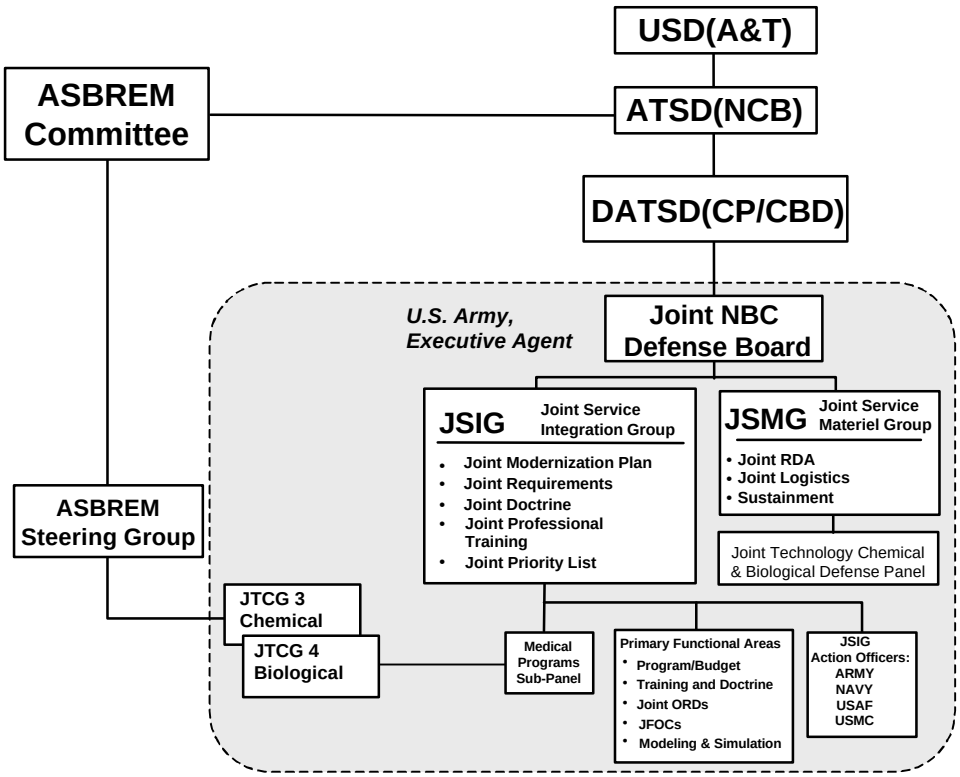
In developing the FY00–01 budget, the OSD Director for Program Analysis and Evaluation conducted a Program Review Group (PRG) assessment of DoD's chemical and biological defense programs,with emphasis on biological defense measures. The Defense Resources Board (DRB) reviewed and approved the results of the assessments. A Program Decision Memorandum (PDM) incorporated the DRB decisions into the development of the FY00–01 budget request. The PDM added approximately $380 million over the future years defense plan (FYDP) for research and development of medical and non-medical biological warfare defense countermeasures.

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 that ensures that Service operational needs are fully 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, represents how the program was coordinated and integrated at the beginning of calendar year 1998. 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 1998.



ASBREM - Armed Service Biomedical Research Evaluation and Management
ATSD(NCB) - Assistant to the Secretary of Defense for Nuclear and Chemical and Biological Defense Programs
DATSD(CP/CBD) - Deputy Assistant to the Secretary of Defense for Counterproliferation and Chemical / Biological Defense
DDR&E - Director, Defense Research and Engineering
JFOCs - Joint Future Operational Capabilities
JTCG - Joint Technical Coordinating Group
USD(A&T) - Under Secretary of Defense for Acquisition and Technology; serves as the chairman of the Defense Acquisition Board

Figure 1-1. Chemical and Biological Defense Program Management and Oversight Structure (At Beginning of Calendar Year 1998)

Throughout FY98 the Deputy Assistant to the Secretary of Defense for Counter-proliferation and Chemical/Biological Defense, DATSD(CP/CBD), as a deputy to ATSD(NCB), was responsible for the overall coordination and integration of all CB defense research, development, and acquisition (RDA) efforts. DATSD(CP/CBD) provided the overall guidance for planning, programming, budgeting, and executing the CB defense program.

DATSD(CP/CBD) remains the single office within OSD responsible for oversight of the DoD 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 DATSD(CP/CBD) is also the Executive Secretary of the OSD NBC Defense Steering Committee (see Figure 1-2.) The OSD NBC Defense Steering Committee provides direct oversight of the DoD Chemical and Biological Defense Program in accordance with Public Law 103-160. It 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, medical biological defense, and modeling & simulation. 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, user testing (*i.e.*, Dugway Proving Grounds), and doctrine development in accordance with the Joint Service Agreement and in compliance with 50 USC 1522. The JSIG is the principal steering group that 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 the execution of RDT&E materiel development efforts to ensure that program risk is mitigated across commodity areas, and the ongoing efforts are complementary but not duplicative. The OSD NBC Defense Steering Committee is composed of the following members: (1) DDR&E, (2) Director, Defense Threat Reduction Agency (DTRA), (3) Director, Chemical Biological Defense Directorate, DTRA, (DTRA(CB)), and (4) DATSD(CP/CBD), who serves as the executive secretary.

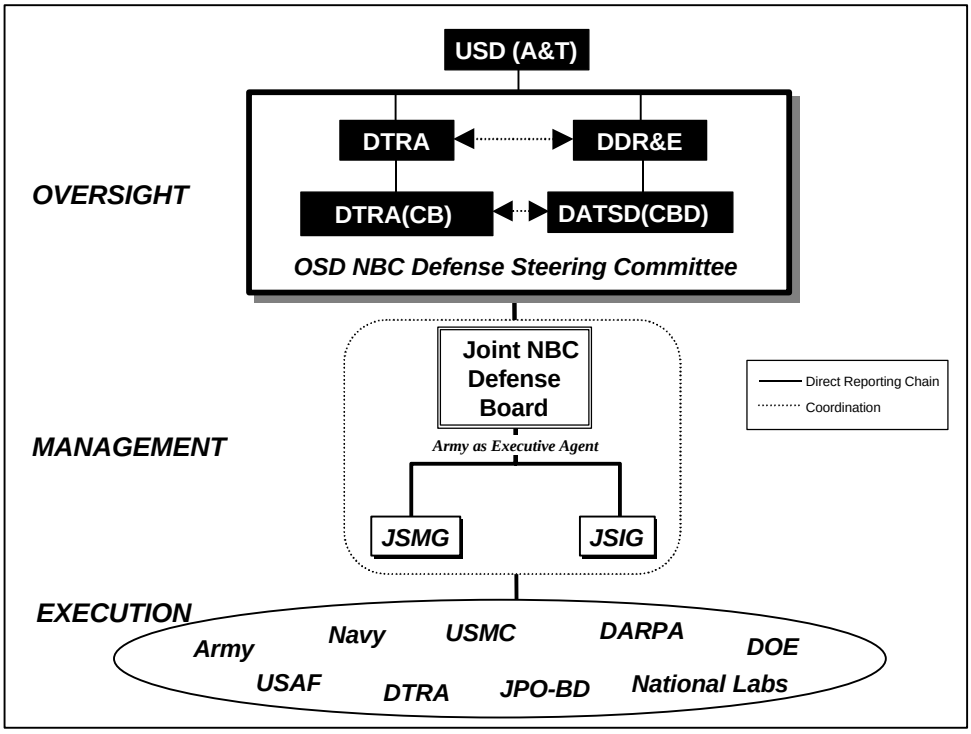


Figure 1-2. Chemical and Biological Defense Management and Oversight Structure

A Medical Program Sub-Panel (MPSP) has been implemented as part of the JSIG. 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 second meeting on 10 September 1998 finalized a draft charter for the

implementation of the MPSP. The MPSP Service Principals met for the first time on 17 December 1998 and concurred on the charter. They recommended forwarding it to the JSIG with a recommendation that it be sent to the Joint NBC Defense Board for approval. The Joint NBC Defense Board approved the charter for the implementation of the MPSP. The MPSP is chaired by the Commander, AMEDDC&S. The purpose of the MPSP is 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 has the primary responsibility for prioritizing medical CB defense requirements. The users and Joint Technology Coordinating Group (JTCG) 3 (Medical Chemical Defense Research Program) and JTCG 4 (Medical Biological Defense Research Program) provide input of medical requirements (separate from non-medical requirements) to the MPSP. The MPSP coordinates, integrates, and prioritizes all of the user requirements input. It provides the consolidated, integrated, and prioritized list of medical CB defense requirements to the JSIG. The JSIG then submits an integrated list of medical and non-medical requirements to the JNBCDB. The JSIG provides comments but makes no changes to the list when submitting the medical requirements to the JNBCDB. The JNBCDB and the OSD NBC Defense Steering Committee may make changes to the medical or the non-medical requirements and priorities list.

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 DATSD(CP/CBD), the DDR&E office responsible for chemical and biological defense programs, 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. DTRA(CB) performs program execution of CB tech base activities for DATSD(CP/CBD) through the Joint Technology Panel for Chemical and Biological Defense (JTPCBD). The JTPCBD coordinates all Service science and technology base activities for the JSMG. By March of each year, DTRA(CB) prepares the relevant NBC defense portions of three key documents detailing DoD S&T efforts, which are submitted to Congress separately in accordance with public law:

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

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 CBDP. The DARPA BW Defense Program coordinates its efforts with DATSD(CP/CBD) through regular briefings to both DATSD(CP/CBD) and DTRA(CB). 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 Defense Sciences Office is represented on the Joint Services Technical Panel for Chemical and Biological Defense (JSTPCBD) and maintains representation at CBD Program committee meetings, such as ASBREM sub-committee meetings. DARPA also participates in the BW Seniors Group, which provides Government coordination outside of DoD.

1.5 FUNDS MANAGEMENT

Figure 1-3 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 funds manager was the Ballistic Missile Defense Organization (FY96-FY98) and is now currently the Defense Threat Reduction Agency (DTRA); 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 (with support provided by DTRA(CB)) and submits them to the DTRA Comptroller for distribution to the operating agencies.

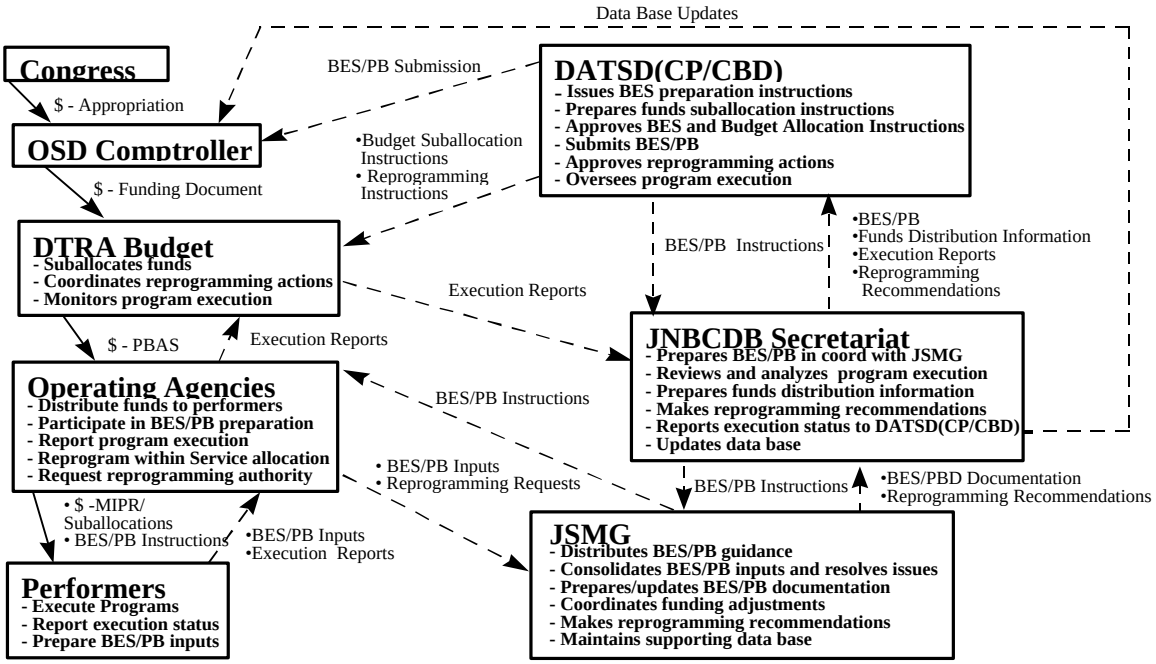


Figure 1-3. Chemical and Biological Defense Funds Management Process

The lead components or operating agencies provide notification of all funding adjustments to the JSMG Executive Office. The JSMG Executive Office, in turn notifies other components and 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 recommendations to DTRA(CB) for DATSD(CP/CBD) approval. Once approved, DATSD(CP/CBD) authorizes the DTRA Comptroller to execute the reprogramming. During the execution year for medical programs, the Headquarters, U.S. Army Medical Research and Materiel Command staffs all actions resulting from the requirement to reallocate funds between the Services.

DATSD(CP/CBD), with the support of DTRA(CB), instructs the DTRA Comptroller to issue execution and program status reporting instructions to the operating agencies. The operating agencies report execution status to the DTRA Comptroller on a monthly basis. The DTRA Comptroller forwards all program funds execution reports to the JNBCDB Secretariat and DTRA(CB) for program and budget database update and analysis, respectively. DTRA(CB) reports execution status to DATSD(CP/CBD) on a quarterly basis. It is the DTRA(CB)'s responsibility to notify the DATSD(CP/CBD) when programs deviate from or are in danger of not meeting OSD obligation and execution goals.

The DTRA Comptroller serves as the funds manager for the CB defense program. This office issues funding documents, per DATSD(CP/CBD) direction, and performs all required

accounting functions, with the assistance of the Army staff which represents the Executive Agent. The JNBCDB Secretariat updates the OSD comptroller program and budget databases as necessary after the POM, Budget Estimate Submission (BES), and President's Budget (PB). DATSD(CP/CBD), with support provided by DTRA(CB), 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:

- DoD has developed 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 (DATSD(CP/CBD)) and oversight is conducted using the DAB process in coordination with the Director, Strategic & Tactical Systems.
- The overall integrity of the CB Defense Program's organizational structure has been maintained throughout implementation of the Defense Reform Initiative (DRI) and establishment of the Defense Threat Reduction Agency through establishment of the OSD NBC Defense Steering Committee.
- A key DoD action in response to the GAO report (GAO Report NSIAD-96-103, "Chemical and Biological Defense: Emphasis Remains Insufficient to Resolve Continuing Problems" March 29, 1996) was the development of an immunization program for biological warfare defense. A description of this program is provided in Chapter 3 (p. 3-16).

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Chapter 2

Non-Medical Nuclear, Biological, and Chemical (NBC) Defense Requirements and Research, and Acquisition Program Status

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 U.S. forces. 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.

Our research, development, and acquisition (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 CB 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 CB 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 technological approaches which may provide a new system or upgrade an existing system.

During FY98 the Joint Service Integration Group documented the Joint Future Operational Capabilities (JFOC). The purpose of the JFOC is to identify and prioritize Joint User (Services and CINCs) far-term future operational capabilities 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 will also support the development of new NBC Defense Joint Mission Needs Statements (JMNSs) and future Joint Operational Requirement Documents (JORDs). The prioritized list of JFOCs establishes a clear link between near and long term Joint NBC Defense research and development efforts and user needs. Table 2-1 provides a synopsis of the current JFOC priorities, descriptions, and objectives. The JFOC has 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 (JWSTP) and the Defense Technology Area Plan (DTAP).

Table 2-1. Prioritized Joint Future Operational Capabilities

1: Contamination Avoidance — An enhanced capability to detect, locate, identify, and confirm the presence or absence of any standard or non-standard NBC hazard. Significantly improve tactical, operational, and strategic NBC situational awareness by rapidly detecting, locating, identifying, confirming and disseminating NBC and toxic industrial material (TIM) detection information to the joint force.

2: NBC Battle Management — Capability to access, assimilate and disseminate NBC information from throughout the battlespace via standard, joint service and automatic information/data transmission systems. Enhance warfighter protection by providing the critical link between detection and protection. Commanders at all levels will be provided sufficient, timely information through early and direct warning. Commanders will be able to quickly and effectively quantify the risk associated with various courses of action and provide real-time display with local 3-D digital terrain graphics to portray the current status of the NBC battlespace.

3: Collective Protection — To protect the joint force by allowing it to operate safely, at near-normal levels of effectiveness, while under NBC threat, or in NBC, TIM or other environmental hazards area. Enhance filter systems on existing vehicles, aircraft, shipboard, communications vans and other static/mobile structures.

4: Restoration Capability — Enhanced capability to provide rapid, effective, and safe removal/neutralization of hazards resulting from NBC or TIM contamination to enable restoration of unit operational capabilities. Protect and sustain the Joint force by rapidly returning equipment and personnel to normal operating modes/efficiencies after exposure to an NBC or TIM contaminated environment.

5: Individual Protection — To protect the joint force by allowing it to operate safely, at near-normal levels of effectiveness, while under NBC threat, or in NBC, TIM or other environmental hazards area.

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. The program acquisition process reduces lifecycle 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

NBC defense programs are categorized broadly under three operationally oriented areas: contamination avoidance, protection, and decontamination. The Services have been working

closely together to increase jointness in ongoing programs for each of these areas. This report highlights improvements during FY98 and discusses cooperative efforts for further Joint development of requirements. This section summarizes the requirements in each of the mission commodity areas. Tables 2-2 through 2-10 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 developmental and fielded equipment can be found in Annexes A–C 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 can (1) assume the optimal protective posture so that they can continue to sustain operations and (2) rapidly identify and decontaminate affected areas, equipment, and personnel. Sensors for the individual warfighter 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, early warning detection, miniaturization, interconnectivity, 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 real-time capability to detect, identify, characterize, locate, and warn against all CB warfare agent threats below threshold effects levels (see Table 2-2). To meet near term needs a number of sensor technologies are being optimized while alternative detection technologies mature. Mid-term technologies focus on developments to improve tactical detection and identification capabilities for both chemical and biological warfare agents. 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. Research and Development (R&D) efforts seek to optimize and balance system sensitivity, size/weight, cost, power consumption, signature and false alarm rate. Ultimately the goal is direct integration of CB detectors as a single system into various platforms, and command, control, communication, computer, and intelligence (C^4I) networks.

Table 2-2. Contamination Avoidance Science and Technology Strategy

By 1999	By 2005	By 2009
• Complete installation of the Portal Shield ACTD biological and chemical detection network at CINC air bases and ports • Complete demonstration of integrated point biodetection capability (Advanced Technology Demonstration)	• Field upgrade (eye safe) Long Range Bio Stand-off Detector in FY00-02. • 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) • Initiate development of Joint Service Warning and Identification LIDAR Detection (JSWILD) • Complete development of Joint Chemical Agent Detector (JCAD) • Complete development of Block II Joint Biological Point Detection System (JBPDS)	• Demonstrate integration of chemical and biological agent detection modules into a single sensor suite • Initiate development of hand-held equipment chemical contamination scanner • Complete development of CB water monitor • Complete development of JSWILD

2.3.1.2 <u>Potential Payoffs and Transition Opportunities</u>. Future CB detection systems will provide the capability to detect, identify in real time, 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 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 <u>Major Technical Challenges</u>. The major technical challenges are in the areas of biological collection, detection and identification, including remote/early warning sensing, improved agent discrimination and quantification, sample processing, interferent and ambient biological background rejection, and genetic probe development. Size, weight, and power reduction of detectors, power generation and consumption, 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.

There are two critical needs, both are focused on biological agent detection. Current technologies require a *high level of logistical support* and *lack discrimination in biological standoff detection*. The challenge in reducing logistical support stems from the dependence on reagents and size, weight, and power requirements of the systems. Several efforts address these issues and can be broken out as efforts in minimizing reagent requirements with higher sensitivity, better stability, and fewer supporting reagents, and scientific/engineering strategies to reduce size, weight, and power requirements, especially in the sample collections components. There are several factors directly limiting the ability to discriminate biological agents using standoff (laser) detection technologies. Key factors include: (1) a lack of fundamental data in understanding the spectral properties of biological warfare agents, (2) range limitations of lasers due to atmospheric absorption, and (3) natural background interference. Over the last two years, a number of strategies and concepts have been developed to improve the discrimination capability of standoff detection for biological materials. Preliminary data developed this past year has shown the potential feasibility of two of these concepts. Further efforts in FY02 and FY03 will

begin to validate the feasibility of providing an enhanced level of discrimination of biological material using standoff detection.

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, detection, identification, and reporting—are critical for force readiness and will continue to be emphasized by the DoD community in the near and distant future. Table 2-3 shows the roadmap of DoD requirements for contamination avoidance.

Table 2-3. Contamination Avoidance Modernization Strategy

	NEAR (FY99-00)	MID (FY 01-05)	FAR (FY 06-15)
Chemical Point Detection	• **Surface sampling capability (ICAM)** • **Automatic point detection of nerve and blister agents (ACADA)** • Navy-*Ship based improved automatic point detection of nerve/mustard (IPDS)* • Navy-*Automatically detect liquid agent (SALAD)*	• **Improved, all-agent programmable automatic point detection; portable monitor, miniature detectors for aircraft interiors; interior ship spaces; individual soldiers (JCAD)**	• **Improved surface contamination monitor** • **Low dosage miniature detector; specific identification; personal monitor** • **Detection of CB contamination in water (Joint Chemical Biological Agent Water Monitor)**
Biological Point Detection	• **Automatic long line source and point/mobile biodetection to detect and identify bio-agents; programmable (JBPDS Block I)** • Navy-*Ship based Interim Biological Agent Detector (IBAD)* • Army-*Biological Integrated Detection System (BIDS)*	• **Automatic point biodetection, to detect and identify; programmable (JBPDS Block II)** • **Joint Biological Remote Early Warning System (JBREWS) - A distributed network of fully automated lightweight sensors.**	• **Automated detection of all validated biological threat agents (Joint Biological Universal Detector, JBUD)** • **Automated, integrated detection of both biological and chemical agents in a single sensor package (Joint Chemical and Biological Universal Detector, JCBUD)**
NBC Reconnaissance and CB Remote and Stand-off Detection	• **Improved NBC Reconnaissance Vehicle with remote/early warning and data infusion capabilities (JSNBCRS)** • Army - *Long Range Stand-off detection and mapping of aerosol clouds (LR-BSDS)*	• **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)**	• **Stand-off detection, ranging, and mapping of chemical vapors and aerosols (JSWILD)** • **Wide area detection** • **Automated standoff detection of biological agents (JBSDS)**
Warning and Reporting	• **Automated warning and reporting (JWARN Phase I)**	• **Automatic NBC warning and reporting interoperable with all Services (JWARN Phase II)**	• **Integrated and automatic warning and reporting (JWARN Phase III)**
Radiation Detection	• Army-*Compact, digital whole body radiation measurement (AN/VDR-13)*		• **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, identify, quantify, and warn against all CB warfare threats below threshold effects levels. Real

time detection of biological agents below threshold effects levels is unlikely in the near to mid-term. Current emphasis is on developing lightweight, automated CB sensors capable of providing enhanced detection and early warning, capable of detecting all known biological and chemical agents. To meet the needs in the near to mid term, several stand-alone detectors and sensors are being developed. Developmental efforts are focusing on system miniaturization, improved sensitivity and specificity, agent characterization and range, decreased false alarm rate, and decreased operation and support costs. This focus will facilitate the integration of chemical detectors into personal warfighter gear, chemical and biological detectors onto various air, sea, and ground platforms, and integration of detectors into automated warning and reporting networks. Table 2-4 provides an overview of RDA efforts and Service involvement.

Table 2-4. Contamination Avoidance RDA Efforts

Category	Nomenclature	Status	USA	USAF	USMC	USN
Automatic Detectors and Monitors	- M22 Automatic Chem Agent Detection Alarm (ACADA)	Production	Joint	Joint	Joint	Rqmt
	- Shipboard Automatic Liquid Agent Detector (SALAD)	LRIP				Rqmt
	- Improved Point Detection System (IPDS)	Production				Rqmt
	- Improved CAM (ICAM)	Production	Rqmt	Interest	Rqmt	Interest
	- Joint Chemical Biological Agent Water Monitor (JCBAWM)	RDTE	Joint*	Joint*	Joint*	Interest
	- Joint Chemical Agent Detector (JCAD)	RDTE	Joint*	Joint*	Joint*	Joint*
	- Biological Point Detection					
	--Interim Biological Agent Detector (IBAD)	Fielded				*Rqmt*
	--Biological Integrated Detection System (BIDS NDI)	Fielded	*Rqmt*			
	--BIDS P3I	Production	*Rqmt*			
	- Portal Shield	Production	Joint	Joint	Joint	Joint
	- Joint Bio Point Detection System (JBPDS)	RDTE	Joint	Joint	Joint	Joint
Remote/ Early Warning	- Joint Service Lightweight Stand-off Chemical Agent Detector (JSLSCAD)	RDTE	Joint	Joint	Joint	Joint
	- Joint Service Warning and Identification LIDAR Detector (JSWILD)	RDTE	Interest	Interest		
	- Biological Stand-off					
	--Joint Remote Biological Early Warning System (JBREWS)	RDTE	Joint	Joint	Joint	Joint
	--Long Range Bio Stand-off Detection System-NDI (LRBSDS-NDI)	Fielded	*Rqmt*	*Interest*		*Interest*
	--LRBSDS	RDTE	*Rqmt*	*Interest*		*Interest*
NBC Recon	- Joint Service NBC Reconnaissance System (JSNBCRS)	RDTE				
	--M93A1 NBCRS/CB Mass spectrometer (See BIDS)	*	*Rqmt*		*Rqmt*	
	--Joint Service Light NBCRS/Lightweight Recon System (JSLNBCRS)	*	Joint*	Joint*	Joint*	*Interest*
Warning and Reporting	- Joint Warning and Reporting Network (JWARN)	RDTE/Prod	Joint*	Joint*	Joint*	Joint*
	-- Multipurpose Integrated Chemical Agent Detector (MICAD)	*	*Rqmt*		*Rqmt*	
Radiation Detection	- AN/UDR-13 Pocket Radiac	Production	Joint	Interest	Joint	

Joint= Joint Service requirement Joint*=Draft Joint Service requirement
Rqmt= Service requirement Int-NIR= Service interest, no imminent requirement
Rqmt, Interest= sub-product requirement or interest *= Sub-product(s) of a Joint project
LRIP= Low Rate Initial Production

The management challenge involves the coordination and consolidation of dozens of detection and warning RDA efforts across the Services. This strategy, led by the JSMG through the Contamination Avoidance Commodity Area Manager, resulted in the initiation of RDA efforts which shared common technical goals, but were constrained to Service unique requirements. Management organizations and initiatives, such as the Joint Program Office for Biological Defense (JPO-BD) and the Joint NBC Defense Board are building Joint Service coordination across the mission area.

Over the past several 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 Detection Alarm (ACADA)
- Joint Chemical Agent Detector (JCAD)
- Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD)
- Joint Service Warning and Identification LIDAR Detector (JSWILD)
- 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 Chemical Biological Agent Water Monitor (JCBAWM)

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 2-3 highlight Joint programs. Detailed descriptions of Joint contamination avoidance programs are provided in Annex A.

Chemical Warfare Agent Contamination Avoidance. An ACADA non-developmental item (NDI) is being procured for point detection of chemical agent vapors. ACADA is suitable for many vehicle-mounted and man-portable applications. A shipboard version of ACADA that addresses unique shipboard interferents is being built to provide the Navy with an interim monitoring capability until JCAD is fielded. JCAD provides point chemical vapor detection and is in Phase II (Engineering and Manufacturing Development, EMD) of the acquisition cycle. JCAD will function as a chemical point detection system in order to accomplish a variety of mission requirements on multiple service platforms. It 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 JSLSCAD provides passive standoff, on-the-move detection of chemical agent vapor and is in Phase II (EMD) of the acquisition cycle. The JSLSCAD program is a joint program with a JORD being approved by all Services. The basic JSLSCAD system (detector, scanner and electronics module) will weigh less than 50 pounds and occupy approximately one cubic foot. The system may be modified to accommodate a variety of requirements, including the addition of a 360° x 60° scanner for Armored Systems Modernization applications (tracked and wheeled vehicles), and a gimbal mount for Marine Corps helicopters and unmanned aerial vehicle (UAV) contamination avoidance roles. The Air Force's primary use for this system will be in air base defense. The Navy will install JSLSCAD on shipboard and airborne platforms and at high priority oversea installations. This system will be fully evaluated by all the Services during EMD.

In the near-term, the Army, Air Force, and Marine Corps have agreed to focus on 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 that 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 standoff detection capability and other electronic improvements including data fusion.

In the far-term, the Army, Air Force, and Marines have agreed to a Joint Chemical Biological Agent Water Monitor (JCBAWM). JCBAWM is a system that will detect the presence of contaminants in potable water. A requirement for an agent water monitor has been identified by the Army, Air Force, and Marines—a tech base program is underway. The operational scenarios defined in the JCBAWM Operational Requirements Document (ORD) include source water, water distributions systems, and verification of water treatment. The Army and Air Force have identified a need for a warning and identification detector. The Joint Service Warning and Identification LIDAR Detector (JSWILD) is a technology base effort to address this problem. JSWILD is a laser-based standoff detection system being developed to meet the need for the detection of chemical liquids, aerosols, and vapors. Although this system is much heavier than its passive counterpart (JSLSCAD), it provides the ability to detect chemical agents in all forms—liquids, vapors, aerosols—as well as mapping and ranging information. In addition, JSWILD will provide similar but shorter range (1–5 km) capabilities in biological standoff detection as those developed and fielded for the Long Range Biological Standoff Detection System.

Biological Warfare Agent Contamination Avoidance. Currently, there are nine biological detection efforts being managed 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 (Portal Shield) Advanced Concept Technology Demonstration (ACTD);
(6) Portal Shield Production;
(7) Joint Biological Remote Early Warning System (JBREWS) ACTD;
(8) Critical Reagents Program;
(9) Technology Transfer Program.

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 has developed and demonstrated the capability of networked sensors to protect high value fixed sites against BW attacks. Portal Shield has transitioned into production to meet urgent Joint Chiefs of Staff (JCS) directed buy. JBPDS will be produced to meet each of the four Services' needs for an integrated biological point detector. This program is developing a standard bio detection suite that will be integrated on Service designated platforms. Fielding of the BIDS P3I to the 7th CML CO began in 1QFY99 and will be completed by 4QFY99. In addition, the Critical Reagents Program consolidates all DoD antibody, antigen and gene probe/primer developments and requirements. This program will ensure the quality and availability of reagents that are critical to successful development, test, and operation of biological warfare detection systems and medical biological products. The Technology Transfer program will ensure the successful and rapid transition of DARPA and other Service breakthrough biological detection technologies into DoD fielded systems.

In the mid-term, the JPO-BD will demonstrate the Joint Biological Remote Early Warning Advanced Concept Technology Demonstration (ACTD). This tactical distributed network system of lightweight, automated sensors will use fusion to reduce false alarms. The ACTD demonstration test in FY00 will demonstrate enhanced capabilities in detection, identification, and advanced warning of BW attacks.

In the far-term, the concept for the ultimate, joint service chemical and biological detector is the Joint Chemical Biological Universal Detector (JCBUD). JCBUD is envisioned to be a miniaturized, multi-technology, automatic system that may be manned or unmanned, capable of detecting all CW/BW agents, and able to automatically warn troops and report pertinent data relative to a CW/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 C^4I equipment both current and developmental. The JWARN Phase I effort began fielding the first version of software in FY98. The JWARN Phase II effort will be initiated in FY99 into EMD for hardware and software integration onto Service designated platforms and installation 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 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. The Navy awarded a production contract in FY97 for the Improved (chemical agent) Point Detection System (IPDS), and will begin installation in FY99. IPDS will be used to automatically detect and alarm in the presence of chemical agents in vapor form and will provide continuous detection and alarm capability in the harsh shipboard environment. The IPDS replaces the existing shipboard Chemical Agent Point Detection System (CAPDS) improving detection thresholds, response time, immunity to shipboard interferents, and adding the capability to detect mustard agents. The Navy is also planning on fielding the Shipboard Automatic Liquid Agent Detector (SALAD) in fiscal year 2000. 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 provide continuous detection and alarm capability in the harsh shipboard environment. A performance-based contract for the low rate initial production of SALAD will be awarded in FY99.

2.3.6 Defense Advanced Research Projects Agency (DARPA) Programs

There are two related BW sensor programs currently ongoing within DARPA: the BW defense environmental sensors programs and the tissue-based biosensors program.

DARPA BW Defense Environmental Sensors Program. DARPA is developing technologies that will enable a multiplexing capability for bioagent identification. Technologies using up-converting phosphors provide improved detection sensitivity, and enhanced multiplexing is being developed that can reveal BW agent family, genus, and species on a single chip. A mass spectrometer is being miniaturized and ruggedized for battlefield use in identifying BW agents and contaminants without the use of liquids. These systems will be automated for unattended operations. Detection technologies that provide information on BW agent pathogenicity and viability are also being developed under the DARPA biological detection program.

DARPA Tissue-Based Biosensors Program. DARPA is exploring the use of biological cells and tissues as detector components for sensor devices that will report on chemical and biological toxins. Cells and tissues can be used to report on the functional consequences of exposure (mechanism and activity) to a wide spectrum of chemical and or biological toxins, whether they are living or dead, or whether they have been bioengineered and are currently undetectable by other means (antibodies, nucleic acid sequencing). Technical issues that are being addressed in the program include, (1) the fabrication of biocompatible matrices and interfaces for the long-term retention of cell and tissue function, (2) pattern recognition from critical pathways responsible for the processing of toxins, (3) sampling strategies to accurately extract and present the toxin from air, liquid, or solid samples, and (4) systems integration into a functional device. The current focus of the program is on the use of neuronal and immunological cells and tissues as detectors for such devices. Engineering of cells and tissues of these origins, including stem cells, is proceeding in order to optimize sensor performance requirements and fabricate prototype devices for testing and evaluation.

2.4 PROTECTION

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

- ***Individual protective equipment*** 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 and physiological burden. Protective clothing is being developed that will reduce the physiological burden, have extended durability and have less weight and heat stress burden than present equipment.

- ***Collective protection equipment*** consists of generic NBC protective filters and air movement devices that provide filtered air to a wide range of applications, transportable shelter systems equipped with NBC filtration systems and, in selected cases, environmental control. 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 power requirements and improve filtration capacity against current and future NBC agents. Technologies that reduce weight, volume, cost, and improve the deployability of shelters and filtration systems are also being pursued.

2.4.1 Protection Science and Technology Efforts

2.4.1.1 Individual Protection Goals and Timeframes. The goal of the individual protection area is to reduce the physiological burden associated with wearing protective equipment while maintaining, and potentially improving, the already high level of protection against CB warfare agents and radiological particles (see Table 2-5). To achieve these goals, key physiological performance requirements to the design and evaluation of clothing and respirators are being established. New barrier and filtration materials and selectively permeable materials are being developed and evaluated to accommodate these performance requirements.

2.4.1.2 Collective Protection (CP) Goals and Timeframes. The goals of the collective protection area are to (1) reduce the weight, size and power requirements of CP systems, (2) reduce the logistical burdens associated with the maintenance of CP filters, (3) improve protection capabilities against current and emerging threat agents and (4) improve the deployability of transportable shelter systems (see Table 2-5). To achieve these goals, improvements to system (including transportable shelters) components are being investigated along with improvements to the current vapor and particulate filtration media. Regenerative vapor and particulate filtration materials processes are being investigated to eliminate the need for filter change and improve the capability against any battlespace NBC threats.

Table 2-5. Protection Science and Technology Strategy

By 1999	By 2005	By 2009
• Prototype mask with 50% reduced breathing resistance and 50% improved field of vision • Joint Service Lightweight Integrated Suit Technology (Overgarment and MULO), extended durability, reduced heat stress, increased protection • Demonstrate regenerative filtration pre-prototype for collective protection applications • Complete evaluation of low cost and lightweight CB tentage materials	• Demonstrate advanced adsorbents to enhance or replace carbon • JLIST P3I, Joint Chemical Ensemble, chemical protective garments, gloves and footwear that are lightweight, and have extended durability and reduced heat stress • Demonstrate a duty uniform utilizing selectively permeable membrane technology that provides integrated environmental protection • Demonstrate new collective protection shelters utilizing low cost and lightweight CB tentage materials and novel CB resistant tentage closures	• New transportable shelter system (JTCOPS) • Improvements to collective protection systems (JCPE) • Continuous operation filter technology • Demonstrate lightweight, self-detoxifying clothing

2.4.1.3 <u>Potential Payoffs and Transition Opportunities</u>. Individual protection investments will result in improved respiratory and percutaneous (skin) protection with reduced physiological and psychological burden to the individual warfighter. Improved air filtration systems and/or technologies for collective protection applications will allow for extended operation, in an NBC contaminated environment, reduce the logistics burden associated with filter replacement, reduce weight, volume and power requirements, and improve the capability against current and emerging threats. Filtration technology has commercial application to the chemical industry and automotive applications.

2.4.1.4 <u>Major Technical Challenges</u>. Integrating CB protection into future weapon 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. CB protective clothing development requires balancing the physiological burden imposed upon the warfighter with maximum obtainable CB agent protection. Significant advancements have been made in improving the weight/bulk and power requirements of personal cooling systems, but further work in this area is needed. Air purification systems require tradeoffs with respect to performance, user requirements, size, weight and power constraints, as well as longer life.

2.4.2 <u>Protection Modernization Strategy</u>

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 allow our forces to maintain combat superiority in contaminated environments. A summary of protection modernization requirements is provided in Table 2-6. Chemical defense capabilities are routinely demonstrated against actual chemical agents in the Chemical Defense Training Facility (CDTF), U.S. Army Chemical School.

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. Near-, mid-, and far-term objectives are to reduce physiological and logistical burdens while maintaining current protection levels. Table 2-7 provides an overview of individual and collective protection RDA efforts and Service involvement.

Protective masks will be improved to provide greater user comfort and to reduce breathing resistance. Mask systems will require increased NBC survivability and compatibility with combat or personal equipment. Future respiratory systems, such as the 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.

Future protective clothing ensembles for U.S. forces will require reductions in bulk and weight without any loss of protection or durability. To satisfy these needs, the Services have consolidated their mission specific requirements into a first truly joint program for the next generation chemical garments—the Joint Service Lightweight Integrated Suit Technology (JSLIST) program. The JSLIST program developed and is fielding 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 baseline 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 with the same advantages and improved protection as JSLIST provides to other warfighters. Similarly, clothing systems for Explosive Ordnance Disposal (EOD) personnel and firefighters are required to enhance existing chemical protection systems without undue physiological burdens.

Table 2-6. Protection Modernization Strategy

	NEAR (FY99-00)	MID (FY01-05)	FAR (FY06-15)
Individual Eye/ Respiratory	• **Voice amplification; laser/ballistic eye protection; improved decontamin-ability, better comfort (M40A1/M42A1)** • Army - *Aircrew mask compatible with Apache helicopter systems with a significantly lighter motor/blower unit (M48/M49)* • Army -*Improved compatibility with aviation sighting/night vision systems; reduced logistics burden using non-blower systems, selected for Land Warrior (M45)*	• **Reduced physiological burden, improved comfort, enhanced optical and communications, improved compatibility** • **New mask systems for general purpose and aviation masks (JSGPM, JSAM)** • Navy -*Improved complete protection for all aircrews (CB Respiratory System)*	• **Advanced Integrated Individual Soldier Protection system (Future Soldier System)** • **Improved multiple agent protection**
Individual Clothing	• **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; Flame protection (JSLIST P3I)** • Army -*Improved protection for short term use for special purposes (ITAP)* • Army -*Improved protection with self contained breathing capability for special purposes (STEPO)*	• **Improved protection (Joint Service Chemical Ensemble)** • **Improved protection for aviators (JPACE)** • **Service Life Indicator and CB duty uniform**	• **Integrated multiple threat modular protection (chemical, biological, environmental, ballistic direct energy and flame)** • **Self-detoxifying clothing**
Collective Protection	• **Chemically Protected Deployable Medical Systems (CP DEPMEDS)** • **Chemically Hardened Air Transportable Hospital (CHATH)** • **Lighter, more mobile, easier setup, more affordable shelters (JTCOPS)** • **Improved current collective protection filters and equipment (JCPE)** • Marine Corps -*Protection for all combat vehicles and unit shelters* • Army -*NBC protection for tactical Medical units (CB Protective Shelter, CBPS).* *- Apply regenerable vapor filter to Comanche,* *- Apply collective protection to advanced vehicle concepts.* *-Modular, reduced size, weight and power for vehicle/ shelter collective protection - Advanced Integrated Collective Protection Shelter (AICPS)* • Air Force - *Upgrade/install collective protection into existing rest/relief shelters.*	• **Improved filters to extend filter life, reduce maintenance and reduce logistical burden** • **Regenerable/advanced protective filtration for vehicles/vans/shelters; reduce logistics burden, improved protection against current and future threats** • **Support medical treatment in a CB environment for Airborne, Air Assault, and Heavy Divisions (CBPS)** • Navy - *Backfit ships with contamination free protected zones - (Selected Area Collective Protection System, SACPS), Integrate collective protection system into V-22*	• **Family of advanced protective filtration systems for vehicles, shelters, ships, and 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 2-7. Protection RDA Efforts

Category	Nomenclature	Status	USA	USAF	USMC	USN
	INDIVIDUAL PROTECTION:					
Integrated	- Force XXI Land Warrior	RDTE	Rqmt	Interest	Interest	Interest
Eye/ Respiratory Protective Masks	- MBU-19/P Aircrew Eye/Respiratory Protection (AERP)	Production	Interest	Fielded	Interest	
	- M48/49 Aircraft Mask	Production	Rqmt			
	- CB Respiratory System (A/P22P-14(V))	RDTE			Rqmt	Rqmt
	- M45 Aircrew Protective Mask (ACPM)	Production	Rqmt		Interest	
	- M40A1/M42A1	Fielded	Rqmt		Rqmt	
	- MCU-2A/P	Production		Fielded		Rqmt
	- Joint Service Aviation Mask (JSAM)	RDTE	Rqmt	Rqmt	Rqmt	Rqmt
	- Joint Service General Purpose Mask (JSGPM)	RDTE	Rqmt	Rqmt	Rqmt	Rqmt
Ancillary Equipment	- Protection Assessment Test System (PATS)	Production	Rqmt	Fielding	Fielded	Interest
	- Voice Communication Adapter	Production	Rqmt	Rqmt	Fielded	Fielded
Battlefield Protective Suits	- CB Protective Overgarment Saratoga	Fielded	Interest		Fielded	Interest
	- Chemical Protective Undergarment (CPU)	Fielded	Rqmt		Int-NIR	
	- Joint Service Lightweight Integrated Suit Technology (JSLIST/JSLIST P3I)					
	-- Overgarment	Prod.*	Rqmt	Rqmt	Rqmt	Rqmt
	-- Undergarment (P3I)	RDTE	Interest	Interest	Interest	
	-- Duty Uniform (P3I)	RDTE	Interest	Interest	Rqmt	
	-- Boots (MULO)	MS III*	Rqmt	Rqmt	Rqmt	
	-- Gloves (P3I)	RDTE	Rqmt	Rqmt	Rqmt	
	-- Socks (P3I)	RDTE	Interest	Interest	Interest	
	-Battledress Overgarment (BDO)	Fielded				
Specialty Suits	-Self-Contained Toxic Environment Protective Outfit (STEPO-I) Interim	Fielded	Rqmt			
	- STEPO	MS III	Rqmt			
	- EOD Ensemble	Production	Rqmt			
	- Improved Toxicological Agent Protective (ITAP)	RDTE	Rqmt		Interest	Interest
	- Joint Firefighter Integrated Response Ensemble (JFIRE)	Production	Rqmt	Rqmt		
	COLLECTIVE PROTECTION:					
Tentage and Shelter Systems	- M20A1/M28 Simplified CP Equipment (CPE)	Fielded	Rqmt	Interest		Rqmt
	- CB Protective Shelter (CBPS) (Medical)	Production	Rqmt		Interest	
	- Portable Collective Protection System (PCPS)	Fielded			Rqmt	
	- CP Deployable Medical System–Chemically/ Biologically Hardened Air Transportable Hospital (DEPMEDS/CHATH)	Production	Rqmt	Rqmt		
	- Joint Transportable CP System (JTCOPS)	RDTE	Rqmt	Rqmt	Rqmt	Rqmt
Collective Protection (CP) Systems	- Shipboard Collective Protection System (CPS)	Production	Interest	Interest		Rqmt
	- Shipboard CPE	RDTE	Interest	Interest		Rqmt
	- Modular Collective Protection System (MCPE)	Fielded	Rqmt	Interest		Interest
	- Advanced Integrated Collective Protection System (AICPS) for Vehicle, Vans, and Shelters	RDTE	Rqmt		Interest	
	- Selected Area Collective Protection System (SACPS)	Production			Interest	Rqmt
	- M8A3 GPFU	Fielded	Rqmt			
	- M13A1 GPFU	Fielded	Rqmt	Rqmt		Rqmt
	Joint Collective Protection Equipment (JCPE)		Rqmt		Rqmt	
Generic Filters	- M48/M48A1 (100 cfm)	Fielded	Rqmt		Rqmt	Rqmt
	- M56 (200 cfm)	Fielded	Rqmt	Rqmt	Interest	Rqmt
	- Fixed Installation Filters	Fielded	Rqmt	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

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 provide clean environments for critical operations (*i.e.*, where individual protective equipment (IPE) otherwise places an unacceptable burden upon the warfighter in performing duties) and for essential rest and relief. Modernization efforts will concentrate on: (1) improvements to current vapor and particulate filtration media to extend filter life and to offer improved performance against current and/or emerging threats, (2) advanced air filtration (vapor and particulate) technologies, integrated with environmental control, to greatly reduce the logistical burden and offer greatly improved performance against current and postulated threats, (3) increased application of collective protection systems onto vehicles, vans, shelters, fixed sites, and ships, within the Joint Services, (4) improved transportable shelter system with integrated power/environmental control/filtration, (5) improvements to current collective protection systems to reduce weight, volume, and power requirements, and (6) standardization of filters within the joint services to address storage and procurement concerns. Efforts are in place to support major weapons systems developments, such as the U.S. Navy V-22 Osprey, the U.S. Army's Comanche, Crusader, Bradley, Breacher, Heavy Assault Bridge, Future Scout and Cavalry System, the USMC Advanced Amphibious Assault Vehicle (AAAV), and other advanced weapons platforms.

2.4.3 Joint Service Protection Programs

Joint programs are shown in Table 2-6 as bolded entries. A detailed description of Joint IPE and CPE programs is provided in Annex B. Section 2.7 provides a response to specific Congressional concerns regarding materials used in the JSLIST program.

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 series 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 CB 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). Development will be completed in the mid-term for 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 coordinated 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 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, petroleum, oil, and lubricant (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 baseline 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 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. Next generation technology will be directed toward integrating CB protection into a system that 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 selectively permeable membranes are being developed using biotechnology, as well as more conventional approaches.

Collective Protection (CP)

The Army has produced the M20A1 Simplified CPE and the M28 shelter liners to provide CP collective protection to existing structures. Environmental control is also being added to selected applications. The new CPE provides liquid agent resistance and allows expansion of protection area. The M20A1 has been fielded. The M28 Simplified CPE has been integrated into CP DEPMEDS and CHATH field hospitals.

CHATH and CP DEPMEDS are joint programs to integrate environmentally controlled collective protection into already fielded Army and Air Force field hospitals in order to sustain medical operations in a CB contaminated 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 in 4Q99 and fielding in FY00.

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 M1113 Expanded Capacity Vehicle (ECV) with a Lightweight Multipurpose Shelter. The vehicle tows a trailer and generator set. The vehicle 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 CBPS presently is in limited production with initial fielding scheduled for 4Q99 to meet an urgency of need requirement. A subsequent Operational Test will be performed in 1QFY00 with full type classification following. A preliminary Operational Test was completed 3QFY98. Mid-term objectives are to initiate development of CBPS to support medical treatment for Airborne, Air Assault and Heavy Divisions.

Other near to mid-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). AICPS will provide transportability and maintainability enhancements and decrease system set-up times. Joint Collective Protection Equipment (JCPE) will use the latest technologies in filtration, environmental controls, and power generation to improve and/or standardize current collective protection equipment so that it is lighter, more efficient, more affordable and less logistically burdensome. The Joint Transportable Collective Protection System (JTCOPS) will be the next generation lightweight, modular, easily transportable, self-supporting collective protection shelter that will provide relief from psychological and physiological stresses during sustained operations in a contaminated environment. JCPE and JTCOPS will initiate 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 AAAV, and U.S. Army advanced vehicle efforts. The USAF is currently upgrading their collective protective fixed site capabilities.

2.4.4 Other Protection Programs

Program supporting requirements of a single service are shown in Table 2-6 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). STEPO provides OSHA level A protection for Army Chemical Activity/Depot (CA/D), Explosive Ordnance Disposal (EOD), and Technical Escort Unit (TEU) personnel. In the near to mid-term, the Army is developing an Improved Toxicological Agent Protective (ITAP) ensemble for short term operations in Immediately Dangerous to Life and Health (IDLH) toxic chemical environments (up to 1 hr), emergency life saving response, routine Chemical Activity operations, and initial entry and monitoring. 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 both the ITAP and STEPO.

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 new high efficiency particulate (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 restoration 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 science and technology is to develop technologies that will eliminate toxic materials without performance degradation to the contaminated object and be environmentally safe (see Table 2-8). 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 fluorocarbons 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 2-8. Decontamination Science and Technology Strategy

By 1999	By 2005	By 2009
• Demo improved sorbent delivery systems • Aircraft Interior Decon procedures (non-system, Project DO-49)	• Sensitive Equipment Decon Systems • Demonstrate enzymatic decon • Fixed Site decon systems	• 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 that 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.

2.5.2 Decontamination Modernization Strategy

Decontamination systems provide a force restoration 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. In addition, existing systems are inadequate for electronic equipment decontamination, deficient for large area, port, and airfield decontamination, and rely on DS2 and water. To improve capabilities in this functional area, the Joint Services have placed emphasis upon new decontaminating technologies that reduce existing manpower and logistics requirements. These technologies are safer on the environment, the warfighter, and equipment. Table 2-9 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. The RDA community is working with the Joint Staff and Services' operations community to prepare a roadmap that will integrate RDA efforts with non-RDA efforts. Other effort include policy, doctrine, standards, and revised tactics, techniques & procedures. Research and development of non-corrosive, all-agent multipurpose decontaminants and decontaminating systems for combat equipment, aircraft, and personal gear remains a priority. Alternative technologies, such as sensitive equipment decontamination methods and large scale decontamination systems attract interest across the four Services. Table 2-10 provides an overview of Joint Service RDA efforts and Service involvement.

Table 2-9. Decontamination Modernization Strategy

	NEAR (FY99-00)	MID (FY01-05)	FAR (FY06-15)
Personal Equipment Decontam-inants	• **More reactive, high capacity adsorbent (M291/M295)**	• **Non-caustic, non-corrosive decontaminant for personnel and equipment** • Army-*Higher efficiency decon methods (Sorbent Decon)*	
Bulk Decontam-inants	• **Non-caustic, non-corrosive, easy to store and manufacture multipurpose decontaminants**	• **Decontaminants for fixed facilities** • Army -*Environmentally acceptable replacement for DS-2* • Army -*Enzymes for chemical agent decontamination* • Navy -*Less caustic capability*	• **Mission tailored decontaminants** • Navy -*Contamination resistant shipboard materials*
Expedient Delivery Systems		• **Auto-releasing coatings; reduces skin contact hazard & labor requirements**	• **Self-decontaminating auto releasing coatings; reduces man-power and logistic requirements eliminates skin contact hazard**
Deliberate Delivery Systems	• **High pressure water wash; mechanical scrubber; improved decontaminant dispenser (increased vehicle throughput)** • Army -*High pressure hot water washing and decontaminate scrubber capability; reduced water, labor, and logistic burden (M21/M22 Modular Decon System)*	• **Rapid large scale decon capability for fixed sites; reduced manpower and logistic burden** • **Non-aqueous capability for electronics, avionics and other sensitive equipment** • Air Force - *Sensitive equipment decontamination system for aircraft interiors*	• **Vehicle interior decon capability** • **Supercritical fluid decontamination apparatus** • Army -*Waterless decon capability for electronics and avionics*

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 2-10 Decontamination RDA Efforts

Category	Nomenclature	Status	USA	USAF	USMC	USN
Personnel	- M295 Individual Equipment Decontaminating Kit - M291 Skin Decontaminating Kit	Production Production	Fielded	Fielded Fielded	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 - Joint Service Fixed Site Decon	Production RDTE RDTE RDTE RDTE	Fielded Rqmt Rqmt	Rqmt Int-NIR Int-NIR Rqmt Rqmt	Fielded Int-NIR Rqmt 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 for the M258A1 decontamination kit for all Services, and has introduced 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 shipboard 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 thorough 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 has explored an alternative man-portable decontamination system and is in the process of procuring an M17 Lightweight Decontamination System (LDS) with a diesel engine. The Air Force is upgrading existing M17 LDS to M17A2 versions and expanding sorbent kit inventories to improve operational and personnel decontamination programs.

2.6 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:

- Identifying baseline capabilities as a measure for determining what tactics, techniques, and procedures may be required.
- 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 that 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 contaminated 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 conferees understand that the Department of Defense is currently dependent upon a single source of supply for permeable chemical protective garment materials used in the joint service chemical protective suit and related chemical protective garments, and believe that the Department of Defense should consider taking actions necessary to qualify additional sources of supply for these materials. The conferees direct the Secretary of the Army, as executive agent for the chemical-biological defense program, to report to the congressional defense committees on any plans to qualify additional sources for these materials."** (Source: H.R. 1119, Conference Report, National Defense Authorization Act for Fiscal Year 1998 Page 649.)

SOLUTION: The primary goal of the Joint Service Lightweight Integrated Suit Technology (JSLIST) program is to provide the best chemical protective ensemble to the individual Soldier, Sailor, Airman and Marine, leveraging state-of-the-art materials and design through joint service management with close industrial partnership. There can be no compromise in this standard. JSLIST successfully completed a Milestone III decision in April of 1997. JSLIST is presently funded and in production. User requirements are stated in the JSLIST

Joint Operational Requirements Document (JORD). Table 2-11 shows several of the *key* requirements.

Table 2-11. Selected JSLIST Operational Requirements

• Protection against specified levels of liquid agents; • Protection against specified concentration of agent vapor; • Protection against specified levels of agent aerosols; • Protection for specified durations; • Compatibility with the use of individual and crew-served weapons, all commonly issued protective masks and handwear, footwear and all standard chemical individual equipment in temperate to hot climates at all Mission Oriented Protective Posture (MOPP) levels so that the performance of combat tasks pertinent to mission completion are comparable to the currently approved garment; • Greater freedom of movement and reduced performance degradation as compared to existing chemical protective garments; • Not cause significant noise when in a combat environment.

Through comprehensive developmental and operational testing, and an independent assessment, The JSLIST program identified only one material combination that passed all testing. As a result, JSLIST production material is sole source.

The JSLIST Pre-Planned Product Improvement (P3I) program is a follow-on to JSLIST. The program includes participation by all Services and Special Operation Forces. The goal of the JSLIST P3I program is to increase the capabilities of the current chemical protective items. Desired requirements that were not achieved by the JSLIST program will be addressed. The JSLIST P3I program is leveraging industry for improved fabric technologies for use in garments. The existing JSLIST design is used as the baseline, with minimum modifications, as necessary for improvement. In order to address the Services' requirements for socks and gloves, state-of-the-art fabric technologies and designs for socks and gloves have been sought. The goal of the JSLIST P3I program is to initiate a qualification list for chemical protective socks, gloves, and fabrics for garments. The qualification list will be used to procure the items.

The program is being conducted in three phases. In phase I, there are two screening periods: phases Ia and Ib. Fabrics, socks, and gloves submitted by interested firms will be evaluated for minimum characteristics, all of which must be met in order to remain in the evaluation. By using two screening periods, manufacturers are provided an opportunity to participate in the initial screening period and then to improve their fabrics, gloves, and socks that did not meet the minimum criteria, and to resubmit during the second period. In addition, manufacturers that did not submit in screening phase Ia, can submit in phase Ib. Data obtained from both screening periods will be used in the selection process, which will occur after the completion of both screening periods. In phase II, developmental/operational testing (DT/OT) will be conducted to assess the field performance of the selected items. In phase III, technical data packages for the successful candidate fabrics, gloves, and socks will be provided to the procuring agency for insertion in the scheduled JSLIST production buys.

A market survey announcement was published in the Commerce Business Daily on 24 June 1997. An information packet detailing the Users' requirements, test criteria, test

methods, and the overall program schedule was provided to companies responding to the source sought announcement and expressing interest in participating in the program.

Phase Ia is completed. Phase Ib began on 7 May 1998 and was completed in 1QFY99. Phase II will be from 1QFY99-4QFY99. JSLIST P3I is scheduled for a Milestone III review in late 1999 or early 2000. The program goal remains the same, provide the best protection ensemble to our warfighters. The program may identify additional materials to accomplish this end. The program recognizes the importance of multi-sourcing and the business impacts on JSLIST ensemble production. Achieving additional material sources via the JSLIST P3I effort is a goal, though achieving the best protection as established by the JORD is the primary goal.

Chapter 3

Medical Nuclear, Biological, and Chemical (NBC) Defense Requirements and Research and Development Program Status

3.1 REQUIREMENTS

3.1.1 Introduction

Many countries and terrorist groups have acquired the means to produce chemical, biological and radiological weapons and the means to deliver them. Nuclear, biological, and chemical (NBC) proliferation increases the threat to deployed U.S. forces. In response, our medical chemical, biological, and radiological defense research programs' (MCBRDRP) mission is to preserve combat effectiveness by timely provision of medical countermeasures. Countermeasures are developed in accordance with joint service mission needs and requirements in response to chemical warfare (CW) threats, biological warfare (BW) threats, and threats associated with radiological/nuclear warfare (RW) devices. 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.
(3) Provide medical management of CW, BW, and RW 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, rickettsiae, and toxins that can be produced by any group with access to a scientific laboratory or a pharmaceutical industrial facility. The primary nuclear threat is 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 the use of a single or a small number of crude, Hiroshima-type nuclear weapons. Exposure to multiple threats may result in synergistic effects. Assessment methodologies enable threat evaluation and injury prediction. Medical prophylaxis and 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 has maintained a medical research and development program for NBC for many years. This program has resulted in the fielding of numerous products to protect and treat service members. The DoD program to stockpile biological defense products has been smaller than the chemical defense effort, but has received greater emphasis in recent years.

Specific initiatives programmed to improve NBC defense medical readiness include:

- Continued emphasis on NBC medical countermeasures research.
- Identification and testing of medications and therapeutic regimens that reduce the effect of radiation on both bone marrow and the intestinal tract.
- A biological defense immunization policy for U.S. forces and for other-than-U.S. forces.
- Cooperative initiative with the U.S. Food and Drug Administration (FDA) for acceptance of efficacy data derived from animal studies as surrogates for large-scale human efficacy trials to license drugs and biological products that cannot be ethically tested for efficacy in humans.
- A prime systems contractor initiated effort to develop, license, produce, and store biological defense vaccines.
- Enhanced medical diagnostic capability for diseases/injuries 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 that greatly improve individual medical protection, treatment, and diagnoses.

The DoD complies with the Food, Drug and Cosmetic Act for Drugs and Public Health Services Act Section 351 for biologics to ensure that drug products are safe and efficacious and biological products are safe, pure, and potent. DoD is working closely with the FDA to amend the Code of Federal Regulations (CFR) for New Drug and Biological Products that cannot meet the efficacy studies required by the FDA for product licensure because they are either not feasible and/or cannot ethically be conducted under the FDA's regulations for adequate and well controlled studies in humans. (See 21 CFR Sec 312.21(2)(b).) DoD presented a proposal to the FDA's Vaccines and Related Biological Products Advisory Committee to use animal efficacy data as evidence demonstrating the efficacy of the Pentavalent Botulinum Toxoid (ABCDE). The Advisory Committee recommended that the FDA accept DoD's proposed animal surrogate data for licensure of the Pentavalent Botulinum Toxoid (ABCDE). The FDA drafted a proposed rule that allows the use of animal efficacy data for those products that either cannot be tested ethically in humans or it is unfeasible to test. This proposed rule is expected to be published in the Federal Register in the near future.

Medical NBC defense products are thoroughly evaluated and tested for their safety in accordance with FDA guidelines before administration 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 NBC weapons. In those cases where efficacy is not understood, the safety profiles of the products are well delineated. In many cases, the safety is well understood because the medical products have been widely

used to treat other medical conditions. (The anthrax vaccine is licensed and has been used since the 1970s to vaccinate veterinarians, textile workers, and others. The Pentavalent Botulinum Toxoid (ABCDE) was administered safely over 10,000 times to laboratory workers prior to its use for military personnel during the Gulf War. Various anti-emetics to protect against radiological threats have been used to treat cancer patients undergoing radiation therapy.) Several studies performed at the U.S. Army Medical Research Institute of Infectious Diseases demonstrated the efficacy of the anthrax vaccine against inhalation anthrax in the monkey model. Rhesus monkeys were vaccinated with one or two doses of the anthrax vaccine and then challenged with highly lethal levels of spores from the Ames strain of anthrax, the most virulent strain tested. In all these studies, the anthrax vaccine protected 42 of 43 monkeys against inhalation anthrax while none of a total of 14 controls used in these experiments survived.

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 also complies with FDA requirements, it also must follow the requirements of Title 21, Food & Drugs, Code of Federal Regulations for the manufacture, testing, and licensing of medical products. The following chart illustrates the correlation of FDA requirements for product development with the requirements of DoD 5000.2-R for the life cycle of product development in accordance with DoD acquisition policy:

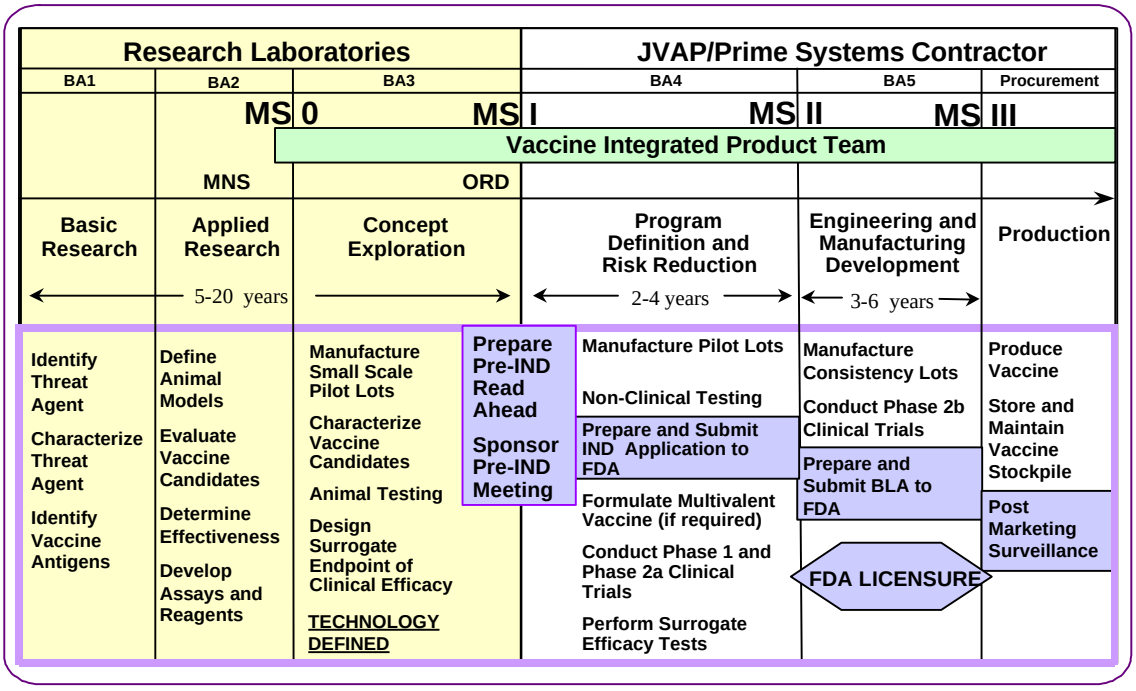

Figure 3-1. Integration of FDA and DoD Milestone Requirements

The medical NBC defense research programs discussed in this section are divided into chemical, biological, and nuclear areas of research. Table 3-3 (on page 3-15) 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

In accordance with the FY95 National Defense Authorization Act, which directed DoD to establish aggressive programs to reduce, refine, or replace the use of research animals, the MCBRDRP utilizes and develops technologies that will reduce reliance on animal research. In FY98, 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 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 that might 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.

DoD policy states that animal use will be conducted in full compliance with the Animal Welfare Act and that animals are to be 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 Medical Chemical and Biological Defense Research Program as prescribed in DoD Directive 5160.5 and, as such, is the lead requirements coordinator. The programs are integrated DoD in-house and external efforts. The 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 minimizes unnecessary program overlaps and costly materiel retrofits. (The integration of program management and oversight of medical and non-medical NBC defense programs is described in Chapter 1.) The Army Science and Technology Base Master Plan, the Defense Technology Area Plan, the Joint Nuclear Biological Chemical Defense Research, Development, and Acquisition Plan, and the Medical Science and Technology Master Plan are the program drivers for the chemical and biological research programs. The Joint Service Integration Group (JSIG) established a Medical Program Sub-Panel (MPSP), which is the user representative from the medical community, to establish and direct joint service NBC medical defense program requirements. The science and technology base is managed through the development and execution of Defense Technology Objectives (DTOs) and Science and Technology Objectives (STOs). 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) through its lead laboratories for medical chemical defense, biological defense, and infectious disease research, U.S. Army Medical Research Institute of Chemical Defense (USAMRICD), U.S. Army Medical Research Institute for Infectious Diseases (USAMRIID), and Walter Reed Army Institute of Research (WRAIR), respectively. 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 is directed by the Joint Program Office for Biological Defense (JPO-BD). The Joint Vaccine Acquisition Program (JVAP) acts as a subordinate element of JPO-BD to transition candidate biological defense vaccines from research laboratories to the Prime Systems Contractor for the development, testing, licensure, production, and storage of vaccine stockpiles.

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 ASBREM. Specific requirements and tasking for AFRRI research comes from the individual services, Joint Staff, and the Defense Technology Objectives (DTOs) through the authority of a Board of Governors (BOG) with funding from the Director, Defense Research and Engineering (DDR&E) under the Secretary of Defense for Acquisitions and Technology. AFRRI is under the administrative control of the Uniformed Services University of the Health Sciences (USUHS). Members of the AFRRI BOG include representatives of Under Secretary of Defense for Acquisition and Technology (USD(A&T)), the Assistant Secretary of Defense for Health Affairs (ASD(HA)), the Surgeons General of the Army, Navy, and Air Force, and the Deputy Chiefs of Staff for Operations of the Army, Navy, and Air Force, or their designated representatives. Major inputs to AFRRI research requirements are driven by the biennial Army Qualitative Research Requirements (QRR) compiled by the U.S. Army Nuclear and Chemical Agency (USANCA) and AFFRI's four DTOs. Currently there is no established advanced development (PDRR and EMD) process for the nuclear medical program.

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 the following:

- Maintain technological capability 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-level 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.
  - Provide education on medical management of chemical casualties.

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 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. Alternatively, in dealing with liquid agent threat, reactive topical skin protectants (rTSPs) can be developed that will protect the skin and simultaneously detoxify the agent.

- For nerve agents, the objective is to field a safe and effective advanced anticonvulsant nerve agent antidote, and to field an advanced pretreatment based on biological scavengers like 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. Although both offer potential long term protection, the enzyme pretreatment requires a single dose rather than three doses daily of pyridostigmine bromide.
- For blood agents, the objective is to develop and field a safe and effective cyanide pretreatment.
- For respiratory agents, the objective is to develop prophylaxes and therapies 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, and 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' warfighting capability during a biological attack.
- Reducing vulnerability to validated and novel threats by maintaining a strong technology base.
- Providing education on medical management of BW casualties.

3.3.2 Objectives

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

- Maintaining technological capability to meet present requirements and counter future threats:
  - Determine sites, mechanisms of action, and effects of exposure to biological warfare agents with emphasis on exploitation of molecular science.
  - 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.

- Providing individual-level prevention and protection to preserve fighting strength:
  - Develop improved vaccines, pretreatments, antidotes, and therapeutic countermeasures.
  - Identify factors that influence safety and efficacy properties of candidate countermeasures.

- Providing training in medical management of biological casualties to enhance survival and

expedite and maximize return to duty:

- Develop concepts and recommend therapeutic regimens and procedures for the management of biological casualties.
- Provide education on medical management of biological warfare casualties

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

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 and naturally occurring diseases. These products include multi-agent vaccines that 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 agents as well as infectious diseases of military importance. The development of these products, as well as the complementary technology-based research and development to enhance and expand these capabilities and to identify and develop new capabilities, is also being supported by collaboration with other agencies, such as the Defense Advanced Research Projects Agency (DARPA) and the Department of Energy (DOE).

Projects and technologies shared with the DOE are related to the strengths of DOE laboratories in developing advanced technologies in order to enable rapid detection of and response to a chemical or biological incident. While DOE focuses internal technology development efforts on the domestic threat, they actively support the DoD. The work spans DNA sequencing and biodetection to modeling and simulation, collaborating on projects such as x-ray crystallography and nuclear magnetic resonance imaging of BW agent antigens. The DNA sequencing efforts have led to advances in developing "lab on a chip" diagnostic technology for several BW threat agents. DOE is not involved in protection and treatment of personnel, but they are assisting DoD with drug/chemical database searches with the intent of identifying novel inhibitors of pathogens.

The DARPA BW defense program includes collaborating with USAMRMC on new platforms to enhance delivery and effectiveness of multi-agent vaccines (for example, stem cells genetically programmed to express antigens sequentially in order to provide automatic boosters in the body). Multi-agent vaccines are similar to the measles-mumps-rubella vaccine administered to children except that 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. Research in both the naked DNA and replicon approaches is advancing rapidly, and transition of a multiagent vaccine to advanced development (post Milestone I) 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 actual 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, 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. With these tools, clinical diagnoses will be made much faster (less than 30 minutes) and farther forward than is possible now. The development of technologies for common diagnostic systems is jointly supported by DARPA.

The MBDRP includes the following areas of research:

Pre-exposure Countermeasures: This area involves prophylactic measures undertaken to prevent illness and injury associated with exposure to bacterial, viral, and toxin threat agents. The primary focus of pre-exposure therapy is efforts to produce effective vaccines. The roles of various factors in stimulating cellular and humoral immunity are determined through study of specific genes or properties of threat agents. This knowledge provides tools for development of second-generation recombinant or multi-agent vaccine candidates as well as pretreatment therapies to intervene in the pathogenic effects of threat agents.

Post-exposure Countermeasures: Research efforts in this area are focused on developing safe, effective treatments to alleviate disease or injury associated with exposure to bacterial, viral, or toxin threat agents. Therapeutic measures may involve administration of antimicrobials, anti-toxins or generic compounds formulated to intervene at the pathogen's site of action. The knowledge necessary to develop such products requires in-depth research in the basic pathogenesis and physiology of the BW agents. These analyses will afford researchers tools to create a universal approach in treating post-exposure casualties of a BW attack.

Diagnostics: Diagnostics research involves the investigation and evaluation of sensitive and specific methods for detection of infectious organisms, toxins, antigens and antibodies in biological materials to include the application of nucleic acid probes or synthetic antigens. Rapid identification tests and diagnostic methods for the assay of toxins, metabolites, and analogs in clinical specimens are major goals of this program area.

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, rickettsiae, 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 when biological agents can produce casualties over an area of thousands of square kilometers. Biological agents could also be used with devastating effect in combination with nuclear, chemical, or conventional weapons.

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

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

- Characterize the biochemistry, molecular biology, physiology, and morphology of BW 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 to include 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 biological defense research and scientific expertise in biological defense. These factors restrict the depth of expertise, facilities, and support available. A recent redress of funds and authorizations over a six year period (FY99-05) will be used for DoD facility upgrades and to maintain scientific and technological expertise.

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).

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

VACCINES

- *Killed* – killed or inactivated microorganism that is incapable of replicating but stimulates immunity.
- *Live, attenuated* – live organism, genetically selected not to cause disease but able to stimulate immunity.
- *Toxoid* – toxin protein treated to inactivate its toxicity but retains its ability to stimulate immunity.
- *Recombinant* – 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.
- *Deoxyribonucleic Acid (DNA)* – 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.
- *Polyvalent* – mixture of antigens that protects against a number of different BW agents.
- *Vectored* – carrier organism bioengineered to confer immunity against an unrelated BW agent or multiple agents.

ANTIBODY (ANTISERUM, ANTITOXIN)

- *Heterologous* – antibodies collected from animals (*i.e.*, 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).
- *Homologous* – antibodies of human origin (*i.e.*, same species as the recipient) that provide protective immunity against the BW threat. These antibodies are not prone to stimulating serum sickness.
- *Monoclonal* – a cell culture technique for producing highly specific antibodies against a disease agent.
- *Bioengineered* – antigen binding site on the variable portion of an antibody elicited in a nonhuman system is combined with the nonvariable portion of a human antibody to produce a "humanized" antibody.

DRUGS

- *Antibiotics* – very effective against bacteria, but are ineffective against viruses and toxins.
- *Antiviral compounds* – Promising drugs in development by the pharmaceutical industry are being evaluated against biological threat viruses
- *Others* – compounds that offer new possibilities for protecting against and treating exposure to BW agents (such as drugs to treat toxins or nonspecifc treatments such as immunomodulators.)

DIAGNOSTIC TECHNOLOGIES

- *Immunological technologies* – These tests rely 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. This technology is currently used in out-patient clinics and doctor's offices.
- *Nucleic acid technologies* – 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 tests 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 real-time (environmental) sensing (described in Chapter 2); medical countermeasures (developing barriers to prevent entry of pathogens into the human body and developing pathogen countermeasures to block pathogen virulence and to modulate host immune response); 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 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 threats. The objective of the Consequence Management thrust is to provide comprehensive protocols to protect or treat combatants by using current and emerging biological countermeasures. It will provide accelerated situational awareness for biological agents 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.

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 DoD and the Military Services. The sole repository of defense radiobiology 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 embedded depleted uranium shrapnel to military 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 require 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 that 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 is increasingly possible by a terrorist or third-world country. If counterproliferation and intelligence efforts fail to deter deployment, medical remediation of casualties must be available. Such a device would most likely 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 would be exposed to the prompt radiation of the initial explosion as well as to chronic exposures resulting from the residual radioactive fallout.

The nuclear weapons inventory of current adversaries is thought to be small, but if a weapon is used for military advantage, concomitant use of biological or chemical weapons should be anticipated. A radiation dispersal device could include the destruction of a nuclear reactor, contamination of a battlefield with nuclear waste, or deliberate radioisotope contamination of a terrorist car bomb-type conventional explosives attack. Most casualties in these scenarios would suffer non-lethal doses of external irradiation. This would complicate the management of their conventional injuries and could cause internal contamination with radionuclides. 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 the new radiogenic wounding agents on the modern battlefield. Table 3-2 presents an overview of countermeasures to radiological exposure and research accomplishments during FY 98.

Table 3-2. Medical Nuclear Defense Countermeasures

PRETREATMENTS

Multidrug combinations: Enhanced survivability has been shown in animal models using a combined aminothiol and cytokine treatment modality. Sustained and effective delivery of prophylactic drugs was demonstrated in animal models using implanted capsules.

Antiemetics: Granisitron (Kytril®) 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: During the next conflict it is anticipated that young female soldiers will be wounded by enemy 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 the 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 that 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. A significant reduction in mortality was shown in animal models using a clinical support protocol based on antibiotic and platelet transfusion regimens.

DIAGNOSTIC TECHNIQUES

Biodosimetry and Dose Assessment: No dose-assessment method other than individual physical dosimeters can be made available currently to deployed soldiers. Automated chromosome dicentromeric analysis has been developed and can be made deployable to the Echelon 3 medical care level, and 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 number 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 that 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 (FY99-00)	MID (FY01-05)	FAR (FY06-15)
Medical Chemical Defense	**Licensed topical skin protectant**	**Licensed advanced anticonvulsant** **Licensed cyanide pretreatment** **Licensed multichambered 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 Amendment for new dosing schedule** **Licensure of Pentavalent Botulinum Toxoid (ABCDE) Adsorbed**	**Licensed Q fever vaccine** **Licensed tularemia vaccine** **Licensed Vaccinia, cell culture derived vaccine** **Licensed Botulinum A/B/E/F monovalent vaccines** **Licensed new Venezuelan Equine Encephalomyelitis (VEE) vaccine** **Licensed brucellosis vaccine**	**Licensed staphylococcal enterotoxin B (SEB) vaccine** **Licensed new plague vaccine** **Licensed combined VEE, Western Equine Encephalomyelitis (WEE), & Eastern Equine Encephalomyelitis (EEE) vaccine** **Multiagent vaccine delivery system** **Hand-Held Common Diagnostic System** **Licensed Botulinum Tetravalent vaccine** **Licensed Ricin vaccine**
Medical Nuclear Defense	**Depleted uranium fragments toxicity assessment** **Multidrug radioprotectants validated** **Combination cytokine therapy validated** **Risk assessment for low dose, low dose-rate radiation effect**	**Radioprotectant transdermal patches** **New-generation prophylactic and therapeutic immunomodulators for multiorgan injuries** **Computer models to understand effects resulting from combined NBC attacks** **Echelon 3 biodosimetry system** **Carcinogenicity assessment of DU**	**Licensed radiation-induced cancer/mutation preventive techniques** **Licensed countermeasure for chem-bio-radiation interaction** **Echelon 2 biodosimetry system**

3.6 MEDICAL R&D REQUIREMENTS ASSESSMENT

ISSUE: **DoD does not have a current approved mechanism for licensure of chemical and biological defense medical products (*i.e.*, drugs and vaccines) because legal and ethical constraints prevent adequate full testing in humans.**

SOLUTION*:* The FDA and DoD are working together to amend the Code of Federal Regulations to allow animal efficacy data to be used in lieu of large-scale human clinical efficacy trials. This mechanism of licensure is vital to provide military service personnel with licensed products. This rule will also establish requirements for licensure and allow the DoD to plan and conduct the appropriate studies to obtain product approval for the products planned for production and licensing. A proposal for the licensure of Botulinum Pentavalent Toxoid using the guinea pig as a surrogate model in lieu of human testing was accepted by a FDA Advisory Committee. The DoD is completing the clinical testing of Botulinum Pentavalent Toxoid for submission of this data to the FDA with projected licensure of this product in FY00.

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

SOLUTION: DoD awarded a prime systems contract to DynPort LLC. This contract establishes a single integrator to develop, license, produce, and maintain a stockpile of BD vaccines for protection against BW agents. DynPort LLC is required to obtain and maintain FDA licensure for all the vaccine products developed and produced under this contract by conducting clinical trials and establishing manufacturing procedures.

The contract was awarded in November 1997 and begins with the development and licensure of three vaccines: Q fever, Tularemia, and Vaccinia, and the storage of the current unlicensed BD vaccine stockpile (IND products). There are options for the development and licensure of ten other BD vaccines, which are programmed for development and licensure by FY10.

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 18 May 1998, DoD decided to systematically vaccinate all U.S. military personnel against anthrax. Current plans call for personnel serving in high threat regions to receive vaccinations, which began in summer 1998. The manufacturing process for the anthrax vaccine has met all FDA requirements for producing and shipping the vaccine safely and contaminant-free. As of February 1999, more than 184,000 military personnel have received shots of the anthrax vaccine. Total force vaccination will follow according to a schedule. This decision is crucial for developing a strategy to maintain the industrial base capability for vaccine production.

A firm fixed price contract to purchase Anthrax Vaccine Adsorbed for the continued supply of anthrax vaccine was awarded negotiated and signed for a 2 year period. DoD continues to work with BioPort to meet the more stringent requirements the FDA has imposed on all vaccine manufacturer. DoD has provided technical guidance on testing and evaluation and the auditing of quality systems. DoD conducted preliminary testing of a reduction of the dosage regime for Anthrax Vaccine Adsorbed from six vaccinations to five over an 18 month period. The results of this study will be presented to the FDA in FY 99. For more information on the DoD anthrax vaccine program, visit "Concerning the Anthrax Threat" on the Internet at http://www.defenselink.mil/specials/Anthrax.

ISSUE: **The effects on humans resulting from the 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, DoD dedicated $5 million to evaluate the chronic effects of low-dose level exposure to chemical agents. Studies are underway 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 that 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 underway. Additional funds have been committed and contracts are being awarded to evaluate potential chronic health complaints resulting from exposure to nerve agents. These contracts were begun 1QFY98.

ISSUE: **Radiation exposures below a level that cause 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 preventive and treatment countermeasures.

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Chapter 4

Nuclear, Biological, and Chemical (NBC) Defense Logistics Status

4.1 INTRODUCTION

The overall logistical readiness of the Department of Defense's NBC defense equipment continues to improve. The Services have increased stock 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 end items of NBC defense equipment. These items are funded through defense-wide funding accounts. 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 their desires 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. 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 the DoD NBC defense logistics readiness and sustainment program and making recommendations to correct funding shortfalls.

The Joint Service Materiel Group (JSMG) coordinates NBC defense 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.

During the past year, increased focus by all Services and DLA on NBC defense logistics has visibly improved the overall program. Estimates are that the risk posed by weapons of mass destruction to early deploying units and special operations forces has been considerably reduced. Readiness shortfalls have been identified and addressed to the degree that full sustainment through a one Major Theater War (MTW) scenario is reasonably assured. The ability to sustain a second nearly simultaneous MTW scenario is not fully assured, due to current and potential critical shortfalls of specific program areas. The Services are programming funds for the FY02-07 POM to specifically address these problem areas. Additionally, the services are formulating

doctrine, tactics, techniques, and procedures for domestic response to terrorist incidents involving weapons of mass destruction.

The Joint Chemical Defense Equipment Consumption Rates (JCHEMRATES) IV study is in the final stages of validation and Service staffing. This study is being sponsored by the Joint Services Coordination Committee and executed through the U.S. Army Center for Army Analysis (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 MTW scenarios. These consumption rates will include both medical and non-medical chemical defense items for each Service and overall DoD roll-ups for both scenarios. They include both initial issue of chemical defense equipment and sustainment through the 120-day period. 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 in draft.

The JCHEMRATES IV study's two MTW requirement is not and should not be considered a procurement target. This study did not fully consider certain factors such as air transport into theaters of conflict or Navy fleet requirements for ships at sea. While the Services agree with the methodology and intent of the study, the study may require further refinement prior to becoming a fully accepted planning tool. The MTW requirement does not consider peacetime training requirements, sizing requirements, or full procurement to the entire active and Reserve forces. The MTW requirement denotes a *minimum planning number*, which if the total DoD inventory drops below, may represent a critical shortfall for that particular item, which should be immediately addressed to avoid diminishing the force's NBC defense capability. Because of this limitation in the study, the Services have identified their total Service requirements as their procurement targets, while acknowledging JCHEMRATES as a necessary step in joint service management of the NBC defense program.

The Services continue to have issues regarding the accountability and management of NBC defense item inventories. Limited asset visibility of consumable NBC defense items below the wholesale level remains a problem due to the lack of automated tracking systems at that level (the exception being the Air Force). This has the full attention of the senior NBC defense managers. Improvement in this area is dependent on the progress of the DoD Total Asset Visibility (TAV) project.

The Services still procure consumable NBC defense items through multiple, separate, and distinct funding authorizations, as discussed in Section 4.6 of this chapter. Each Service is addressing secondary item procurement policies independently. However, 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 initiated its third Joint Service NBC Defense Logistics Support Plan (LSP) in September 1998. This report focuses 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 (results as of March 1998). 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 data call conducted for the FY99 LSP was used to develop 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 area, with respect to the two MTW scenario outlined in the Quadrennial Defense Review. Developmental NBC defense programs that will be fielded within the POM time period are addressed to identify modernization efforts that are underway.

As currently envisioned, 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. As a matter of policy, Navy ships stock 90 days of consumable material. However, these values are notional in that they are based on peacetime demand and/or projections of wartime demand as contained in pertinent allowance documentation. For NBC defensive material, and particularly in the case of individual protective equipment (IPE), the days of supply represent a minimum stockage position based on current investment guidelines for such material. 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."

DLA and the Army Materiel Command (AMC) are the item 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 for the entire DoD force during a full two MTW scenario. These numbers are reflected in the tables of this chapter.

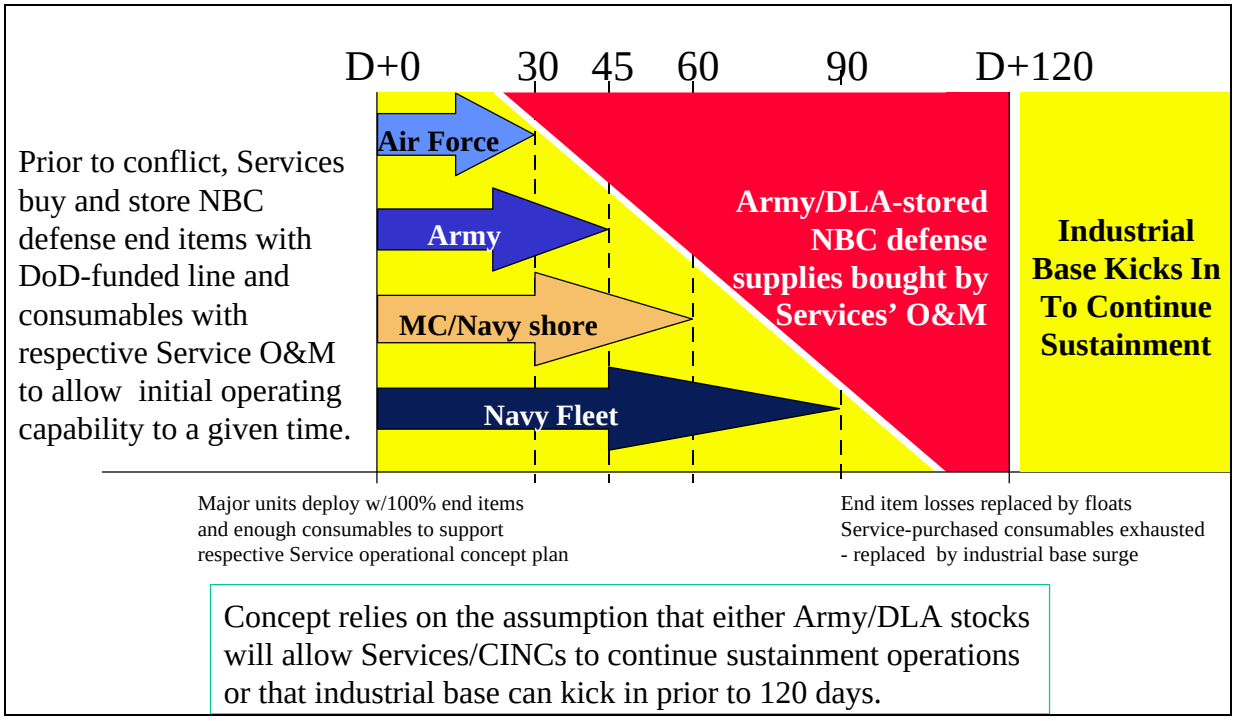

Figure 4-1. War Reserve Requirements and Planning

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. 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 that will link existing DoD logistics automated systems.

The Army has improved its visibility through an initiative to standardize individual issue of eleven critical NBC defense items across all major commands. In addition, consumable chemical defense equipment for all forces other than Force Package I and other early deploying units will be centrally stored at Bluegrass Army Depot. This seven-year execution plan is managed by HQ AMC and will enable better visibility and rotation of NBC defense consumable items. The Air Force has a similar program that consolidates stocks of NBC defense items for deployment in support of contingency operations. These initiatives have also reduced surveillance costs and improved overall management of NBC defense stocks. The Marine Corps has been leading a joint surveillance Technical Working Group, whose initiatives have been increasing cooperative efforts in surveillance and shelf life programs.

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 (to include active and reserve forces), and includes peacetime replacements (wear and tear) and training requirements. The two MTW requirement quantities are those computed by the draft JCHEMRATES IV study (November 1998 data). Materiel requirements for training, sizing variations and peacetime replacements are *not* included in the wartime requirements. 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.

The "Stocks On-Hand" represents 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, both peacetime stores and war reserve). This number includes quantities for which a Service or agency has submitted a funded requisition or purchase order in FY98, 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 FY98 report, information on the inventory status of 123 fielded NBC defense equipment was compiled. While radiacs have not traditionally been a part of this chapter, they have been added as an effort towards continuity with other chapters and annexes of this report. NBC defense items such as batteries, spare parts, and sub-components were considered a subset of the primary item for risk assessments, and were 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 current FY98 report:

- AN/VDR-2 Radiac Set
- AN/PDR-75 Radiac Set
- AN/PDR-77 Radiac Set
- AN/UDR-13 Radiac Set
- ADM-300 series Radiacs
- Older radiac sets still in service with the Navy include the AN/PDR-27, AN-PDR-43, AN/PDR-56, AN/PDR-65, CP-95 Radiac Computer-Indicator, CP-95 Radiac, DT-60 and IM-143 Dosimeters (also used by the USAF), and PP-4276/PD charger
- Chemically/Biologically Hardened Air Transportable Hospital/Chemically Protected Deployable Medical System
- Decontaminable Folding Litter
- Medical Equipment Set, Chemical Agent Patient Decontamination Kit
- Patient Chemical Wraps
- Medical antibiotics and chemical defense treatments, to include ciprofloxacin, doxycycline, sodium nitrite and sodium thiosulfate

The Army's M51 Protective Shelter and the Marine Corps's Portable Collective Protection Shelter (PCPS) were dropped from the Report as they were considered unserviceable and no longer in use, respectively. The Marine Corps's Individual Chemical Agent Detector (ICAD) was also dropped as they no longer employ this detector.

Two changes involved standardizing names among the Services. The Air Force Chemical Outfit was retitled with the same name as the DLA's Impregnated Chemical Protective Undergarment, as both had the same NSNs. The Air Force CPO Foot Covers were retitled as the Chemical Protective Footwear Covers in a similar fashion. This creates the perception of eliminating two items, but it is in reality consolidating NBC defense items with the same NSNs.

Of the 123 items extensively reviewed, we developed risk assessments for 50 items based on data gathered as of 30 September 1998 (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 the two MTW requirements (draft JCHEMRATES IV average requirements as of November 1998) 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 four-year comparison of data assessments is shown in Figure 4-2. In comparison to FY97 report data, the percentage of the FY98 report's items in the low risk category dropped from 61 percent to 58 percent. The percentage of items in moderate risk rose from 17 percent to 20 percent, while the percentage of items in the high risk category remains steady at 22 percent.

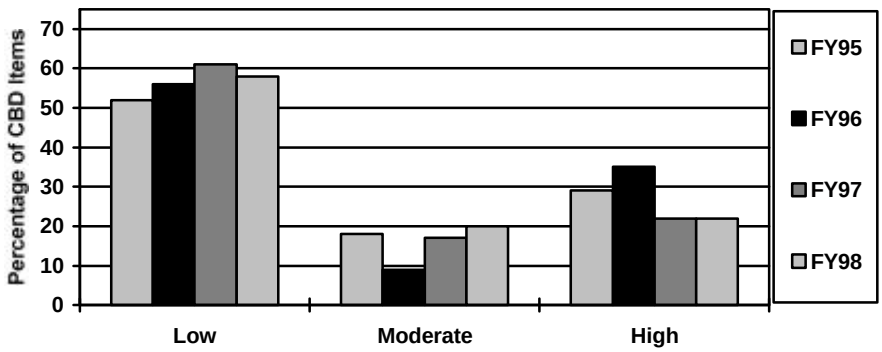

Figure 4-2. Logistic Risk Assessments: 50 NBC Defense Items

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

- The status of M8A1 chemical agent detectors has improved due to downsized units turning in their equipment, thus resulting in lower overall requirements. The Army's assessment and rebuild program returned 1,600 detectors to units, and another 1,500 are being repaired. The M8A1 detector will remain in the field until its successor, the M22 ACADA, is available in quantities to avoid any shortfalls.
- Limited quantities of M93A1 NBC Recon Systems and M21 RSCAALs continue to constrain early warning chemical reconnaissance and detection capabilities. Continued purchases through FY06 and acquisition of the JSLSCAD and JSLNBCRS will reduce this risk.
- Quantities of BDOs are not adequate to fill the Air Force requirement. The Air Force developed a mitigation plan in concert with procurement of the JSLIST ensembles to minimize risk. The recent plus-up of procurement funds for protective suits has aided in plans to transition to the JSLIST program. Due to the overall DoD WRM stockage of BDOs, the immediate risk is assessed as low. The BDOs will remain in inventory until they reach maximum shelf life.

- With the fielding of JSLIST overgarments, there is a need for additional personnel protection similar to the Army's Second Skin to be applied to the MCU-2/P series masks.
- CWU 66/77P remains the only Air Force capability for air crew ensembles with the end of the Chemical Protective undercoverall procurement, and are assessed at moderate risk. Continued planned procurements should correct this assessment in the short term. The Joint Protective Aircrew Ensemble (JPACE), being procured in FY03, will replace this suit.
- The collective protection area is assessed as high risk at this time, in part due to the continued high 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.
- With the expiration of M258A1 kits beginning in FY99, the status of M291 kits will become a moderate risk area. Production issues have delayed the delivery of M295 kits to the Services. Inventories remain low. The status of the M291 and M295 kits will improve as procurement funds are released, but this area requires careful monitoring.
- Medical chemical defense materiel remains in low risk. The shortage of Nerve Agent Antidote Kits (NAAK) can be supplemented with existing supplies of atropine and 2-PAM autoinjectors, reducing its risk from moderate to low. These items will gradually be replaced by the Nerve Agent Antidote Delivery System (NAADS) beginning about FY04.
- Execution of 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 FDA-approved capabilities to produce and store vaccines in quantities required to protect the force.

Table 4-1. Logistic Risk Assessments: 50 NBC Defense Items

CONTAMINATION AVOIDANCE/DETECTION EQUIPMENT

Items	Risk Assessment	Remarks
Radiological		
AN/VDR-2 Radiac Set	Low	USMC is short 22% of requirements
AN/PDR-75 Radiac Set	Low	USMC has less than half of requirements (in both above cases, USA quantities offset risk)
AN/UDR-13 Pocket Radiac	High	Low inventory, still fielding
Biological		
Biological Integrated Detection System (BIDS)	Moderate	Low inventory, still fielding
Chemical		
M256A1 Chemical Agent Detector Kit	Low	Shelf life expiration may reduce stocks in future
M8 Detection Paper	Low	
M8A1 Automatic Chemical Agent Alarm	Low	DoD downsizing has reduced total requirements
M1 Chemical Agent Monitor (CAM)/Improved CAM	Moderate	Low inventory; still fielding
Chemical Agent Point Detection System (CAPDS)	Low	
AN/KAS-1 Chemical Warfare Directional Detector	Low	
M21 Remote Sensing Chemical Agent Alarm (RSCAAL)	High	Low inventory, not being procured
M22 Automatic Chemical Agent Detector/Alarm	High	Low inventory; still fielding
M93A1 NBC Reconnaissance System "Fox"	High	Low inventory; still fielding
Automatic Liquid Agent Detector (ALAD)	Moderate	Low inventory
M272A1 Water Testing Kit	Low	
M274 NBC Marking Set	Low	Meets minimum 2 MTW avg. requirements

INDIVIDUAL PROTECTION

Items	Risk Assessment	Remarks
Masks		
MCU-2/P-series Mask	Low	USAF/USN mask
M40-series General Purpose Mask	Low	USA/USMC mask
M42-series Tank Mask	Low	
M48 Apache Mask	Moderate	Replaces M43-series mask, still fielding
MBU-19/9 Aircrew Eye/Resp. Protection (AERP)	Moderate	Replaces MBU-13/P; still fielding
Suits		
JSLIST protective suits	Moderate	In process of fielding to all Services
Battle Dress Overgarment (BDO)	Low	No further production – being replaced by JSLIST
Saratoga Suit	Low	No further production – being replaced by JSLIST
CWU 66/77P	Moderate	Low inventory; augmented by USAF CPU
Chemical Protective Undercoverall	Low	
Mark III Suit, Collective Protection, Overgarment	Low	No further production – being replaced by JSLIST
Aircrewman Cape	Low	
Gloves/Overboots		
Chemical Protective Gloves (7/14/25-mil)	Low	
Green/Black Vinyl Overshoes (GVO/BVO)	Low	Risk lowered due to chemical protective footwear
Chemical Protective Footwear Covers	Low	cover stocks
Disposable Chemical Protective Footwear Covers	Low	Replaced by GVO/BVO

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

COLLECTIVE PROTECTION

Items	Risk Assessment	Remarks
Chemical and Biological Protective Shelter (CBPS)	High	Low inventory, still fielding
M20A1 Simplified Collective Protective Equipment (SCPE)	High	Low inventory, not in production
M28 CPE HUB	High	Low inventory, still in production
M48A1 General Purpose Filter	High	Low inventory
Filter For (M59, M56, Shipboard) (200 CFM)	High	Low inventory

DECONTAMINATION EQUIPMENT

Items	Risk Assessment	Remarks
M258A1 Skin Decontaminating Kit	Low	Stocks will expire in FY99
M291 Skin Decontaminating Kit	Moderate	M258A1 stocks no longer augment M291
M295 Individual Equipment Decontamination Kit	High	Low inventory, still in production
DS-2, M13 Can	High	Low inventory
M11 Decontaminating Apparatus	Low	
M13 Decontaminating Apparatus, Portable	Moderate	Low inventory
M17-series Lightweight Decontamination System (LDS) (to include the A/E32U-8 Decontamination System)	Low	
M12A1 Power Driven Decontamination Apparatus (PDDA)	Moderate	Risk increased due to maintenance rqmts

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 as of November 1998, 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 REQUIREMENTS

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. The Services have indicated that adequate NBC defense equipment is on-hand to conduct training.

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.

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. 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 and Air Force's current inventories 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 (the Marine Corps views the BDO as a secondary protective ensemble). 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

With the end of the Cold War, a smaller DoD force, and subsequently reduced requirements for NBC defense items, lowered purchases of NBC defense consumables continue to threaten the industrial viability of this sector. While the sector is improving, vulnerabilities still exist. Collective protection systems (filters in particular) continue to be the most critical sub-sector 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 mission of the Joint Service Integrated Product Team (IPT) for Industrial Base Management and Planning is to assist the Services in identifying problems and issues associated with implementing and executing a Joint Service NBC Defense Industrial Base Management Plan. The IPT will be able to provide DoD decision makers with accurate industrial base information and analyses. It consists of representatives from the JSMG and JSIG, Joint Staff, Office of the Secretary of Defense, logistics representatives and Commodity Area Managers from the four Services and DLA.

The IPT is addressing issues from across the Services for more than 128 items/systems and spare parts critical to readiness. The IPT is conducting analyses to include industrial and technology capabilities, alternative sources of supply, and a financial and economic analysis. These analyses will provide the NBC management structure with alternatives and recommendations within the sub-sectors of NBC defense. To date, all systems were evaluated, with most identified as having no need for further assessments, and 37 as requiring action of some sort. The results of the initial screenings indicate that the M293 Maintenance Kit, the M40 Universal Second Skin, the CWU-66/77 protective suit, the M295 decontamination kit, and diazepam injections require further industrial base studies.

4.8 NBC DEFENSE LOGISTICS SUPPORT ASSESSMENT

ISSUE: **The Department of Defense's NBC Defense Program has a full capability to support and sustain the first of two MTWs. Readiness shortfalls that would preclude full support of a second MTW have been identified and will be addressed in the next POM (FY02-07). The Services' modernization efforts and common war reserve requirements will lessen the overall risk over the near term.**

SOLUTION: The Services continue to increase their readiness and sustainment status by consolidating common stocks and increasing visibility of their wholesale stocks. In most cases, accelerated procurement of critical items into war reserves will increase readiness against the potential use of weapons of mass destruction.

During 1998, all four Services participated in the continued 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.

ISSUE: **DoD continues to lack 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.

ISSUE: **NBC defense industries have a limited ability to augment specific shortfalls during any future contingency, in part due to lowered DoD procurements and the inability to retain warm production lines in critical areas. Without the introduction of significant plus ups or the use of innovative business practices (such as the use of performance specifications and use of ALPHA contracts), many of the small firms that make up this sector may choose to focus entirely on the commercial market place.**

SOLUTION: 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.

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

The following tables display NBC defense equipment total Service requirements, their wartime requirements, stocks on-hand quantities to include FY98 quantities on contract, and FY99–00 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, updated as of November 1998. This study has not yet been approved, but formal acceptance by the Services is anticipated in 1999.

It should be emphasized that the JCHEMRATES IV study's two MTW requirement is not and should not be considered a procurement target. This study did not fully consider air transport into theaters of conflict or Navy fleet requirements for ships at sea. While the Services in general agree with the methodology and intent of the study, it may require further refinement prior to becoming a fully accepted planning tool. The MTW requirement does not consider peacetime training requirements, sizing requirements, or full procurement to the entire active and Reserve forces. The MTW requirement does denote a minimum planning number, which if the total DoD inventory drops below, may represent a critical shortfall for that particular item, which should be immediately addressed to avoid diminishing the force's NBC defense capability.

Because of this limitation in the study, the Services have identified their total Service requirements as their procurement targets, while acknowledging JCHEMRATES as a necessary step in joint service management of the NBC defense program. The Services continually update these data call sheets on a frequent basis and consider these working papers rather than a static set of figures. The Services and DLA are working through the FY99 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.

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

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY98 DUE INS	PROJECTED DUE INS					
					FY99	FY00	FY01	FY02	FY03	FY04
INDIVIDUAL PROTECTION COMMODITY AREA										
CB MASK										
MASK, CB, M17A2	4240-01-143-2017-20	218,274	0	733,806	0	0	0	0	0	0
MASK, CB, M40/M40A1	4240-01-258-0061-63	508,832	308,295	1,036,297	0	0	0	0	0	0
MASK, M24, AVIATOR	4240-00-776-4384	46,391	0	53,530	0	0	0	0	0	0
MASK, M25A1, TANK	4240-00-994-8751-52	17,642	0	132,138	0	0	0	0	0	0
MASK, M42, TANK	4240-01-258-0064-66	96,249	18,514	208,977	0	0	0	0	0	0
MASK, M43, APACHE	4240-01-208-6966-69	4,553	710	3,127	0	0	0	0	0	0
MASK, M45, AVIATOR	4240-01-141-4034-52	9,500	1,844	13	0	0	0	0	0	0
MASK, M48, APACHE	4240-01-386-0198	5,801	1,844	191	0	0	0	0	0	0
MASK, M49	4240-01-413-4095-99	12,744	1,844	13,591	0	0	0	0	0	0
MISC PROTECTION										
PATS, M41	4240-01-365-8241	2,534	3,334	5,523	0	0	0	0	0	0
CONTAMINATION AVOIDANCE COMMODITY AREA										
RADIOLOGICAL DETECTION EQUIPMENT										
AN/PDR-75	6665-01-211-4217	6,039	5,445	7,378	0	0	0	0	0	0
AN/PDR-77	6665-01-347-6100	685	532	1,131	0	0	0	0	0	0
AN/UDR-13	6665-01-407-1237	1,861	26,901	458	2,376	2,863	2,926	4,211	8,673	12,849
AN/VDR-2	6665-01-222-1425	36,974	33,405	47,320	39	0	0	0	0	0
BIOLOGICAL DETECTION EQUIPMENT										
BIDS, M31	6665-01-392-6191	124	85	55	28	21	20	0	0	0
LR-BSDS, M34	6665-00-422-6605	24	10	4	0	4	4	3	0	0
CHEMICAL DETECTION EQUIPMENT										
ACADA, M22	6665-01-348-6963	28,839	28,839	1,724	1,540	4,668	7,274	0	0	0
ALARM, CAA, M8A1	6665-01-105-5623	27,755	28,000	29,958	0	0	0	0	0	0
CAM/ICAM	6665-01-357-8502	18,817	18,817	9,391	839	2,239	2,974	0	0	0
M21 RSCAAL	6665-01-334-6637	123	123	97	0	0	0	0	0	0
NBC RECON SYS, M93A1	6665-01-372-1303	123	123	43	12	15	15	4	4	17
DECONTAMINATION COMMODITY AREA										
DECON APPAR, M11	4230-00-720-1618	18,980	37,287	32,274	0	0	0	0	0	0
DECON APPAR, M13	4230-01-133-4124	226,800	111,125	31,338	16,653	0	0	0	0	0
DECON APPAR, PDDA, M12A1	4230-00-926-9488	682	129	477	0	0	0	0	0	0
L/WT DEC SYS, M17A1	4230-01-303-5225	1,327	2,516	2,598	30	0	0	0	0	0
COLLECTIVE PROTECTION COMMODITY AREA										
CP DEPMEDS (HUB, CP, M28)	4240-01-395-5179	17	16	5	1	1	1	1	1	1
SHELTER, CB PROTECT	5410-01-441-8054	792	792	95	41	36	39	43	43	57
SHELTER, CP, M20/M20A1	4240-01-166-2254	2,019	1,747	626	23	0	0	0	0	0
MEDICAL COMMODITY AREA										
LITTER, DECONTAMINABLE	6530-01-380-7309			6,026	1,052	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 FY98 DUE INS	PROJECTED DUE INS FY99	PROJECTED DUE INS FY00
INDIVIDUAL PROTECTION COMMODITY AREA						
OVERGARMENTS						
CHEM PROT UNDERGARMENT	8415-01-363-8692–00 8415-01-363-8683–91	728,718	254,312	132,757	173,413	169,464
JSLIST (ABDO) 45 DAYS	8415-01-444-1163 8415-01-444-5902	2,346,809	1,582,994	619	0	0
SCALP (TAN AND GREEN)	8415-01-364-3320–22 8415-01-364-3458–60	10,065	122,256	3,122	0	0
SUIT, CP CAMO (BDOs)	8415-01-137-1700-07	0	0	4,727,163	106,852	0
OVERBOOTS/GLOVES						
BLK/GRN VINYL OVERBOOTS	8430-01-317-3374-85	7,412,697	2,242,434	2,678,278	3,041	0
CP FOOTWEAR COVERS	8430-01-021-5978	1,028,707	0	641,791	7,094	0
CP GLOVES 7 MIL	8415-01-138-2501-04	473,041	121,741	254,204	0	0
CP GLOVES 14 MIL	8415-01-138-2497-00	1,067,558	486,963	797,789	0	0
CP GLOVES 25 MIL	8415-01-033-3517-20	6,270,220	3,368,247	5,702,880	5,718	0
MISC PROTECTION						
2D SKIN, M40 SERIES	4240-01-413-1540	812,709	354,231	194,415	10,081	0
CP HELMET COVER	8415-01-111-9028	1,320,556	4,085,749	530,325	35,575	0
FILTER CAN, C2A1	4240-01-361-1319	1,764,884	710,196	1,464,905	58	0
FILTER CAN, M10A1	4240-00-127-7186	196,464	0	77,969	1,523	0
FILTER ELEMENT, M13A2	4240-00-165-5026	584,511	0	377,722	0	0
HOOD, M40	4240-01-376-3152	3,534,562	1,046,139	1,401,518	15,252	0
HOOD, M5 (FOR M25A1)	4240-00-860-8987	46,316	0	24,902	0	0
HOOD, M6A2 (FOR M17)	4240-00-999-0420	733,910	0	491,311	0	0
HOOD, M7 (FOR M24)	4240-00-021-8695	44,172	0	45,514	2,424	0
CONTAMINATION AVOIDANCE COMMODITY AREA						
CHEMICAL DETECTION EQUIPMENT						
DET KIT, M256A1	6665-01-133-4964	198,290	38,587	64,689	2,462	0
DET PAPER, M8	6665-00-050-8529	1,348,777	1,840,515	1,621,206	14,852	0
DET PAPER, M9	6665-01-226-5589	1,797,646	1,817,497	538,915	5,026	0
MAINT KITS, M293/M273	5180-01-379-6409 5180-01-108-1729	93,422	37,708	15,168	2,261	0
NBC MARK SET, M274	9905-12-124-5955	38,733	2,986	46,087	8	0
WATER TEST KIT, M272A1	6665-01-134-0885	8,778	7,730	7,956	4	0
DECONTAMINATION COMMODITY AREA						
DECON KIT, M258A1	4230-01-101-3984	834,253	0	250,577	136	0
DECON KIT, M291	4230-01-276-1905	1,147,688	150,511	284,162	4,050	0
DECON KIT, M295	4230-01-357-8456	752,595	150,441	63,143	0	0
DS2, 1 1/3 QT	6850-00-753-4827	224,797	625,770	200,061	0	0
DS2, 5 GAL	6850-00-753-4870	314,155	4,852,261	315,910	7	0
DS2, M13 CAN	4230-01-136-8888	154,609	1,971,215	109,962	68	0
STB, 50 LB	6850-00-297-6653	7,321	4,651	12,110	14	0

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

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY98 DUE INS	PROJECTED DUE INS FY99	PROJECTED DUE INS FY00
COLLECTIVE PROTECTION COMMODITY AREA						
FILTER, CP M12A2 (M14 GPFU)	4240-01-365-0981	12,180	8,342	4,726	0	0
FILTER, CP M13 SERIES (M14 GPFU)	4240-00-368-6291	11,200	8,342	3,638	0	0
FILTER, CP M18A1	4240-00-365-0982	32,370	40,196	15,264	0	0
FILTER, CP M19	4240-00-866-1825	19,236	34,779	8,364	0	0
FILTER, GP M48A1	4240-01-363-1311	10,350	10,553	2,499	0	0
FILTER SET FOR (M59, M56, SHIPBOARD)	4240-01-369-6533	218	687	125	0	0
MEDICAL COMMODITY AREA						
2-PAM CHLORIDE AUTOINJ	6505-01-125-3248	99,666	1,055,520	1,260,789	0	0
ATROPINE AUTOINJ	6505-00-926-9083	99,666	1,055,520	561,732	0	0
CANA AUTOINJ	6505-00-274-0951	290,106	1,228,345	558,656	185,187	185,187
NAAK, MKI	6705-01-174-9919	504,878	1,885,775	923,410	222,189	0
PYRIDOSTIGIMINE TAB	6505-01-178-7903	76,254	1,408,778	421,470	11,866	11,866
PATIENT WRAPS	6530-01-383-6260		58,176	9,175	0	0
MES CHEM AG PAT DECON	6545-01-176-4612			394	104	0
OTHER TREATMENTS						
CYPROFLOXACIN	6505-01-272-2385 6505-01-273-8650 6506-01-333-4154			42,270 27,622 398	0	0
DOXYCYCLINE CAPS	6505-01-153-4335			96	0	0
SODIUM NITRITE	6505-01-206-6009			20,034	0	0
SODIUM THIOSULFATE	6505-01-334-8781			1	0	0

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

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY98 DUE INS	PROJECTED DUE INS					
					FY99	FY00	FY01	FY02	FY03	FY04
INDIVIDUAL PROTECTION COMMODITY AREA										
CB MASK										
MASK, AERP	8475-01-339-9782(S)	29,879	29,879	21,542	6,068	200	112	0	0	0
MASK, CB, M17A2	4240-01-143-2017-20	1,625	5,132	2,600	0	0	0	0	0	0
MASK, MCU-2/P, MASK, MCU-2A/P	4240-01-415-4239-41 4240-01-284-3615-17	345,856	345,856	344,880	20,002	2,045	0	0	0	0
MISC PROTECTION										
PATS, M41	4240-01-365-8241	1,208	1,208	500	112	258	435	0	0	0
CONTAMINATION AVOIDANCE COMMODITY AREA										
RADIOLOGICAL DETECTION EQUIP										
ADM 300-A KIT	6665-01-362-6213NW	300	117	265	20	20	0	0	0	0
-B KIT	6665-01-342-7747NW	800	597	899	25	39				
-C KIT	6665-01-320-4712NW	750	518	900						
-E KIT	6665-01-426-5071NW	250	119	239	10	20				
CHEMICAL DETECTION EQUIP										
ACADA, M22	6665-01-348-6963	2,140	2,140	177	220	50	25	0	0	0
ALARM, CAA, M8A1	6665-01-105-5623	423	331	0	0	0	0	0	0	0
CAM/ICAM	6665-01-357-8502	125	108	98	8	10	0	0	0	0
CHEM AGENT MONITOR/ICAM	6665-01-199-4153	1,000	1,960	450	838	672	10	0	0	0
M90 CWA	6665-01-408-5108	65	58	60	0	0	0	0	0	0
DECONTAMINATION COMMODITY AREA										
A/E32U-8 DECON SYS	4230-01-153-8660	175	0	169	8	0	0	0	0	0
L/WT DEC SYS, M17	4230-01-251-8702	299	0	300	0	0	0	0	0	0
L/WT DEC SYS, M17A1	4230-01-303-5225	50	0	48	0	0	0	0	0	0
L/WT DEC SYS, M17A2	4230-01-	380								
L/WT DEC SYS, M17A3	4230-01-346-3122	100	157	100	0	0	0	0	0	0
COLLECTIVE PROTECTION COMMODITY AREA										
CHATH (SHELTER, CP, M28)	NOT ASSIGNED	21	20	1	10	10	0	0	0	0
KMU-450 SHEL MOD KIT	4240-01-044-7659	25	16	25	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 FY98 DUE INS	PROJECTED DUE INS FY99	PROJECTED DUE INS FY00
INDIVIDUAL PROTECTION COMMODITY AREA						
OVERGARMENTS						
AIRCREWMAN CAPE	8415-01-040-9018	290,014	278,664	300,001	5,000	12,012
CLOTHING TEST KIT	6630-00-783-8192	200	167	9	0	0
CP UNDERCOVERALL	8415-01-040-3141	75,000	67,376	95,777	500	258
IMPREG UNDERGARMENT	8415-00-782-3242-5	5,000	5,000	4,925	0	0
JSLIST (ABDO) 45 DAYS	8415-01-444-1163 8415-01-444-5902	1,220,638	1,220,638	0	125,000	125,000
SUIT, AIRCREW, CWU-66/77P	8475-01-328-3454(S)	96,545	96,545	65,000	30,000	15,000
SUIT, CP CAMO (BDO)	8415-01-137-1700-07	0	801,167	558,701	54,425	17,252
SUIT, CP CAMO-DESERT 3 clr	8415-00-327-5347-53	0	13,878	57	0	0
SUIT, CP CAMO-DESERT 6 clr	8415-01-324-3084-91	0	23,656	36,085	1,996	0
OVERBOOTS/GLOVES						
BLK/GRN VINYL O/BOOTS	8430-01-317-3374-85	1,012,127	556,574	1,442,927	84,283	27,002
CP FOOTWEAR COVERS	8430-01-118-8172 (S) 8430-01-021-5978 (L)	154,802	106,612	200,005	2,005	5,697
CP GLOVES 7 MIL	8415-01-138-2501-04	226,002	167,619	341,003	21,006	7,014
CP GLOVES 14 MIL	8415-01-138-2497-00	1,834,565	653,715	2,279,351	537,229	106,024
CP GLOVES 25 MIL	8415-01-033-3517-20	90,000	12,960	122,380	3,056	90
CP SOCKS	8415-01-040-3169	200,056	170,768	199,070	3,111	787
DISP FOOTWEAR COVER	8430-00-580-1205	201,980	185,771	225,000	15,000	2,903
GLOVE INSERTS	8415-00-782-2809 (S)	2,245,876	1,688,335	2,441,469	330,002	75,000
MISC PROTECTION						
FILTER CAN, C2/C2A1	4240-01-119-2315	1,998,925	407,526	2,776,246	300,900	132,977
FILTER ELEMENT, M13A2	4240-00-165-5026	6,500	41,056	2,567	0	0
HOOD, M6A2 (FOR M17)	4240-00-999-0420	95,093	76,707	69,357	0	0
HOOD, MCU-2/P	4240-01-189-9423	2,225,189	851,056	3,071,242	49,707	81,000
MICS (COOL SYSTEM)	4240-01-298-4140YR	100	21	0	59	35
MICS VEST	8415-01-217-5634	1,110	80	1,410	0	0
CONTAMINATION AVOIDANCE COMMODITY AREA						
CHEMICAL DETECT EQUIP						
DET KIT, M18A2 KIT	6665-00-110-9492	100	37	62	29	38
DET KIT, M256A1	6665-01-133-4964	50,123	1,300	25,045	490	122
DET PAPER, M8	6665-00-050-8529	454,096	209,953	992,378	10,890	7,888
DET PAPER, M9	6665-01-049-8982 6665-01-226-5589	50,606 310,345	 249,650	40,308 300,090	302 30,000	16,699 12,090
MAINTENANCE KIT, M293	5180-01-379-6409	90	0	65	39	25
NBC MARK SET, M274	9905-12-124-5955	725	2,200	700	55	100
WATER TEST KIT, M272A1	6665-01-134-0885	100	445	115	10	19

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

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY98 DUE INS	PROJECTED DUE INS FY99	PROJECTED DUE INS FY00
DECONTAMINATION COMMODITY AREA						
CALCIUM HYPOCHLORITE	6810-00-255-0471	625	625	55	0	0
DECON KIT, M258A1	4230-01-101-3984	725,370	0	521,675	200,180	199,000
DECON KIT, M291	6850-01-276-1905	1,800,000	1,800,000	274,080	250,000	250,000
DECON KIT, M295	6850-01-357-8456	1,000,000	1,000,000	41,840	150,000	150,000
DRY SORBENT POWDER	6850-01-262-0484	1,150	100	55	992	194
SODIUM HYPOCHLORITE	6810-00-589-7316	100	625	100	0	0
STB	6850-00-297-6653	350	440	300	0	0
COLLECTIVE PROTECTION COMMODTY AREA						
FILTER, CP M13 SERIES (M14 GPFU)	4240-00-368-6291	0	0	0	0	0
FILTER, GP M48A1	4240-01-363-1311	0	4	0	0	0
FILTER SET FOR (M59, M56, SHIPBOARD)	4240-01-369-6533	0	0	0	0	0
MEDICAL COMMODITY AREA						
2-PAM CHLORIDE AUTOINJ	6505-01-125-3248 6505-01-080-1986	84,951	316,716	769,903 14,616	185,376 3,782	159,213 3,066
ATROPINE AUTOINJ	6505-00-926-9083 6505-00-299-9673	184,860	316,716	805,462 18,138	178,315 5,505	163,963 7,881
CANA AUTOINJ	6505-00-274-0951	64,620	105,572	265,339	155,295	140,211
NAAK, MKI	6705-01-174-9919	2,947	0	140	0	16
PYRIDOSTIGIMINE TAB	6505-01-178-7903	26,731	50,272	71,845	0	0
TETRACYCLINE	6505-00-655-8356	0	44,311	40,821	10,029	8,475
OTHER TREATMENTS						
CIPROFLOXACIN	6505-01-273-8650 6505-01-333-4154			27,530 9,059	76,403 6,504	34,644 4,854
SODIUM NITRITE	6505-01-206-6009			0	60	20
SODIUM THIOSULFATE	6505-01-206-6010			32	21	13

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

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY98 DUE INS	PROJECTED DUE INS					
					FY99	FY00	FY01	FY02	FY03	FY04
INDIVIDUAL PROTECTION COMMODITY AREA										
CB MASK										
MASK, MCU-2/P	4240-01-173-3443	8,863		4,601	0	0	0	0	0	0
MASK, MCU-2A/P	4240-01-284-3615/17	3,928	27,576	3,093	0	0	0	0	0	0
MASK, MCU-2A/P (WR) USN	4240-00-327-4148-50	189,094		200,086	0	0	0	0	0	0
CONTAMINATION AVOIDANCE COMMODITY AREA										
RADIOLOGICAL DETECTION EQUIP										
AN/PDR-27	6665-00-543-1435	1,642	953	1,556	0	0	0	0	0	0
AN/PDR-43	6665-00-580-9646	3,782	948	3,022	0	0	0	0	0	0
AN/PDR-56	6665-00-086-8060	163	76	218	0	0	0	0	0	0
AN/PDR-65	6665-01-279-7516	370	299	436	0	0	0	0	0	0
CP-95	6665-00-526-8645	29,782	386	20,031	0	0	0	0	0	0
PP-4276	6665-00-489-3106	6,054	377	4,009	0	0	0	0	0	0
IM-143	6665-00-764-6395	10,734	6,679	17,692	0	0	0	0	0	0
DT-60	6665-00-978-9637	135,344	74,686	112,957	0	0	0	0	0	0
BIOLOGICAL DETECTION EQUIP										
IBAD	NOT ASSIGNED	25	25	20	0	0	0	0	0	0
CHEMICAL DETECTION EQUIP										
ACADA, M22	6665-01-348-6963	300	300	0	142	80	78	0	0	0
ALARM, CAA, M8A1	6665-01-105-5623	262	128	262	0	0	0	0	0	0
CAPDS	6665-01-294-2556	230	230	225	0	0	0	0	0	0
CHEM AGENT MONITOR/ICAM	6665-01-199-4153	545	250	0	250	0	0	0	0	0
CWDD, AN/KAS-1	5855-01-147-4362	376	401	366	0	0	0	0	0	0
IPDS	NOT ASSIGNED	234	234	32	28	28	45	43	40	38
M21 RSCAAL	6665-01-334-6637	142	98	0	0	0	0	0	0	0
DECONTAMINATION COMMODITY AREA										
DECON APPAR, M11	4230-00-720-1618	2,078	1,250	960	0	0	0	0	0	0
L/WT DEC SYS M17A3 DIESEL	4230-01-346-3122	138	137	5	0	0	0	0	0	0
COLLECTIVE PROTECTION COMMODITY AREA										
SHELTER, CP, M20/M20A1	4240-01-166-2254	670	40	205	40	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 FY98 DUE INS	PROJECTED DUE-INS FY99	PROJECTED DUE-INS FY00
INDIVIDUAL PROTECTION COMMODITY AREA						
OVERGARMENTS						
IMPREG UNDERGARMENT	8415-00-782-3242-5	240	240	0	0	0
JSLIST (ABDO) 45 DAYS	8415-01-444-1163 8415-01-444-5902	319,000 339,000	69,768 339,000	2,800	0 81,504	0 88,121
SUIT, CP, OG MK3	8415-00-214-8289-92	0	289,665	214,556	0	0
OVERBOOTS/GLOVES						
BLK/GRN VINYL O/BOOTS	8430-01-317-3374-85	168,846	109,519	175,534	0	0
CP FOOTWEAR COVERS	8430-01-118-8172 (S) 8430-01-021-5978 (L)	 339,000	 339,000	13,058 121,993	0	0
CP GLOVES 7 MIL	8415-01-138-2501-04	0	56,472	0	0	0
CP GLOVES 25 MIL	8415-01-033-3517-20	339,000	339,000	330,782	0	0
CP SOCKS	8415-01-040-3169	0	177,248	0	0	0
DISP FOOTWEAR COVER	8430-00-580-1205	0	177,248	0	0	0
GLOVE INSERTS	8415-00-782-2809	478,000	478,000	254,739	0	0
MISC PROTECTION						
CP HELMET COVER	8415-01-111-9028	0	55,152	0	0	0
FILTER CAN, C2/C2A1	4240-01-119-2315	480,000	480,000	315,204	0	0
HOOD, MCU-2/P	4240-01-189-9423	0	63,408	0	0	0
CONTAMINATION AVOIDANCE COMMODITY AREA						
CHEMICAL DETECT EQUIP						
DET KIT, M256A1	6665-01-133-4964	10,235	159	10,077	0	0
DET PAPER, M8	6665-00-050-8529	91,567	49,220	48,059	0	0
DET PAPER, M9	6665-01-226-5589	30,902	68,132	36,569	0	0
NBC MARK SET, M274	9905-12-124-5955	522	22	480	0	0
TUBE PHOSGENE	6665-01-010-7965	1,207	1,596	1,750	0	0
WATER TEST KIT, M272A1	6665-01-134-0885	421	77	290	0	0
DECONTAMINATION COMMODITY AREA						
CALCIUM HYPOCHLORITE	6810-00-255-0471	9,001	9,001	3,618	0	0
DECON KIT, M258A1	4230-01-101-3984	26,402	0	19,944	0	0
DECON KIT, M291 (20 PER)	4230-01-276-1905	124,410	3,170	156,188	0	0
DECON KIT, M295 (20 PER)	4230-01-357-8456	0	1,585	0	0	0
DS2, 5 GAL	6850-00-753-4870	0	12,160	0	0	0
SODIUM HYPOCHLORITE	6810-00-598-7316	0	613	0	0	0
STB	6850-00-297-6653	37	1,437	0	0	0
COLLECTIVE PROTECTION COMMODITY AREA						
FILTER, GP M48A1	4240-01-363-1311	0	293	0	0	0
FILTER SET (FOR M59, M56, SHIPBOARD)	4240-01-369-6533	0	586	0	0	0
PRE-FILTER, SHIPBOARD CPE	4240-01-066-3266	23,655	293	9,176	1,848	1,428

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

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY98 DUE INS	PROJECTED DUE-INS FY99	PROJECTED DUE-INS FY00
MEDICAL COMMODITY AREA						
2-PAM CHLORIDE AUTOINJ	6505-01-125-3248	19,521	95,112	227,529	0	0
ATROPINE AUTOINJ	6505-00-926-9083	19,521	95,112	337,580	0	0
CANA AUTOINJ	6505-00-274-0951	6,507	31,704	38,984	0	0
NAAK, MK1	6705-01-174-9919	19,521	95,112	17,384		
PYRIDOSTIGIMINE TAB	6505-01-178-7903	65,068	15,097	50,696	0	0
TETRACYCLINE	6505-00-655-8356	0	3,271	0	0	0
OTHER TREATMENTS						
CIPROFLOXACIN	6505-01-273-8650 6505-01-333-4154			540 239	0	0
DOXYCYCLINE CAPS	6505-00-009-5060 6505-00-009-5063			2,214 7,811	0	0
SODIUM NITRITE	6505-01-206-6009			4	0	0
SODIUM THIOSULFATE	6505-01-334-8781			4	0	0

Table 4-5a. Marine Corps Logistics Readiness Data – Non-Consumables

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY98 DUE INS	PROJECTED DUE INS					
					FY99	FY00	FY01	FY02	FY03	FY04
INDIVIDUAL PROTECTION COMMODITY AREA										
CB MASK										
MASK, CB, M40/M40A1	4240-01-258-0061-63		71,474	199,137	30,000	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	227,069	0	612	0	0	0	0	0	0
MASK, M42, TANK	4240-01-258-0064-66	(total roll-up of	4,174	5,214	0	0	0	0	0	0
MASK, MCU-2/P	4240-01-415-4239-41	mask rqmts)	0	98	0	0	0	0	0	0
MISC PROTECTION										
MASK COMM ADAPTOR	5996-01-377-9695	50,000	50,000	21,393	34,000	0	0	0	0	0
PATS, M41	4240-01-365-8241	258	258	258	0	0	0	0	0	0
CONTAMINATION AVOIDANCE COMMODITY AREA										
RADIOLOGICAL DETECTION EQUIP										
AN/PDR-75	6665-01-211-4217	1,203	1,203	681	0	0	0	0	0	0
AN/VDR-2	6665-01-222-1425	2,343	2,343	1,826	0	0	0	0	0	0
CHEMICAL DETECTION EQUIP										
ACADA, M22	6665-01-348-6963	579	579	0	460	119	0	0	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
M21 RSCAAL	6665-01-334-6637	151	472	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	7,056	43,271	0	0	0	0	0	0
DECON APPAR, M13	4230-01-133-4124	1,600	16,864	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	0	344	0	0	0	0	0	0
L/WT DEC SYS, M17A3	4230-01-346-3122	884	1,350	884	0	0	0	0	0	0
COLLECTIVE PROTECTION COMMODITY AREA										
**										

** - Note: The Marine Corps has stopped using the Portable Collective Protection System; therefore there are no collective protection systems to report.

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

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY98 DUE INS	PROJECTED DUE INS FY99	PROJECTED DUE INS FY00
INDIVIDUAL PROTECTION COMMODITY AREA						
OVERGARMENTS						
JSLIST (ABDO) 45 DAYS	8415-01-444-1163 8415-01-444-5902	696,000	286,457	23,905	7,000	7,000
SUIT, CP CAMO (BDO)	8415-01-137-1700-07	(total roll-up of	0	174,020	0	0
SUIT, CP, SARATOGA	8415-01-333-7573-76	rqmts)	596,131	629,776	0	0
SUIT, CP, SARATOGA DESERT	8415-01-333-7577-80		50,000	0	0	0
OVERBOOTS/GLOVES						
BLK/GRN VINYL O/BOOTS	8430-01-317-3374-85	654,000	505,812	273,846	0	0
CP FOOTWEAR COVERS	8430-01-021-5978	0	0	368,825	0	0
CP GLOVES 25 MIL	8415-01-033-3517-20	654,000	646,820	715,125	0	0
MISC PROTECTION						
2D SKIN, M40 SERIES	4240-01-413-1540	277,069	109,514	23,696	51,000	0
CP HELMET COVER	8415-01-111-9028	0	425,531	0	0	0
FILTER CAN, C2/C2A1	4240-01-119-2315 4240-01-361-1319	554,246	152,546	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	0	197,065	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	25,973	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	0	0	0	0
CONTAMINATION AVOIDANCE COMMODITY AREA						
CHEMICAL DETECT EQUIP						
DET KIT, M256A1	6665-01-133-4964	6,324	19,493	4,841	0	0
DET PAPER, M8	6665-00-050-8529	12,654	201,547	12,654	0	0
DET PAPER, M9	6665-01-049-8982 6665-01-226-5589	189,747	317,903	10,565	0	0
MAINTENANCE KIT, M293	5180-01-379-6409	0	0	0	0	0
NBC MARK SET, M274	9905-12-124-5955	2,286	2,204	209	0	0
WATER TEST KIT, M272A1	6665-01-134-0885	3,159	920	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	25,826	340,876	0	0
DS2, 1 1/3 QT	6850-00-753-4827	4,453	14,112	13,648	0	0
DS2, 5 GAL	6850-00-753-4870	7,252	289,223	5,359	0	0
DS2, M13 CAN	4230-01-136-8888		23,920		0	0
NITROGEN CYLINDERS	4230-00-775-7541	2,316	15,847	13,081	0	0
STB	6850-00-297-6653	7,410	1,202	401	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 FY98 DUE INS	PROJECTED DUE INS FY99	PROJECTED DUE INS FY00
COLLECTIVE PROTECTION COMMODITY AREA						
FILTER, CP M12A2 (M14 GPFU)	4240-01-365-0981	115	847	0	0	0
FILTER, CP M13 SERIES (M14 GPFU)	4240-00-368-6291	115	847	0	0	0
FILTER, CP M18A1	4240-00-365-0982	437	2,352	0	0	0
FILTER, CP, M19	4240-00-866-1825	219	1,176	0		
FILTER, GP M48A1	4240-01-363-1311	233	488	0	0	0
FILTER SET FOR (M59, M56, SHIPBOARD)	4240-01-369-6533	0	0	0	0	0
MEDICAL COMMODITY AREA						
2-PAM CHLORIDE AUTOINJ	6505-01-125-3248	291,216	271,135	291,216	0	0
ATROPINE AUTOINJ	6505-00-926-9083	205,344	271,135	205,344	0	0
CANA AUTOINJ	6505-00-274-0951	93,336	66,026	93,336	0	0
NAAK, MKI	6705-01-174-9919	0	354,800	0	0	0
PYRIDOSTIGIMINE TAB	6505-01-178-7903	93,336	0	93,336	0	0

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

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY98 DUE INS	PROJECTED DUE INS FY99	PROJECTED DUE INS FY00
INDIVIDUAL PROTECTION COMMODITY AREA						
OVERGARMENTS						
AIRCREWMAN CAPE	8415-01-040-9018	N/A	N/A	27,534	0	0
IMPREG UNDERGARMENT	8415-00-782-3242-5	N/A	N/A	6,226	0	0
JSLIST SUITS	8415-01-444-1200-70 8415-01-444-5504-98	N/A	N/A	0	42,000	41,000
SCALP (TAN AND GREEN)	8415-01-364-3320-22 8415-01-364-3458-60	N/A	N/A	1,248 27,113	0	0
SUIT, AIRCREW, CWU-66/77P	8475-01-328-3454(S)	N/A	N/A	0	4,000	25,000
SUIT, CP CAMO (BDO)	8415-01-137-1700-07	N/A	N/A	34,010	0	0
SUIT, CP CAMO-DESERT - 3 color	8415-00-327-5347-53	N/A	N/A	142,498	0	0
SUIT, CP CAMO-DESERT - 6 color	8415-01-324-3084-91	N/A	N/A	0	0	0
SUIT, CP, OG MK3	8415-00-214-8289-92	N/A	N/A	13,671	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	264,229	105,000	154,000
CP FOOTWEAR COVERS	8430-01-118-8172 (S) 8430-01-021-5978 (L)	N/A	N/A	0	0	0
CP GLOVES 7 MIL	8415-01-138-2501-04	N/A	N/A	147,482	0	0
CP GLOVES 14 MIL	8415-01-138-2497-00	N/A	N/A	649,542	0	0
CP GLOVES 25 MIL	8415-01-033-3517-20	N/A	N/A	1,211,189	0	0
CP SOCKS	8415-01-04-3169	N/A	N/A	271,667	0	0
DISP FOOTWEAR COVERS	8430-00-580-1205-06	N/A	N/A	50,579	13,455	14,052
MISC PROTECTION						
CP HELMET COVER	8415-01-111-9028	N/A	N/A	188,704	0	0
HOOD, MCU-2A/P	4240-01-189-9423	N/A	N/A	846,411	0	0
CONTAMINATION AVOIDANCE COMMODITY AREA						
CHEMICAL DETECTION EQUIP						
MAINT KIT, M293	5180-01-379-6409	N/A	N/A	2,374	0	0
TUBE PHOSGENE	6665-01-010-7965	N/A	N/A	48	196	196
DECONTAMINATION COMMODITY AREA						
CALCIUM HYPOCHLORITE	6810-00-255-0471	N/A	N/A	103,612	27,752	55,504
DRY SORBENT POWDER	6850-01-262-0484	N/A	N/A	80	0	0
STB, 50 LB	6850-00-297-6653	N/A	N/A	540	1,380	1,380
COLLECTIVE PROTECTION COMMODITY AREA						
PRE-FILTER, SHIPBOARD CPE	4240-01-348-8785	N/A	N/A	554	588	588

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

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY98 DUE INS	PROJECTED DUE INS FY99	PROJECTED DUE INS FY00
MEDICAL COMMODITY AREA						
2-PAM CHLORIDE, AUT	6505-01-125-3248	N/A	N/A	237,887	250,000	250,000
ATROPINE AUTOINJ	6505-00-926-9083	N/A	N/A	375,172	340,000	340,000
CANA	6505-00-274-0951	N/A	N/A	267,034	300,000	300,000
DIAZEPAM	6505-00-137-5891	N/A	N/A	5,588	0	0
NAAK, MKI	6705-01-174-9919	N/A	N/A	552,000	0	0
PYRIDOSTIGIMINE TABLETS	6505-01-178-7903	N/A	N/A	256,196	100,000	100,000
LITTER DECONTAMINABLE	6530-01-380-7309	N/A	N/A	3,500	1,518	0
MES CHEM ACT PAT TR	6545-01-141-9469	N/A	N/A	164	0	0
MES CHEM AG PAT DECON	6545-01-176-4612	N/A	N/A	108	0	0

APPENDIX 2
FIELDED 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, as compared to other commodity areas. Many programs will complete their fielding beyond FY04.

Current numbers of biological detection devices, to include the Biological Integrated Detection System (BIDS) and Interim Biological Agent Detector (IBAD), are sufficient as measured against the draft average MTW requirements. Automatic biological agent point detectors and stand-off detectors are currently in development, and will not be deployed in significant numbers prior to FY02. The USAF has no fielded biological agent detection capability other than the limited quantities of Portal Shield ACTD biological detectors.

The combined total of chemical agent detection systems remains at moderate risk, but will improve slowly with the M22 Automatic Chemical Agent/Detector (ACADA) supplementing the M8A1 Automatic Chemical Agent Alarm. An Army initiative to inspect and repair M8A1 alarms at Anniston Army Depot has resulted in the quick assessment and return of 1,600 units to the field. Another 1,500 alarms were coded as requiring depot maintenance and are undergoing repairs. As a result of this program, the Army has no shortage of alarms for training purposes and there is no longer an acquisition gap between the combined acquisition of M8A1 and M22 alarms.

The M21 Remote Sensing Chemical Agent Alarm (RSCAAL) is at moderate risk with 82 percent two MTW fill projected by FY04. Technology from this system will be applied to the JSLSCAD, now under development. The M93A1 NBCRS is currently fielded at less than half 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.

The Army and Air Force radiac programs are expected to meet the two MTW scenario average requirements. The Army National Guard still has a large number of obsolete radiacs. These will be replaced in the near future by the AN/VDR-2 which is available in sufficient quantities through the depot system. The Navy has a small quantities of older radiacs still in the inventory, which should be replaced through a modernization program currently underway. The Marine Corps has about three-quarters of the required AN/VDR-2s and less than half of its AN/PDR-75s as compared to the MTW requirements. While Army stores or industry could compensate for this shortfall, it represents a potential risk, especially at the onset of any contingency.

2. INDIVIDUAL PROTECTION

Currently fielded protective suits and masks were primarily designed for use in the European environment against a Soviet threat. Equipment in this area is designed to protect 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. Fielding of the M40/42 protective masks, JSLIST protective suits and the MULO boot has begun to resolve many of these former challenges.

2.1 Protective Ensembles

The Services have initiated acquisition of 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 have begun delivery, equating to about 260,000 suits. The initial contracts did not include surge option clauses. Defense Supply Center Philadelphia (DSCP) took management of JSLIST in FY98, whose solicitations include the surge option as a 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 FY05, the number of suits on hand will fall below total 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 (14 years), and the Services have no plans for new production. There are no companies currently

manufacturing the BDO. The Army and Air Force have sufficient suits on hand in war reserves to sustain its requirements for the near term. The Saratoga suit, purchased by DSCP for the Marine Corps, is also out of production, but current stocks will sustain the Marine Corps until the JSLIST is available in adequate numbers. The Navy is relying on existing stocks of their Mark III chemical protective suit (also out of production) as stocks of JSLIST are being procured.

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 smaller total requirements for aircrews (relative to ground troops). The only exception is the CWU-66/77, which is supplemented by the Chemical Protective Undercoverall to result in a moderate 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 have less than 25 percent of MTW requirements on hand. Increased procurements would reduce both risks in the short term.

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 FY04 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. Their shortages are supplemented by the Black/Green Vinyl Overboot (BVO/GVO), which 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 total DoD inventory shows adequate quantities of protective footwear, resulting in low risk assessment. The USMC is the only service reporting a shortage of footwear, but DLA can fill their shortfall.

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. This modernization effort is still ongoing; not all units have replaced their M43-series masks. All of these masks are at low risk, as the combined numbers of all

aviator masks 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 mask 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 generally exceeds the requirement. The USAF has some shortages in masks and does not have second skins to provide complete personal protection. 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. Quantities of this mask are at 80% of the draft MTW requirements, making this a moderate risk.

In order to provide complete protection to our forces on the contaminated battlefield, particularly from liquid chemical agents, protective hoods and helmet covers are required as part of the individual protective ensemble. The protective hood for the M40 is rated as low risk. It is being replaced by the second skin for the M40 series mask, which is a high risk program with only 60 percent of requirements on hand by FY04. The MCU-2P hood is at low risk with an abundant inventory. Protective hoods for the M17-series, M24, and M25A1 masks are not a readiness issue, as these masks are leaving the inventory. The Chemical Protective Helmet Cover is a moderate risk with 66 percent of FY04 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 currently exceeds requirements through FY04. The M13A2 filter element also exceeds requirements, but as stated will be leaving the inventory with the retirement of the M17-series mask. 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 collective protective filters.

The Air Force has expressed interest in a greater 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.

In the near term, the M51 shelter will be replaced by the new Chemical and Biological Protective Shelter (CBPS). All Army M51 shelters have been coded as unservicable. The CBPS is presently in production with fielding to initiate in 1QFY99. 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 originally planned, and all these components are not funded to meet Force Package I requirements. The effort to complete development and production of chemically protected latrine and water distribution systems and alarms remains unfunded.

The M20-series Simplified CPEs are 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. There are some Force Package II units designated for deployments into high threat regions that will not be equipped with M20 shelters. 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. The Marine Corps has Portable Collective Protection Shelters (PCPS) but does not plan to field them. The M20A1 SCPE is by default the only modern collective protection stand-alone shelter outside of the medical community in the inventory.

The Services have continued to improve integrated collective protection systems in armored vehicles and vans. All modern armored vehicles and armored vehicles in development have either filtered air systems, hybrid collective protection or full collective protection systems designed into their chaises. Notable progress has been 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.

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. Continued difficulties in obtaining a strong industrial base in this field compound the issue of fielding and sustaining these items.

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 that 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. While the M11 is assessed as posing low risk, there are insufficient quantities of the M13 DAP as measured against the MTW requirements. The 1½ quart M11 can be used in place of the 14-liter M13 DAP, but they do not fulfill the same exact capability (in part due to the volume of DS-2).

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. The Air Force employs the M17 at the squadron level for operational equipment decontamination. The M17 is assessed as a low risk, but may be increased due to a delay in rebuilding several hundred systems caused by a lack of funding since 1990. 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. The Air Force is deleting stocks of A/E32-U systems by attrition, modifying existing M17s to M17A2s, and procuring additional M17A3s to satisfy shortages.

In the Army, the M12A1 Power-Driven Decontamination Apparatus (PDDA) and the M17A3 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 displace 200 M12A1 PDDAs over the POM period, resulting in a high-low mix of technology. By FY02, the on-hand quantities of the M21/M22 MDS alone should satisfy the two MTW requirement. Additionally, the Marine Corps is replacing their M12A1 PDDAs with the M17-series LDS.

Although sufficient quantities of bulk DS-2 are available, the Army and Marine Corps plans for stocking containers of DS-2 (5-GAL and M13 Can) are below the MTW requirements expected for decontamination operations. While less hazardous replacement decontaminants are being developed, the quantities and packaging of current decontaminants present potential risk. The projected stockage of STB meets average MTW requirements, but has been considered a high-risk category in the past. Slight shortages in calcium hypochlorite and sodium hypochlorite can be made up by the industrial base, using commercially available alternatives. These increased requirements come as a result of increased attention to the need for decontamination capabilities in the 2 MTW scenario, and will be further refined. Continued monitoring is recommended.

The M258A1 Skin Decontamination Kit is the primary item used in personnel decontamination. The replacements for the M258A1 is the M291 Skin Decontaminating 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. These M258A1 kits are expected to expire in FY99, which will raise the risk assessment next year if procurements of the M291 kit are not increased. Rohm & Haas, Co., the sole supplier of the resin, sold the mixing and packaging equipment they used to manufacture the M291 Decontaminating Kit. Pine Bluff Arsenal, Arkansas, set up a production line and began to manufacture the M291 Decontaminating 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.

The projected stockage of the M295 Individual Equipment Decontamination Kit puts it in a high risk category when compared with 2 MTW requirements. The M295 Decontamination Kit uses the same resin mix as the M291 Decontaminating Kit, and began delivery in December 1997. True Tech Inc. has been producing this item in quantities of 760 kits per month for the past year. Increased funding for its procurement would alleviate the risk.

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. Current projections for medical chemical defense material indicates that sufficient quantities should be on hand through the POM years and present low risk. Quantities of Nerve Agent Antidote Kits (NAAK), Convulsant Antidote Nerve Agent (CANA), and Nerve Agent Pyridostigmine Pretreatment (NAPP) tablets now support two MTW requirements. The overall status of medical CB defense programs has not changed since last year, but this year's report has expanded its scope to include medical treatments for biological warfare agents and a cyanide exposure.

NAAP is still an Investigational New Drug (IND) for the use as a nerve agent pretreatment. The U.S. Army Medical Materiel Development Activity (USAMMDA) has continued to work with the FDA for approval. Roche manufactures NAAP in Great Britain. Roche has sold this production line to ICN. Defense Supply Center –Philadelphia (DSCP) is working with ICN to establish a requirements contract for the manufacturer of NAAP.

The sole supplier to DoD for NAAK, atropine autoinjectors, pralidoxime autoinjectors and CANA is Meridian Medical Technologies, St Louis, Missouri. The medical chemical defense production line is being maintained with an IBMC. Meridian is an U.S. company but it obtains its atropine for the autoinjectors from a German supplier. Currently there is no domestic source for this drug. Pralidoxime and diazepam (CANA) for the autoinjectors is available from U.S. sources.

Patient Chemical Wraps have not been procured since 1991 and are made of the BDO materiel. USAMMA and the AMEDDC&S are currently assessing several versions of the patient wrap before initiating new procurement of this item. All services are procuring the new decontaminable litter, but in limited quantities, for first line units. There is a very large stockpile of canvas litters that can be used once in a NBC environment and then destroyed. As the canvas litters are depleted, they will be replaced with the new nylon decontaminable litter.

The Army has centrally funded, procured, stored, and managed Medical Chemical Defense Materiel since 1994 at Surgeon General designated storage locations. The U.S. Army Medical Materiel Agency (USAMMA) is the project manger for this materiel. Materiel is stored at strategic locations as Division Ready Brigade sets (DRBs), which support 5000 service members or by lot, manufacturer and product at Meridian Medical Technologies under an IBMC. The Air Force, Navy and Marine Corps maintain their medical CB materiel in decentralized unit locations. Visibility of on-hand assets has been improved with the release of the Joint Medical Asset Repository (JMAR) which is the Class VIII (medical) portion of JTAV.

Medical research programs continue to explore medical countermeasures to deter and defeat the use of biological warfare agents against U.S. forces. The Joint Program Office for Biological Defense (JPO-BD) has awarded a prime systems contract through the Joint Vaccine Acquisition Program (JVAP) for the development, FDA licensure, storage, and production of vaccines against DoD's identified potential biological warfare agents. Currently, the U.S. total force (active and reserve forces) is being vaccinated against the primary high-threat BW agent, anthrax. The anthrax vaccination program is a three-phase program, starting with the troops serving in-or identified to deploy to-the two high-threat areas where hostile anthrax-use poses the greatest potential danger. The vaccination program is on-schedule and will take between seven and eight years to complete for all service members (to include new personnel acquisitions as the program extends over the entire period).

JPO-BD has assisted the sole domestic supplier of anthrax vaccine to maintain its FDA licensure and transition the production facility to private ownership in FY98. A follow-on contract was also awarded in FY 98 to ensure sufficient anthrax vaccine to meet the DoD vaccination program. Other vaccines (or combinations) are currently in various stages of development and testing to protect against other BW agents identified in the Chairman of the Joint Chiefs of Staff (CJCS) validated BW threat list. In the area of medical therapeutics, the Department is maintaining a stockpile of antibiotics (*e.g.*, ciprofloxacin, doxycycline, etc.) sufficient to address the treatment needs of potential BW exposures, where such treatment is medically indicated.

Chapter 5

Nuclear, Biological, and Chemical (NBC) Defense Readiness and Training

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 builds on the successes of each Service to develop a viable Joint orientation to NBC defense capabilities, which include Joint requirements documents; Joint doctrine and tactics, techniques, and procedures; Joint modeling, simulation, and wargaming; and Joint professional training.

5.2 NBC DEFENSE DOCTRINE

Joint 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.

Multi-National Doctrine. The U.S. Army Nuclear and Chemical Agency (USANCA) has been delegated the DoD representative for international standardization of NBC operational matters. USANCA participates in the following North Atlantic Treaty Organization (NATO) groups:

- NBC Defense Interservice 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.

The USANCA also has been delegated as the representative 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). The US Army Chemical School (USACMLS) participates with USANCA to incorporate NBC group agreements in revising existing manuals.

The USACMLS has been delegated as the representative at the NATO Training Group (Joint Services Subgroup) in addition to providing representation and subject matter expertise to support USANCA at NATO/QWG meetings as required. This includes consultation to coordinate the official US position on NBC defense issues prior to international meetings.

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 the 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

The US Army Chemical School (USACMLS) has the task from the Joint Staff to revise Joint Pub 3-11, *Joint Doctrine for Nuclear, Biological, and Chemical (NBC) Defense*. The title of the Joint Pub will be changed to Operations in an NBC Environment. This change reflects an increased emphasis on sustaining operations in a contaminated environment. An initial draft was staffed with all Services, comments consolidated, and recommendations for changes recorded. A second draft was published and distributed to the combatant Commands, Services, and the Joint Staff for comment in March 1999.

The JSIG is working with the Air Land Sea Application (ALSA) Center and the Joint Warfighting Center to lead the effort in the development of multi-service NBC defense doctrine. Currently ALSA is revising FM 3-4-1, *Multi-Service Procedures for NBC Defense of Fixed Sites, Ports, and Airfields*, in coordination with all the Services.

The USACMLS also provided exercise and training support to CINCs and various organizations throughout the year. Subject matter experts were provided to the Army War College for their Crisis Action Exercises, to the Atlantic Command (ACOM) for Joint Task Force (JTF) training, and to Exercise Silent Breeze II for briefing support.

The U.S. Army Medical Department Center and School (USAMEDDC&S) has been tasked to revise Joint Publication 4-02, *Doctrine for Health Service Support in Joint Operations*. The revision contains additional information on the medical aspects of NBC defense. USAMEDDC&S is assisting OSACMLS in revising the medical support aspects of Joint Pub 3-11.

5.2.3 Army Medical Doctrine Development Program

Multi-Service Doctrine. The FY98 effort consisted of initiatives to develop new Army Medical Department (AMEDD) NBC defense doctrine products, provide AMEDD input to other service NBC doctrine publications, and provide input to multinational medical NBC procedures. The initial draft of the FM 8-284, *Treatment of Biological Warfare Agent*

Causalities is completed. The draft has been distributed for review. Development of a new manual, FM 8-283, *Treatment of Nuclear Warfare Causalities and Low-Level Radiation Exposure* will be initiated when FM 8-284 is in the advanced stages of completion. These two manuals will be developed as multiservice publications. FM 8-10-7, *Health Service Support in a Nuclear, Biological, and Chemical Environment* is being revised and reviewed as a multiservice publication. 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, industrial radiation, biological, and chemical hazards.

Multi-National Doctrine. The Office of The Surgeon General (DASG-HCO) has been designated the head of Delegation for the NBC Medical Working Group for standardization of NBC Medical operational matters. OTSG, DASG-HCO participates in the NATO groups shown in Table 5-1. The AMEDD participated in numerous NATO medical NBC procedural product reviews, resulting in several NATO Standardization Agreements (STANAGs) being updated. Further, the AMEDD participated in a Quadripartite Working Group to develop and update additional Quadripartite Standardization Agreements (QSTAGs), which are medical NBC procedural products. 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 the proponent.

Table 5-1. Selected NATO Groups

- NBC Defense Working Group
- NBC Medical Working Group – Head of Delegation
- Land Group 7 (LG.7) – Joint NBC Defense
- Working Group 2 (LG.7) – Low Level Radiation in Military Environments
- Challenge Subgroup (LG.7) – Chemical/Biological Toxicity Challenge Levels
- General Medical Working Party, Aeromedical Working Group
- Research Technology Area/Human Factors Medical (RTA/HFM) Panel NB&C Medical Subgroups.

5.2.4 Air Force Medical Doctrine Development Program

HQ USAF/SGXR has been participating with the Army in development of a doctrine field manual, *Treatment of Biological Warfare Agent Casualties*. A CONOPS was completed that standardized wartime medical contamination control operations. During FY98 SGXR has also participated in the review of numerous NATO Standardization Agreements that were updated during the year.

5.2.5 Marine Corps Doctrine

The Marine Corps continues to systematically review multi-service NBC doctrine. The Marine Corps has reviewed a number of NATO Standardization Agreements as well as multi-service doctrine with both the U.S. Army and the U.S. Navy. The Marine Corps has completed a new Marine Corps Warfighting Publication (MCWP) 3-37, *Marine Air Ground Task Force (MAGTF) NBC Defense*.

5.3 STANDARDS/PROFICIENCY AND CURRENCY

Each service establishes standards of proficiency and currency for NBC defense training.

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. The USACMLS is responsible to train and sustain Chemical Corps soldiers and leaders and provide task/condition/standard limits, suggested training products, and oversight in the areas of NBC matters. Although the U.S. Army Chemical School (USACMLS) is neither designated nor resourced to be the DoD Executive Agent for joint NBC defense training, it has initiated several actions to counter NBC threats, including:

(1) assisting CINCs, Major Commands, and their staffs in assessing and providing reference materials regarding the NBC threat and recommending 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 instructional capabilities for both resident and nonresident instruction;
(5) conducting the Joint Senior Leader Training Course – A Focus on Weapons of Mass Destruction, intended to provide leaders from all Services with an understanding of joint NBC defense operations, training, readiness, threat, doctrine, and capabilities.

The initiatives have not been completed due to lack of resources.

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 that 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 most units have 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 at least 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 Army Training and Exercise Plan (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. In February 1998, the 20th Chemical Detachment (BIDS) deployed in support of Operation Desert Thunder. Additionally, the 310th Chemical Company (BIDS) was mobilized from the Army Reserve for mobilization training during March-June 1998 to support Operation Desert Thunder.

The USACMLS Move to Fort Leonard Wood. Construction of facilities at Fort Leonard Wood is on schedule. Completion and availability dates are shown as follows.

Facility	Construction Completion	Available for Occupancy
CDTF Admin Building	30 September 1998	15 November 1998
CDTF Training Building	7 January 1999	12 February 1999
Chemical Applied Training Facility	13 October 1998	8 January 1999
General Instruction Facility	17 May 1999	21 July 1999
Unaccompanied Enlisted Housing	17 May 1999	2 July 1999

In preparation for the move, the first individuals departed Fort McClellan in October 1998 and will be assigned to the CDTF at Fort Leonard Wood. A second large group left during February through March 1999. These include the combat developers, the training developers, and portions of the Chemical Brigade staff. The training departments will move to Fort Leonard Wood during May to August 1999 upon completion of scheduled training at Fort McClellan.

The USACMLS expects to stand up the 3d Chemical Brigade at Fort Leonard Wood during April through May 1999. This brigade will be responsible for all training activities at the Chemical School after the move is complete. Additionally, the brigade will provide command and control for the 82d Chemical Battalion (OSUT), the 84th Chemical Battalion, and the 58th Transportation Battalion.

All personnel and equipment that belong to the USACMLS must be on the way to Fort Leonard Wood by 30 September 1999.

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 field medical operations and to treat, manage, and evacuate battlefield casualties. The NBC Sciences Branch provides classes and practical exercises in the skills necessary to perform battlefield medical operations in an NBC environment, to decontaminate, manage and treat contaminated casualties, and to train non-medical soldiers in casualty decontamination procedures. In FY98, more than 350 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 about NBC contamination avoidance and the medical implication of NBC exposures. This experience includes 39 hours of classroom instruction and 12 hours of field training exercises, which emphasize confidence building, hands-on equipment training, and management of NBC contaminated casualties. There are six courses annually for active Army components and five courses for Reserve/National Guard components. In FY98, over 1,550 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 military 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. The AMEDD officer participates in a group of 12–18 officers led by one experienced officer. The small group leader facilitates discussions and assignments with emphasis on sharing individual experiences for the collective good of the group. NBC subject matter expertise is provided by the NBC Sciences Branch, with emphasis on the supervision of medical operations in NBC-contaminated environments during a capstone, Corps level, field training exercise, Medical Unit Staffs in Operations. In FY98, over 490 officers were trained in this course.

The Medical Management of Chemical and Biological Casualties Course (MCBC) provides DoD personnel, primarily physicians, physician assistants, 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 field experience to establish essential skills, instill confidence, and define limitations in therapeutic modalities with each type of medical setting. The course also provides instruction 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 fours times annually at the U.S. Army Medical Research Institute of Chemical Defense (USAMRICD), Aberdeen Proving Ground, Maryland and the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID), Ft. Detrick, Maryland in addition to the three day exportable course provided on-site for individual units or posts.

In FY 98, 38 courses were taught consisting of:

- Three (3) MCBC in house courses
- Three (3) Field Management of Chemical and Biological Casualties Courses (FCBC)
- Five (5) Train the Trainer Courses
- One (1) Video Teleconference (VTC)
- Twenty-one (21) MCBC offsite courses
- Five (5) FCBC offsite courses.

2,525 students attended these courses. The student breakdown is as follows: Army (2,108), Navy (201), Air Force (124), Civilians (67), and Foreign Nation Students (25).

The MCBC course was taught twice at the AMEDD Officer's Advanced Course and will be taught four times during the next fiscal year. A two-hour block of instruction on depleted uranium was added to the MCBC in-house course. The in-house MCBC course has doubled in size from 70 students to approximately 140 students. The offsite courses are now being replaced with distance learning VTC, satellite broadcasting, and CD-ROM. USAMRICD conducted five "train-the-trainer" courses in FY98, training twenty Army, Navy, and Reserve personnel to be utilized as instructors for offsite courses.

USAMRIID's Operational Medicine Division, in conjunction with USAMRIID scientists, CDC experts, and nationally known leaders in Public Health, have just completed a 12-hour, fully accredited satellite distance learning program on Medical Defense against Biological Warfare and Terrorism. This educational outreach program, funded by the Office of the Army Surgeon General, trained 18,167 healthcare professionals at 583 down-link sites in CONUS and overseas from 22–24 September 1998. Army, Air Force, Navy/Marine Corps, Veterans Administration, and Public Health Service medical care providers were trained, as were personnel in Canada, the United Kingdom, Germany, Saudi Arabia, and several other overseas sites. This live interactive educational experience provided thousands of healthcare personnel with the information needed to prevent, diagnose, and treat biological casualties in both military warfare and civilian bioterrorism scenarios. The program was broadcast from the FDA's television studio in Gaithersburg, Maryland to sites around the world. The broadcast was taped and then re-broadcasted the weekend of 3 and 4 October, 1998 to reach primarily Reserve and National Guard medical personnel. The cost effectiveness of this type of education is staggering: the program cost $69.29 per healthcare professional, or a cost of $5.77 per CME credit hour, compared to the traditional way of training students at Fort Detrick, with a cost per student of approximately $1,000. Further decreases in the cost per provider educated are possible with wider dissemination of the program in future years. This type of education also is an excellent way for providers to update their skills on a regular basis without ever leaving their home station or community.

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. The medical problems associated with radiation, including external exposure and internal contamination are investigated. This course is offered twice annually at the Armed Forces Radiobiology Research Institute (AFRRI), Bethesda, Maryland along with shorter "road" courses provided on-site for individual units or installations. In FY98, 502 Army, 137 Navy, 161 Air Force, and 51 Non-DoD Civilian personnel trained in this course, for a total of 851 personnel.

The focus of the Medical NBC Readiness Course (formerly the Medical NBC Professional Filler (PROFIS) Course) is on medical NBC battlefield operations, humanitarian operations, standards, and the threat. The intent of this course is to inform and educate military medical and preventive medicine professionals about the medical response in the event of an intentional NBC attack. The course addresses response to, and new standards for, peacetime operations in areas contaminated with low levels of radioactive material or industrial chemicals. This course is sponsored by the US Army Office of the Surgeon General and hosted by the AMEDDC&S. The course is open to Department of Defense preventive medicine officers and professionals assigned to deployable units or positions who are directly responsible for NBC consequence management (*i.e.*, military environmental scientists, health physicists, preventive medicine physicians, environmental engineers, medical operations officers, *etc*.)

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 inter-connected 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 that allows the user to explore all electronic information in support of medical 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 courses is to certify personnel 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 initial and annual refresher training to personnel in or deployable to NBC high threat areas (HTAs). 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 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. Unit level training follows the classroom 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 base 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 the following NBC defense training courses:

AUDIENCE[1,2]	TYPICAL INITIAL INSTRUCTION TIME	INITIAL (FREQUENCY)	REFRESHER (FREQUENCY)	REMARKS
Low threat	6 hours	Within 90 days of assignment to mobility positions or 90 days prior to PCSing to a CB HTA.	Annual show of competency or as directed by MAJCOM.	Allow extra time for quantitative fit testing (QNFT)/ confidence exercise and CCA training.
Medium threat	6 hours	Within 90 days of arrival	Within 90 days of arrival	See Note 2
High threat	6 hours	Within 90 days prior to PCSing to HTA.	Within 30 days of arrival - topics should only include theater specific procedures and QNFT.	See Note 2

NOTES:
1. NBC Defense Training is required for military personnel and emergency essential civilians in or deployable to chemical-biological medium and high threat areas.
2. Initial training is required if there has been a break of 36 months or more in NBC defense training.

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. In addition, aircrews are required to conduct a one-time flight while wearing chemical defensive equipment.

Unit Training. Units in or deployable to NBC threat areas must conduct the following training:

CB Threat Area	MINIMUM EXERCISE REQUIREMENTS
Low	**Annually** - Conduct attack response exercise implementing the base OPlan 32-1 and other contingency plans (*i.e.*, NBC, terrorist, or conventional attack). **AND** - Conduct an attack response exercise for units' mobility commitments based upon the threat at deployment locations.
Medium	**Semiannually** - Conduct attack response exercise implementing the base OPlan 32-1, BSP, and other contingency plans (*i.e.*, NBC, terrorist, or conventional attack). One exercise can be satisfied by a tabletop exercise. **AND** - Conduct attack response exercise for unit mobility commitments based on the threat at deployment locations. One exercise can be satisfied by a tabletop exercise.
High	**Semiannually** - Conduct attack response exercises implementing the base OPlan 32-1, BSP, and other contingency plans.

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.

Medical Training Initiatives. Following the Air Force Medical Service (AFMS) NBC Warfare Defense Training Workshop in 1998, several training initiatives were prepared to meet gaps in Air Force chemical and biological medical defense training. Computer-based training tools for the AFMS re-engineered unit type codes, such as: (1) Patient Decontamination Teams, (2) Chemically Hardened Air Transportable Hospital, (3) Preventive and Aerospace Medicine (PAM) team training, (4) Bioenvironmental Engineering NBC team training, (5) PACAF AFMEDPAC 2000, (6) Continuing Medical Readiness NBC training, (7) NBC CD-ROM Toolboxes, (8) ACC/Force Protection Battlelab – Bio Agent detection training, and (9) NBC Defense Leadership Skills training were identified for contractor development. The Army (funded by the AF) is the OPR for two other initiatives: Medical Management of Chemical Casualties and the NBC CD-ROMs. Care providers who have not been afforded the opportunity to attend the Army MCBC Course will receive an instructor based course on medical management of chemical and biological casualties training at their units. Overseas locations have priority over CONUS bases for this initiative. In addition, identified medical UTC teams will receive medical reference materials developed by the US Army and civilian contractors for training.

5.3.3 Navy

Navy CBR-D training is conducted in two phases: individual and unit training. Individual training consists of attendance at formal school courses and completion of basic and advanced CBR Defense Personnel Qualification (PQS) training. Navy personnel also conduct periodic unit CBR Defense training and pre-deployment unit training exercises.

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. After reporting to designated units, Navy personnel also are required to complete basic and advanced CBR-D PQS training.

Officer and Enlisted Personnel assigned to ship and shore billets requiring CBR-D expertise receive additional CBR-D related courses. These courses include the Disaster Preparedness Specialist Course and the CBR-D Operations and Training Specialist Course conducted at the U.S. Army Chemical School. Additional CBR-D training is covered in the Repair Party Leader Courses conducted at various Fleet Training Centers. Officers receive additional CBR-D related training at the Damage Control Assistant Course, the Shipboard Department Head Course, the Prospective Executive Officer Course, and the Prospective Commanding Officer Course held at the Naval Education and Training Center Newport, RI.

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 CBR-D Operations and Training Specialist Course conducted at the U.S. Army Chemical School. Navy units conduct basic, intermediate, and advanced training exercises as part of the Training and Readiness Cycle prior to deployment. During the basic training phase, CBR-D training exercises are overseen by the appropriate Type Commander and may involve additional unit training by CBR-D specialists from an Afloat Training Group (ATG). During the intermediate and advanced phases of the training cycle, combat readiness is reinforced through Composite Training Unit Exercises (COMPTUEXs) and Fleet Exercises (FLEETEXs).

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 and 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 task 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 conduct training in two categories: Individual Training based on ITSs and Collective (unit) Training based on MPSs. Figure 5-1 shows the individual NBC training provided to all Marines.

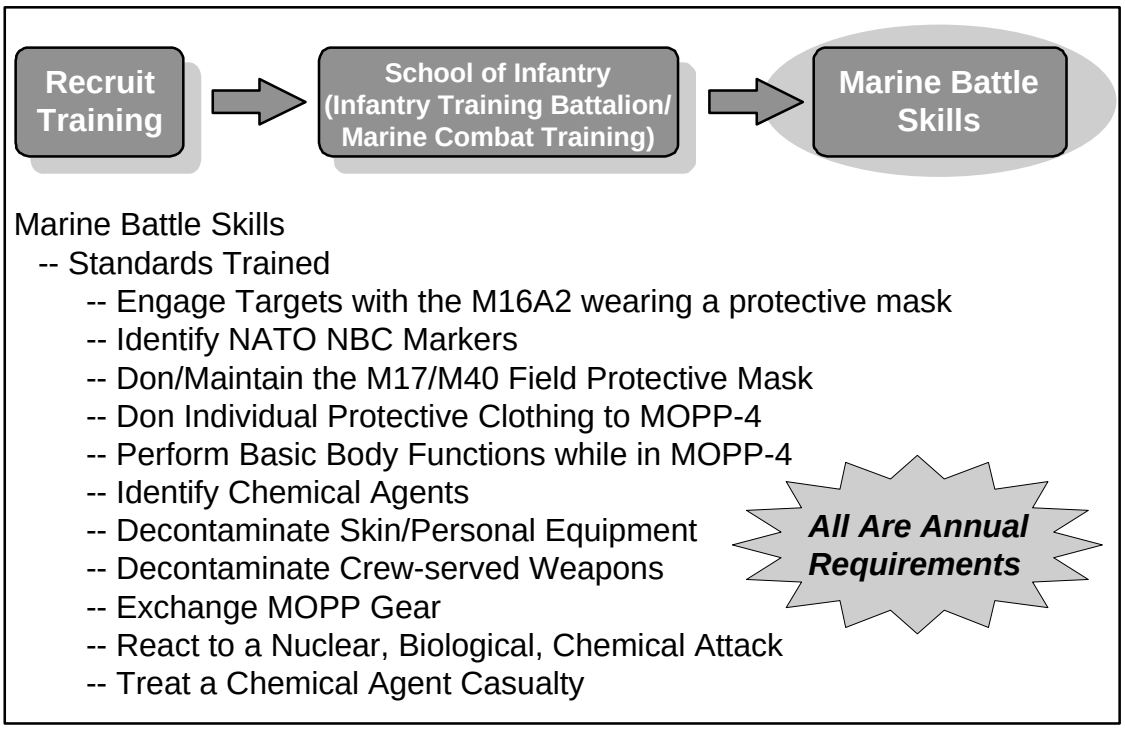

Figure 5-1. USMC Individual NBC Training

Individual Training. Enlisted Marine 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). The training focus is surviving and functioning in an NBC environment. Training transitions 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 Training program. Marine Battle Skills is a set of tasks which all Marines are required to be proficient in and are

evaluated annually. Marine Battle Skills NBC training focuses on providing Marines the capability to survive as well as function in an NBC environment.

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.) 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 MPSs assigned to it. These MPSs are published as 3500 Series Marine Corps Orders.

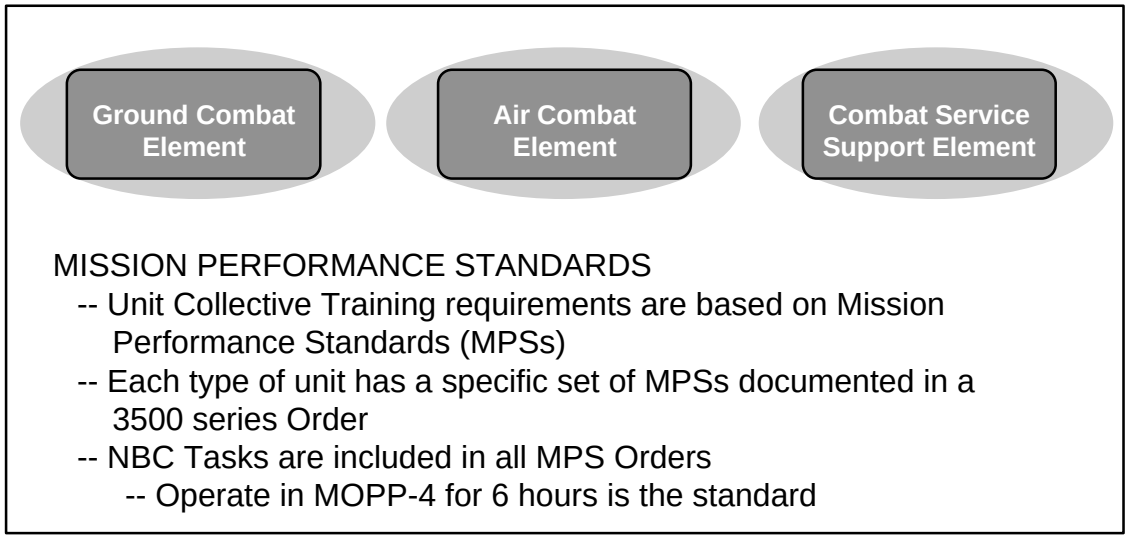

Figure 5-2. USMC Collective Training, NBC Requirements

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 (UDP) and designated Marine Expeditionary Units (MEUs) 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 United States Army Chemical School at Fort McClellan, Alabama. Fort McClellan is scheduled for closure in FY99 and new training facilities are planned to open 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, DTRA at Kirtland AFB, New Mexico, conducts a nuclear hazards training course.

5.4.1 Joint NBC Defense Professional Training

The JSIG has established a Joint Training Council (JTC) comprised of Service detachment representatives at the USACMLS to discuss issues pertaining to facilities and range scheduling and any other training issues that impact the ability of the Services to conduct effective professional 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 unique training requirements each Service possesses. 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.

Joint Professional Military Education, Phases I and II, currently contains no NBC defense considerations or requirements. It is essential that officers of all Services assigned to joint staffs understand the NBC threat, are familiar with U.S. capabilities to detect and mitigate the threat, and comprehend their staff roles and responsibilities in dealing with NBC issues. The JSIG, along with the Services, Joint Staff, and CINCs will address these important shortfalls and requirements in the coming year.

Within the joint medical arena, the US Army Medical Department sponsors the Medical Management of Chemical and Biological Casualties (MCBC) course, which provides training to DoD personnel. Additional 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), health care providers are directed to receive certification for assignments during military operations. This certification includes NBC defense training and provider courses where applicable. The medical commander will review certification 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 presently takes place at Fort McClellan, Alabama. In June 1999, this training will begin moving to Fort Leonard Wood, Missouri.

Training consists of three enlisted/noncommissioned officer courses and two officer courses. At 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 program provides 18 weeks of intensive training, culminating in live/toxic agent training in the Chemical Defense Training Facility. Toxic agent training is an integral, mandatory component of all professional courses. In October 1998, the initial entry enlisted training program was extended to 19 weeks to accommodate Army Values training.

Initial Entry Training
19 Weeks

Standards Trained:

- Radiological Survey
- Radiological Defense
- Chemical and Biological Agent Characteristics and Hazards
- Chemical and Biological Defense
- Decontamination Operations
- Smoke Operations
- Individual NBC Protection
- Chemical Defense Training Facility

Figure 5-3. U.S. Army Entry Training

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. During training 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, 10-weeks during mobilization. Reserve Component officers must attend the resident course. The Maneuver Support Center (MANSCEN), to be established at Fort Leonard Wood, will instruct the 3-weeks of common lieutenant training from the Chemical, Engineer, and Military Police schools. The Chemical Officer Basic Course (COBC) prepares lieutenants to serve as a Chemical Corps 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 and unit tactical operations, and biological detection operations. This 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 a Chemical 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. The duration of this course will be cut to 18 weeks, beginning in October 1998. In the MANSCEN configuration due to begin in March 1999 at Fort Leonard Wood, Missouri, the Chemical Officer will share training with Military Police and Engineer Officers in Common Training, Shared Tactical Training, and Battle Lab exercises.

Officer Advanced Course Training
19 Weeks

Standards Trained:

- Leadership
- Army Operations
- Plan and Conduct NBC Reconnaissance
- Decontamination Operations
- Chemical and Biological Agent Detection Operations
- Smoke and Flame Operations
- Nuclear Target Analysis/Vulnerability Analysis
- Operational Radiation Safety
- Environmental Management
- Chemical Defense Training Facility

Figure 5-4. U.S. Army Officer Advanced Training

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 six 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 a career development correspondence course 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 Chemical Defense Training Facility (CDTF) live agent training in five of six in-residence courses. Training is provided on every major piece of equipment available in the field today, including state-of-the-art items currently being fielded.

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 and depleted uranium awareness, are also topics of instruction at briefings for Air War College, Air Force Institute of Technology, or Joint Senior Leaders Course.

The School of Aerospace Medicine at Brooks AFB teaches a variety of readiness courses to medical personnel. Courses—such as Bioenvironmental Engineering, NBC Battlefield Nursing, Preventive and Aerospace Medicine contingency training, Global Medicine, Military Tropical medicine, Medical Survival training, plus many others—are provided at the San Antonio, TX base.

5.4.4 Navy CBR Defense Professional Training

The Navy Construction Training Center Detachment at the U.S. Army Chemical School 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 military 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 200 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 Council (JTC).

In addition to CBR-D Specialist courses conducted at the US Army Chemical School, the Navy has incorporated CBR-D readiness training into courses that are attended by personnel at all levels of professional development.

Course Name	**Course Location**
Recruit Training CBR-D	Naval Training Center Great Lakes, IL
Damage Control "A" School	Naval Training Center Great Lakes, IL
Senior Enlisted Damage Control	Fleet Training Center San Diego, CA
Hospital Corpsman "A" School	Naval Training Center Great Lakes, IL
Independent Duty Corpsman	Naval School of Health Sciences San Diego, CA and Naval School of Health Sciences Portsmouth, VA
Management of Chemical Casualties	U.S. Army Medical Research Institute for Chemical Defense, Aberdeen Proving Ground, MD
Medical Affects of Ionizing Radiation	Armed Forces Radiobiology Research Institute Bethesda,MD
Radiation Health Indoctrination	Naval Undersea Medical Institute Groton, CT
Radiation Health Officer	Naval Undersea Medical Institute Groton, CT
CBR-D Command Center	Naval Construction Training Center Gulfport, MS
CBR-D Personnel Protection	Naval Construction Training Center Gulfport, MS
CBR-D Team Training	Naval Construction Training Center Gulfport, MS and Naval Construction Training Center Port Hueneme, CA
Repair Party Leader	Fleet Training Center San Diego, CA Norfolk, VA Mayport, FL Ingleside, TX Pearl Harbor HI Yokosuka, Japan
Repair Party Officer Short Course	Surface Warfare Officers School Newport, RI
Division Officer	Surface Warfare Officers School Newport, RI
Damage Control Assistant	Surface Warfare Officers School Newport, RI
Department Head	Surface Warfare Officers School Newport, RI
Executive Officer	Surface Warfare Officers School Newport, RI
Commanding Officer	Surface Warfare Officers School Newport, RI

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 ITSs 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 5-5.

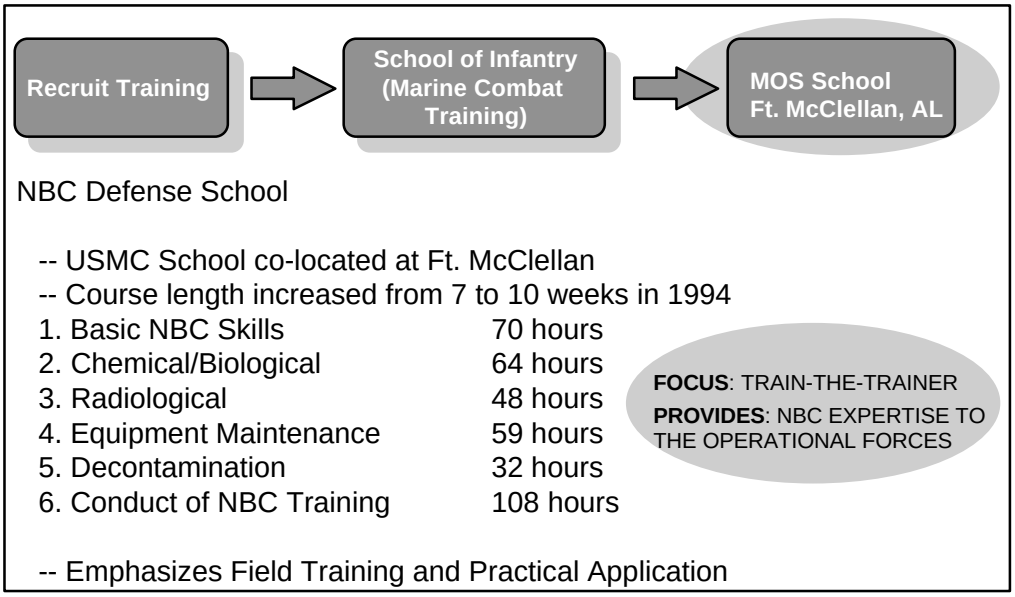

Figure 5-5. USMC Individual Training (Enlisted NBC Specialists)

Training For NBC Officers. Establishment of a Marine Corps Basic NBC Officer Course is complete. This course, shown in Figure 5-6, 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 focused specifically towards Warrant Officers and will build on previous training received. NBC Officers also attend the Army's Chemical Officer Advanced Course and Joint NBC courses as part of advanced Military Occupational Specialist (MOS) training.

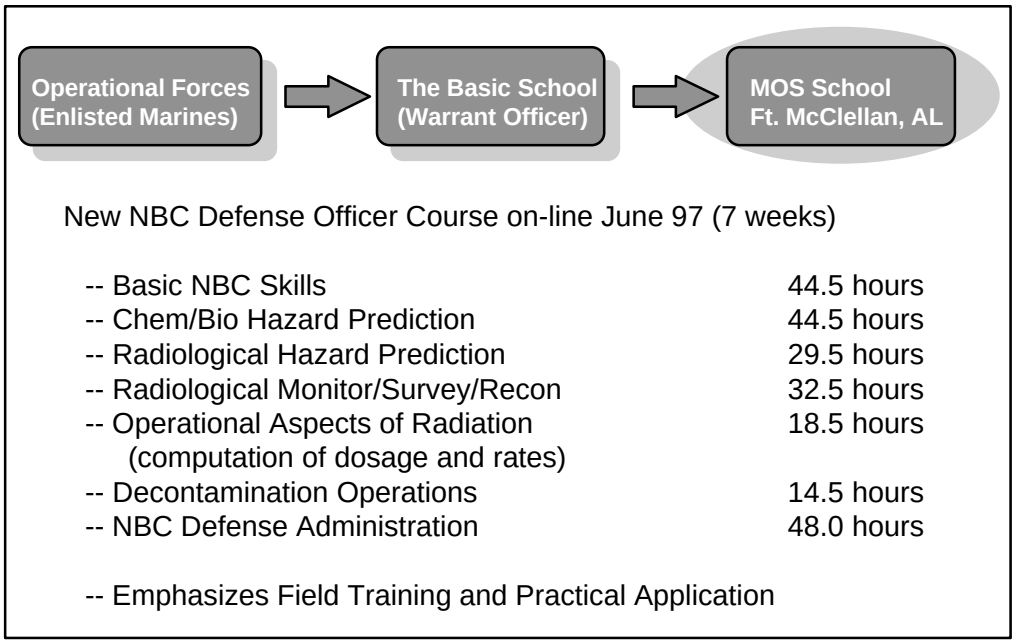

Figure 5-6. USMC Individual Training (Training for NBC Officers)

5.5 TRAINING IN A TOXIC CHEMICAL ENVIRONMENT

In 1987 the Army established the Chemical Defense Training Facility (CDTF) at Fort McClellan, Alabama. (A discussion of the transfer of the CDTF from Fort McClellan to Fort Leonard Wood is provided in Section 5.3.1 above.) 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 47,000 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 personnel become very familiar with NBC considerations. 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 and other first responder-type 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 effects. The configuration controlled version of Tactical Warfare (TACWAR) has within it a chemical module for theater level chemical effects that is under examination by the Joint Staff and OSD for its ability to accurately model the effects of chemicals on a theater level war.

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 Janus-A for the Louisiana Maneuvers (LAM) 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. 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 effects 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, and 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 Center for Army Analysis (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 have not received sufficient funding to adequately portray and 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 must be 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. Although an integral part of this certification procedure is determining unit, personnel, and equipment operational readiness under NBC conditions, ACOM is not adequately staffed or organized to perform this certification.

(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, but chemical and biological scenarios are not adequately exercised.

(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. The Chairman of the Joint Chiefs' 1998 requirement for immediate action on WMD and NBC defense operations mandates integration of these topics into all futures NIEXs.

Joint Vision 2010 provides the operational based templates for the evolution of our Armed Forces to meet challenges posed by an adversary's use of weapons of mass destruction. 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 importantly, CJCS and Service leaders should recognize that NBC strategic and operational level of war expertise is an essential resource requirement in the Joint Warfighter 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 should staff their organization appropriately with the right expertise to meet current and future requirements to shape and respond to NBC challenges.

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

The Chairman of Joint Staff published Master Plan Exercise Guidance in May 1998. This guidance provides exercise objectives to the CINCs. This guidance provided specific counterproliferation objectives. NBC Defense and Force Protection were identified as the Chairman's top training issues. This guidance will influence and guide development of CINC exercises and training, which will be conducted in Fiscal Year 2000.

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 negative NBC training trends at the company, battalion, and brigade level. This inferior performance at the CTCs is directly attributable to the lack of homestation NBC training. These results clearly indicate that there is a dire need to educate

senior leaders on influencing homestation training through providing command emphasis *and* dedicated resources to conduct NBC training. Conversely, units that (1) have the necessary command support and equipment, (2) balance NBC within their overall training requirements, and (3) execute according to approved training plans, are able to survive and continuously operate in a simulated NBC environment. However, increasingly constrained training resources limit NBC training to fundamentals. This often means training consists only of NBC survival and not training for continuous operations in an NBC environment.

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 that incorporate realistic NBC situations. Following are examples that describe exercises incorporating NBC situations:

- TEAM SPIRIT - Pacific Air Forces (PACAF) Joint/combined large-scale air, sea, land exercise to demonstrate US resolve in South Korea.
- ULCHI FOCUS LENS - PACAF Joint/combined command and control exercise conducted in conjunction with the Republic of Korea's national mobilization exercise "ULCHI."
- FOAL EAGLE - PACAF Joint/combined rear area battle and special operations field training exercise.
- EFX – Air Combat Command sponsored expeditionary force projection exercise.

Navy. Due to the unique nature of Naval force deployments, CBR defense training is conducted whether platforms are operating independently or in a group. During scheduled CBR defense training periods, realism is stressed and CBR defense equipment is used extensively.

Naval units conduct basic, intermediate, and advanced training CBR-D exercises prior to deployment. During the basic training phase, CBR-D training exercises are overseen by the appropriate Type Commander and may involve additional unit training by CBR-D specialists from Afloat Training Groups (ATG). During the intermediate and advanced phases of the training cycle, combat readiness is reinforced through Composite Training Unit Exercises (COMPTUEXs) and Fleet Exercises (FLEETEXs).

The exercises conducted by deploying Battle Groups and Amphibious Readiness Groups during pre-deployment Composite Training Unit Exercises and Fleet Exercises are designed to meet CINC training requirements for forces in the deployment area of responsibility.

Naval CBR-D scenarios are also incorporated into the "Global" Wargame conducted annually at the Naval War College in Newport, RI. The CBR-D scenarios addressed at "Global" are directed at strategic decisionmakers and National Command Authorities.

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. Mission, threat, and task organization determine the level. During FY98, the Marine Corps incorporated NBC defense training into the following exercises:

- JTF Exercise United Endeavor
- Ulchi Focus Lens 98
- Foal Eagle
- IMEFEX
- Keystone 98
- Global 2000
- Bio 911
- Azure Haze
- Urban Warrior
- ChemWar 2000
- Brave Knight
- Agile Lion

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. At the request of the Deputy Assistant Secretary of Defense for Counterproliferation and Chemical and Biological Defense, DATSD(CP/CBD), the JSIG has established a Commodity Area (CA) for CB M&S and appointed the Navy to be the lead service. Unlike other commodity areas, which manage advanced development programs, the M&S CA will primarily develop joint requirements, identify funding requirements to improve training and doctrine development, and promote standardization.

To support the M&S CA, the JSIG has tasked a contractor to develop a CB M&S Master Plan. When completed and approved, the plan will form the basis for future M&S R&D conducted by both the JSIG and JSMG. Initial findings from the Master Plan will be used to refine the M&S portion of the Modernization Plan in the second quarter FY99.

The DATSD(CP/CBD) has initiated a study to evaluate the suitability of VLSTRACK and HPAC for operational analysis. A study advisory group has been formed to evaluate the study and recommend how to consolidate the capabilities of the two models into a single system and reduce future duplication of developmental effort.

The Counterproliferation Review Council (CPRC) V&V Standards Working Group will be initiating a process in FY99 to standardize the V&V of CB models. This effort should

improve overall V&V activities, allow model-to-model comparisons and simplify eventual accreditation for various applications.

JCATS, JWARS and JSIMS are the future joint models for constructive and virtual combat simulation for training and analysis applications. Plans to incorporate CB defense effects into these models were initiated in FY98. VLSTRACK has been loosely coupled to JCATS to demonstrate the ability to add high resolution CW effects. The JSIG will be funding the continuation of this effort in FY99 and beyond. A contractor has been tasked by the JWARS program office to develop a plan for incorporating CB effects into JWARS.

The JSMG is sponsoring a program to develop models to evaluate effects of CB defense at APODS and SPODS.

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 scenario-driven exercise in the CDTF revolving around a terrorism incident involving chemical munitions. This training is provided to advanced students and differs from the lock step training provided to Apprentice-level students. The scenario will be reviewed/revised annually during the respective course reviews. Air Force instructors are qualified to conduct joint classes at the CDTF and are fully integrated into CDTF operations. Readiness instructors lead Air Force students from five of six residence courses through the training and also assist the other services with their training requirements. Additionally, they provide an orientation of NBC defense concepts and live-agent training in the CDTF for key Air Force personnel during the semi-annual Joint Senior Leaders Course.

The school revised its courses of instruction effective October 97 to comply with changes to the Specialty Training Standard (STS) resulting from the Readiness Utilization and Training Workshop held in October 1996. The new STS requires Readiness students and personnel be highly qualified in chemical-biological warfare operations, including conducting and advising leaders on hazards analysis and the use of emerging detection and plotting technologies.

Air Force Readiness personnel enrolled in correspondence courses for upgrade training to the five skill level will soon be able to complete the course on interactive CD-ROM including full motion-video and sound. The course is presently available only in a paperback version, which will continue to remain available for a limited period after the CD-ROM release. Interactive courseware development began in FY97 and is expected to be completed by FY00.

The Air Force NBC Ability to Survive and Operate (ATSO) Working Group (WG) (IPT) is a cross-functional forum that identifies and tracks AF NBC defense action items. Current NBC defense training initiatives tracked by the WG include the following:

- Implement a chem-bio protective mask quantitative fit training (QNFT) program to maximize protection by ensuring personnel attain the best fit possible
- Enhance Civil Engineer Squadron Commanders Course to put more emphasis on NBC defensive operations; provide an overview of Air Force Manual (AFMAN) 32-4019, *Chemical-Biological Warfare Commander's Guide*, to include the Vulnerability Assessment Tool; and new consequence management (CM) requirements
- Enhance Air Force Group Commanders Course to include new CM requirements
- Enhance On-Scene Commanders Course to include new CM requirements
- Develop a multimedia training format for AFMAN 32-4019
- Develop AFMAN 32-4019 training for Readiness personnel
- Incorporate AFMAN 32-4019 training in Air Force SILVER FLAG training site curriculum

- Incorporate depleted uranium training in initial and refresher NBC defense training; NBC readiness training plans (RTPs) have been revised and depleted uranium awareness is beginning to be taught at AF installations
- Provide robust DU training to personnel who have a greater risk of exposure to DU on the battlefield; AF special operations personnel are reviewing functional pipeline courses and evaluating new DU training requirements in the NBC RTPs
- Enhance AF NBC defense unit training to allow for increased emphasis on NBC defensive posture during unit training.

Additionally, the AF Medical Service has developed, or is in the process of developing, NBC Defense Training contract SOWs for eleven initiatives. Paragraph 5.3.2 lists all eleven. All are being managed by HQ AETC/SGP and HQ USAF/SGX.

5.7.4 Navy

The Navy's main initiative is the 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 supplemental funds made available from the FY96 National Defense Authorization bill have been utilized to upgrade existing training aids and delivery of training support equipment to all units.

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.

The Navy is also working to improve Joint CBR Defense Doctrine. The Navy is actively supporting a Joint Service Integration Group (JSIG) and Air Land Sea Application Center (ALSA) initiative to streamline the development of multi-service CBR-Defense tactical publications. The implementation of the JSIG/ALSA process in FY99 will provide a method for implementing service specific CBR-D requirements into Tactical Training Publications used by all services.

5.7.5 Marine Corps

During FY98 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 Presidential Inauguration, the Summit of Eight Conference in Denver, Colorado, two State of the Union Addresses, the Papal Visit to St. Louis, and numerous other

exercises to include Agile Lion, Bold Endeavor, and Ill Wind. A CBIRF detachment was deployed in support of Operation DESERT THUNDER. The CBIRF was a primary participant in both the BIO-911 Advanced Concept Technology Demonstration (ACTD) and the Port and Airfield ACTD.

National Asset Activated 1 April 1996

-- Provides an operational force to rapidly respond to WMD incidents
-- Tests New Equipment, Procedures, and Techniques
-- Provides Consequence Management training to Marine Forces through Mobile Training Teams
-- Assists Unit/Facility Vulnerabilities to Enhance Force Protection Planning
-- Works with other Emergency Response Agencies

FORCE MULTIPLIER FOR THE MAGTF.

Figure 5-7. 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 360 skilled and trained Navy and Marine personnel, organized into five elements: Headquarters (including a Reach-Back Advisory Group), Security, Search and Rescue, Service Support, Force Protection (Reconnaissance/Decontamination) and Medical. The CBIRF has state-of-the-art detection, monitoring, medical and decontamination equipment and is prepared for operations in a wide range of military-civilian contingencies. 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 consequence management. This will provide operational forces with the most up-to-date techniques, tactics, and procedures developed by the CBIRF. CBIRF also assists in Unit/Facilities Vulnerability Assessments to enhance force protection. The bottom line is that the CBIRF serves as a force multiplier to the MAGTF.

Marine Corps FY98 Accomplishments:

- Revised Marine Corps NBC Specialist Individual Training Standards (ITS), (MCO 1510.71) on 5 August 98.
- Conducted a Marine Corps-wide Table of Equipment and Table of Organization Review.
- Participated in Joint Marine Corps and Navy shipboard decontamination exercises with 7th Fleet.
- Developed an Enhanced NBC Capability Set for MEUs.
- Developed and initiated CBIRF training packages for MEUs.

- Published MCWP 3-37, *MAGTF NBC Defense*, September 1998.
- Conducted and managed the Joint Service Mask Surveillance and Testing Program.

Marine Corps FY99 Initiatives:

- Integration of NBC defense procedures in Mission Oriented Tasks (Garrison and Field).
- Conduct USMC NBC Defense Course Content Reviews based on revised ITSs and emerging NBC equipment requirements.
- Continue development 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.
- Continue development of an "Enhanced NBC" capability for MEUs.

5.7.6 Emergency Response: Army Medical Response

The AMEDD continues to be involved in supporting DoD and federal counterterrorism initiatives and contingency operations related to NBC threat agents, mainly with elements of the Medical Research and Materiel Command (MRMC). The following offices and agencies have 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.

The U.S. Army has recently published AR 525-13, Antiterrorism Force Protection (AT/FP): Security of Personnel, Information, and Critical Resources from Asymmetric Attacks, dated 10 September 1998. From this regulation it is assumed that U.S. Army medical treatment facilities and clinics will be called upon to provide assistant to civilian first responders if a WMD terrorist act occurs and to provide emergency room and inpatient treatment for both eligible DoD beneficiaries and civilian casualties. This regulation specifically states that the Surgeon General (TSG) will:

a) Establish policy and guidance on the management and treatment of conventional and nuclear, biological, and chemical (NBC) casualties.
b) Coordinate emergency medical NBC response capabilities worldwide with other DoD, Joint, Federal, state, local and HN agencies.
c) Maintain medical NBC response teams to address nuclear, biological/emerging infection, chemical accidents/incidents worldwide
d) Provide chemical and biological analysis of biomedical samples from patients/decease to assist in the identification of agent(s) used against U.S. personnel.
e) Provide guidance on the vaccination and prophylaxis against biological warfare agents.

The Office of the Surgeon General is currently updating Army Regulation 40-13, Nuclear/Chemical Accident Incident Response, to include all medical teams which could potentially be available to support civil authorities in the event of a terrorist attack with Weapons of Mass Destruction (WMD). The regulation will also include the Army policy for fixed facility medical treatment facilities in support of local domestic first responders.

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), the United States Army Center for Health Promotion and Preventive Medicine (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 to 24 hours of notification. The two SRTs that can support NBC are the Special Medical Augmentation Response Team – Preventive Medicine (SMART-PM) and the Special Medical Augmentation Response Team – Chemical/Biological (SMART-CB).

The mission of the SMART-PM 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. The SMART-PM 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 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.

In general, the SMART-PM team provides augmentation and public health and environmental engineering expertise in the following areas:

(1) ISO 9000 Accredited Laboratories
(2) Environmental Health
(3) Epidemiology & Disease Surveillance
(4) Toxicology
(5) Entomology
(6) Health Physics (Nuclear/Radiological)
(7) Industrial Hygiene
(8) Water Quality
(9) Clinical Preventive Medicine
(10) Sanitation
(11) Solid & Hazardous Waste Management
(12) Food Service Sanitation

The Special Medical Augmentation Response Team – Chemical/Biological (SMART-CB) includes 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 Rapid Response Team (C/B-RRT) 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 that 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, C/B-RRT 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 numbers 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 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 tasked 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 in the 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 causalities, and 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 SBCCOM Tier I CB Rapid Response Team (C/B-RRT) 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 that 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

CJCSI 3401.02, 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. Adequately resource CJCS J-7 and CINC ACOM to ensure that WMD and NBC defense issues are integrated into all joint training exercises and that integration and training assessments are conducted by subject matters experts. Existing reporting systems may provide an adequate mechanism for assessing readiness if the assessments are formally performed by WMD/NBC defense subject matter experts.

***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 is responsible for assisting the U.S. Army in the development of this doctrine under sponsorship of the Joint Staff. Current initiatives with the Air, Land, Sea Application Center (ALSA) to revise and update NBC doctrinal publications is underway. 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 defense to joint simulations has been allocated by the JSIG M&S Commodity Area for FY99 and beyond. The program will focus on incorporating chemical effects into JCATS and JSIMS in FY99-00 and BW effects in FY00-01. To add CB defense capabilities to

OneSAF, the possibility of incorporating the CB-ModSAF model developed by SBCCOM will be considered.

Chapter 6

Status of DoD Efforts to Implement the Chemical Weapons Convention (CWC)

6.1 INTRODUCTION

The Chemical Weapons Convention (CWC) was opened for signature on January 13, 1993. The Convention entered into force on April 29, 1997. As of 12 November 1998, 121 countries, including the United States, had signed and ratified the CWC. Another 48 countries have signed but not ratified.

6.2 DEPARTMENT OF DEFENSE IMPLEMENTATION OF THE CWC

Since the CWC entered into force, DoD has hosted more than 40 visits and inspections at chemical weapons storage, former production, and destruction facilities. The Army, (the Service most directly impacted by CWC implementation activities), and OSIA (now part of DoD's Defense Threat Reduction Agency (DTRA)) continue to host and escort Organisation for the Prohibition of Chemical Weapons (OPCW) Technical Secretariat inspectors who conduct both continuous monitoring at DoD CW destruction facilities and systematic inspections at DoD CW storage and former production facilities.

The Department of Defense conducts a Chemical Weapons Agreements Implementation Working Group (CWIWG) 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 Departments, the Military Services, and DoD agencies and activities coordinate planning efforts to ensure proper implementation of the CWC. Formal meetings of the CWIWG are scheduled approximately monthly and small group meetings are held as needed to address specific requirements in support of the CWIWG. A Compliance Review Group (CRG) was established within DoD to meet as needed to address CWC compliance concerns, should they arise.

OSD, the Joint Staff, the Military Services, and DTRA provide technical experts to support activity at the U.S. Delegation to the OPCW in The Hague, The Netherlands. The OPCW is charged with overseeing worldwide implementation of the CWC.

The Army was tasked to destroy all chemical warfare materiel under the Program Manager for Chemical Demilitarization (PMCD). PMCD includes programs for unitary stockpile destruction, destruction of bulk agent by alternative technologies (non-incineration), and destruction of other chemical warfare materiel and former CW production facilities. There is a separate non-PMCD program to demonstrate alternative technologies to destroy assembled

CW munitions. DoD and the Army coordinate closely to ensure that these programs are compliant with CWC provisions.

6.3 SAFETY ORIENTATION FOR INSPECTORS

OPCW inspectors who conduct continuous monitoring at U.S. chemical weapons demilitarization facilities have attended a 32-hour safety orientation which is broken down into two sections. One section is a 24-hour hazardous waste operations and emergency response (HAZWOPR) course which is a U.S. Government requirement of all personnel who must be present on a more than short-term basis at U.S. chemical demilitarization facilities. The second section is an 8-hour demilitarization protective ensemble (DPE) procedures course required only for those inspectors designated by the OPCW Technical Secretariat, whose responsibilities would include the use of such protective equipment. Approximately 200 inspectors have attended HAZWOPR training; some 50 of the 200 inspectors have taken the 8-hour DPE class. The orientation is conducted at the Chemical Demilitarization Training Facility in Edgewood, MD. Annual 8-hour HAZWOPR refresher classes are also required, and are being accomplished.

6.4 PREPARATION OF DEFENSE INSTALLATIONS

The Military Services and DTRA have developed individual implementation and compliance plans to provide guidance for their commands and activities under the CWC.

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.

The Military Services continue to coordinate actively with DTRA to prepare 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 inspections even though not declared, have been visited by Military Service representatives and DTRA technical experts. DTRA will continue to support site assistance visits and Army treaty compliance implementation meetings.

All of the Military Services have held exercises to test their preparedness for short-notice CWC challenge inspections. Such exercises involve the active participation of Service, DTRA, and other DoD representatives in the roles they would assume during a real challenge inspection. DoD and the Services have exercised written DoD guidance and procedures to test the operational readiness of personnel and facilities. Commonly, the lead Service responsible for developing an exercise also produces comprehensive lessons-learned to further ensure DoD readiness for challenge inspections. The Services have initiated efforts to ensure that in the case of a challenge inspection affected commands take timely and appropriate measures, based on lessons-learned, to demonstrate compliance while protecting security concerns.

6.5 DEFENSE TREATY INSPECTION READINESS PROGRAM

The Defense Treaty Inspection Readiness Program (DTIRP), for which DTRA 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, mock inspections, 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. DTIRP, in close coordination with the Naval Surface Warfare Center at Indian Head, MD, has also produced and conducted the first Chemical Technology Security Course, to be given annually.

6.6 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.

6.7 VERIFICATION TECHNOLOGY

DTRA conducts RDT&E to support U.S. roles in global chemical arms control initiatives by developing technologies and procedures for DoD identified implementation, verification, monitoring and inspection needs as required by chemical weapons arms control agreements. The arms control technology 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 U.S. policy, minimizing inspection and implementation costs, and enhancing the safety of treaty inspections.

The current DTRA arms control technology program continues to support DoD's efforts to implement the CWC by focusing on the following: compliance support/data management; off-site monitoring; non-destructive evaluation; and on-site analysis.

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Annex A

Contamination Avoidance Programs

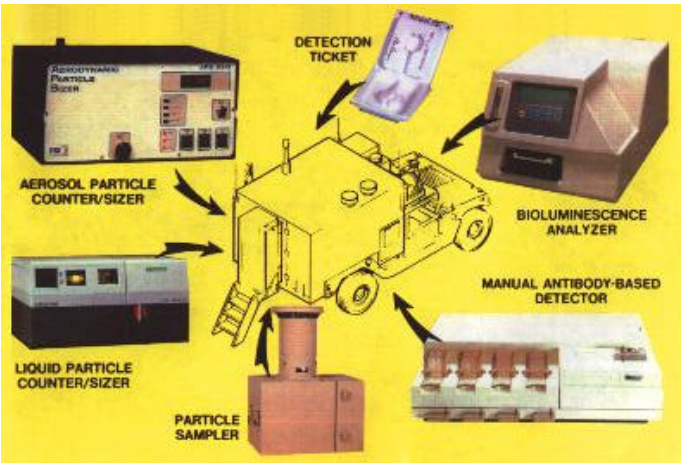
SECTION 1: FIELDED AND PRODUCTION ITEMS

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 one 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.

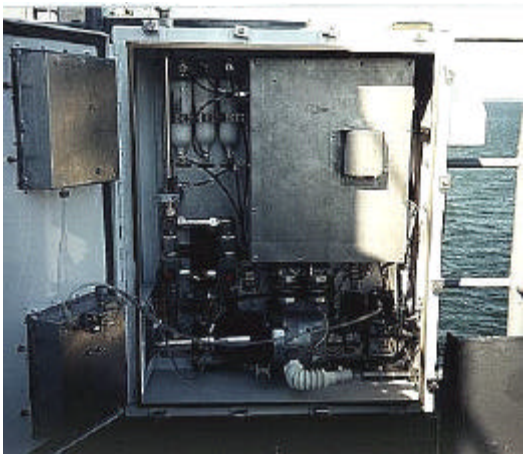
M31 Biological Integrated Detection System (BIDS) NDI



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. The system is capable of detecting and presumptively identifying four BW agents simultaneously in less than 45 minutes. Thirty-eight BIDS (NDI versions) were

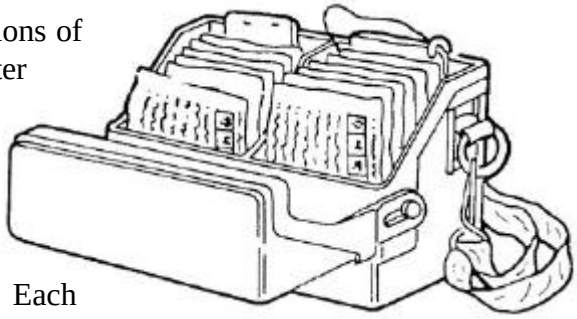
fielded to the 310th Chemical Company (U.S. Reserve) during FY96. This gives the Department of Defense its first credible, rapidly deployable biological detection capability. The BIDS is a Corps level asset. The BIDS program includes a P^3I development effort which will increase automation and integrate 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.

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, wet wall cyclone particle sampler, and hand held colorimetric, immunochemical assay tickets for identification of suspect aerosol particles (through hand-held assay). 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. 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. Twenty IBAD systems are currently fielded. These systems will be among ship platforms as dictated by fleet priorities.

M256A1 Chemical Agent Detector Kit



The M256A1 kit can detect and identify field concentrations of nerve agents (sarin, tabun, soman, GF, and VX), blister agents (mustard, phosgene oxime, mustard-lewisite, and lewisite), and blood agents (hydrogen cyanide and cyanogen chloride) in about 15–20 minutes. The kit consists of a carrying case containing twelve 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.

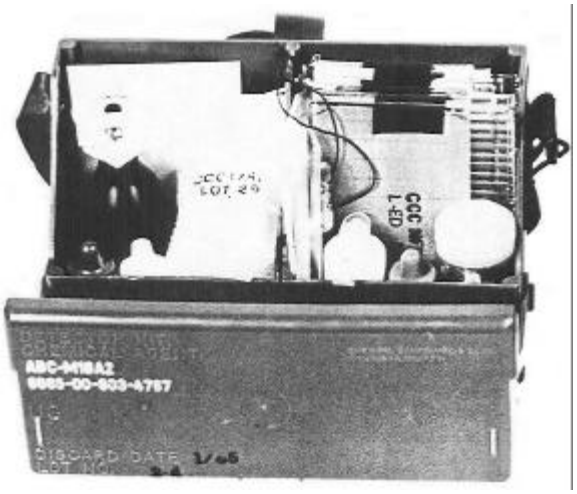
ABC-M8 VGH, and M9 Chemical Agent Detector Paper

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, and GF), 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" x 2-$^{1}/_{3}$" roll. M9 paper can detect G and V nerve agents, and H 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.

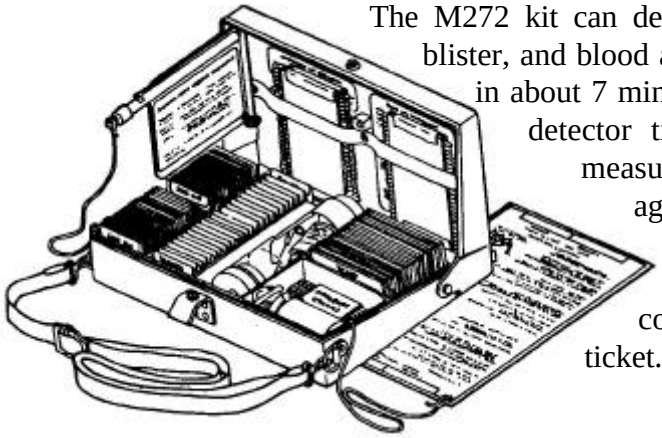
M9 Paper

M18A2 Chemical Agent Detector Kit



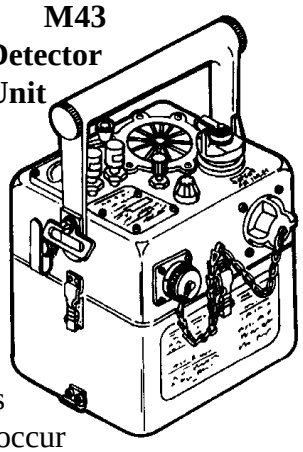
The M18A2 can detect and identify dangerous concentrations of nerve agents (sarin, tabun, soman, GF, and VX), blister agents (mustards, phosgene oxime, mustard-lewisite mixture, phenyl dichlorarsine (PD), ethyl dichlorarsine (ED), and methyl dichlorarsine (MD)), blood agents (hydrogen cyanide and cyanogen chloride), and choking agents (phosgene) in about 1–4 minutes. The kit is also used to confirm results of the M256A1 kit. The M18A2 kit contains a squeeze bulb and enough detector tubes, detector tickets, and chemical reagents needed to conduct 25 tests for each agent vapor. The kit also contains a booklet of M8 chemical agent detector paper to detect liquid agents. Agent vapor detection is indicated by the production of a specific color change in the detector tubes. The M18A2 kit was fielded in 1982 and only used by special teams such as surety teams or technical escort personnel.

M272 Water Test Kit



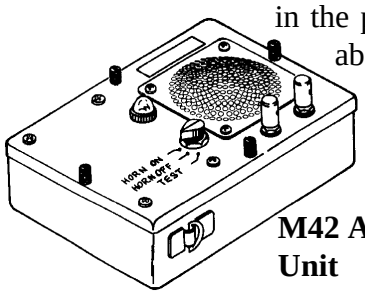
The M272 kit can detect and identify hazardous levels of nerve, blister, and blood agents in treated or untreated water resources in about 7 minutes. The kit contains enough detector tubes, detector tickets, a test bottle, and pre-packed, pre-measured test reagents to conduct 25 tests for each agent. The kit also contains simulants used for training. Agent detection in water is indicated by the production of a specific color change in the detector tubes or in the ticket. The M272 was fielded in 1984.

M8A1 Automatic Chemical Agent Alarm (ACAA)



M43 Detector Unit

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, then detects electrical current changes that occur in the presence of nerve agents. 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.



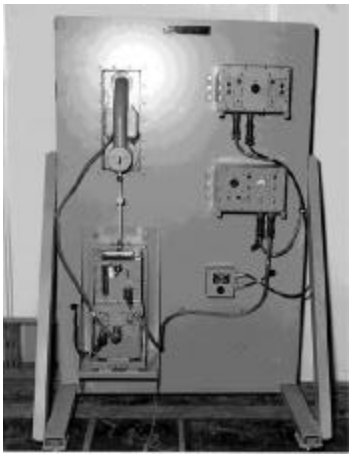
M42 Alarm Unit

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.

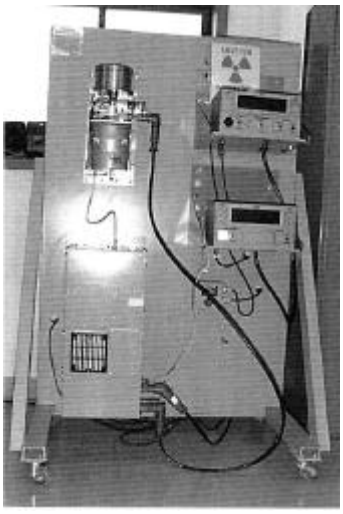
Automatic Liquid Agent Detector (ALAD)

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 field wire to a central alarm unit. Although the remote transmission is useful, the device only detects droplets of liquid agents. It must be used in conjunction with other point or standoff 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 agent vapors 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 found on Navy ships.

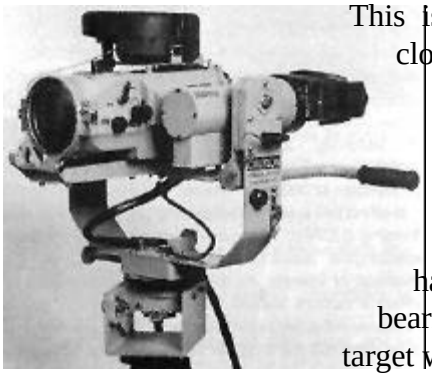
M22 Automatic Chemical Agent Detection Alarm (ACADA)

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. A shipboard version of the ACADA is being built to address the unique interferents found aboard Navy ships that cause false alarms on the NDI ACADA. The shipboard version of ACADA will serve to cover the Navy's emergency requirements until the Joint Chemical Agent Detector can be fielded.

STAND-OFF DETECTION AND REMOTE/EARLY WARNING

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



This is a semi-portable system designed to detect nerve agent vapor clouds at ranges up to five kilometers. The AN/KAS-1/1A must be removed from its stowage case and set up on a pre-installed pedestal for operation. A trained, diligent operator must manually aim the detector at the suspect cloud and interpret its infrared images to determine whether or not the cloud contains nerve agent vapors. The AN/KAS-1A provides a remote video display, an enhanced capability for vapor cloud analysis, and a remote relative bearing indicator useful for avoiding the agent cloud 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 (GA, GB, and GD) and blister (H and L) 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 backscatter 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 1,240 pounds and 2.3 cubic meters, has three major components: a pulsed laser transmitter operating at IR wavelengths; a receiver and telescope; and an information processor and display. The system is mounted on a UH 60 Blackhawk

helicopter for operations. This program 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 2.5 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).

NBC RECONNAISSANCE

M93 NBC Reconnaissance System (NBCRS)

The M93 NBC Reconnaissance System, known as the FOX, is a high mobility armored vehicle capable of performing NBC reconnaissance on primary, secondary, and cross country routes throughout the battlefield. The NBCRS was procured as a Non-Developmental Item and is capable of detection, warning and sampling the effects of NBC weapons and is used as a reconnaissance vehicle to locate, identify and mark chemical and nuclear contamination on the battlefield. The M93 FOX usually accompanies the scouts or motorized reconnaissance forces when performing its NBC mission. The NBCRS has an overpressure filtration system that permits the crew to operate the system in a shirt sleeve environment which is fully protected from the effects of NBC agents and contamination. It utilizes a secure communications system to warn follow-on forces. Samples gathered are forwarded to the Theatre Area Medical Laboratory for further analysis and verification. The mobility platform is a six wheeled all wheel drive, armored combat vehicle capable of cross-country operation at speeds up to 65 MPH. The Fox System is fully amphibious and is capable of swimming speeds up to 6 MPH. The M93 NBCRS has been fielded worldwide to the Army and Marine Corps forces.

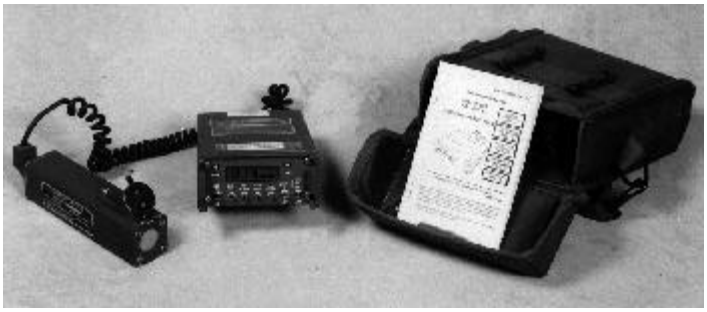
M93A1 – FOX System

The Block I Modification–M93A1 NBCRS contains an enhanced and fully integrated NBC sensor suite consisting of the M21 RSCAAL, MM1 Mobile Mass Spectrometer, CAM/ICAM, AN/VDR-2, and M22 ACADA. The NBC sensor suite has been digitally linked together with the communications and navigation subsystems by a dual-purpose central processor system known as the MICAD. The MICAD processor fully automates NBC Warning and Reporting functions and provides the crew commander full situational awareness of the Fox's NBC sensors, navigation, and communications systems. The M93A1 FOX is also equipped with an advanced position navigation system (GPS & ANAV) that enables the system to accurately locate and report agent contamination. The NDI mobility

platform is a six wheeled, all wheel drive armored vehicle capable of cross-country operation at speeds up to 65 MPH. The Fox System is also fully amphibious and is capable of swimming at speeds up to 6 MPH. It is used as a reconnaissance vehicle to locate, identify, and mark chemical and biological agents on the battlefield. The FOX usually accompanies the scouts or motorized reconnaissance forces when performing its NBC mission.

RADIACS

AN/VDR-2



The AN/VDR-2 measures gamma dose rates from 0.01 µGy/hr (micro-Grays per hour) to 100 Gy/hr and beta dose rates from 0.01 µGy/hr to 5 cGy/hr. The unit functions simultaneously as a dose rate meter and dose meter with independent adjustable 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 consists of a dosimeter and a reader. It 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 Joint Service Chemical Biological 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:

- Joint Army, Air Force, and 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 (SOFCAS)
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:

- Joint Army, Navy, Air Force, and 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. The device must be sufficiently sensitive to warn aircrews before accumulation, over the entire mission, of levels of agent that may cause miosis or more severe effects. JCAD will also provide hand-held monitoring capabilities, protecting the individual soldier, sailor, airman, and marine through the use of pocket-sized detection and alarm.

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. The SALAD EDM consists 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. Production units will be contracted for based on a performance specification. These units may use detection technologies other than that selected for the EDM.

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 service-unique requirement
- Navy, Air Force, and 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
- Knowledge-based system to process detector information
- FM/HF radios to communicate
- Automatically identify biological pathogens and toxins
- Reject common battlefield interferents and be re-programmable to detect new agents

- Be data-linked with a centralized hazard information data collection center
- Respond to agent vapors or aerosols
- Possess modules to accommodate future advances in technology and CB threat

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 P^3I 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 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 (Portal Shield)
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 interim systems to sponsoring CINCs that provides rapid, automated biological attack detection, identification and warning (in less than 20 minutes) to high value fixed sites (*e.g.*, ports and airfields)
- Automated “smart” sensor network
- Chemical sensor interfaces for automated biological and chemical network warning and reporting
- 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; unmasking procedures; contamination detection sampling kits, tested tactics, techniques and procedures.

- Demonstrate the military utility of a smart sensor network and exercise 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), we still have potential vulnerabilities in protecting those high value fixed sites that will play critical roles in force projection operations. Ports and air-bases, 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 an ACTD, provide a limited number of biological detection systems to warfighting CINCs. The concept has been to build an intelligent network of sensors based on the Navy's IBAD components, but add to each sensor an automated immunoassay ticket reader for near real time identification of BW agents, location and meteorology modules and "smart" network algorithms to reduce use of consumables and lower false positive rates. The detector network is able to detect significant changes in background aerosol concentrations in near real time, and can also (15-25 minutes) provide the operator located in the central command post 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 detection and identification hardware and procedures, it will also provide leave-behinds for post attack actions, such as: contamination detection sampling kits that can provide BW identification of contaminated surfaces such as missile fragments, in 15 minutes; and Enzyme Linked ImmunoSorbent Assay (ELISA) kits for a "gold standard' identification capability. User acceptance testing was completed in September 1997. The prototype Mark II network was successfully deployed to Kuwait in support of Operation Desert Thunder in February 1998. Full scale deployment of the ACTD to CENTCOM and PACOM will begin in 2QFY99. The Joint Chiefs of Staff (JCS) directed the production of additional Portal Shield networks starting in FY99 and funded their fabrication and support through FY02.

Joint Biological Point Detection System (JBPDS)

Rationale:

- Joint Army, Navy, Air Force, and Marine Corps 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
- Provide a common suite of biological detection equipment that can be applied to all four services' designated platforms
- Provide a man-portable version (Air Force and Marine Corps)
- Be operable while on the move (Army and Navy)

Description:

JBPDS is the joint biological point detection system. This developmental system will replace all existing biological detection 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 confirmatory 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 the 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 detection/identification, information processing and engineering sciences. JPO-BD awarded an Engineering and Manufacturing Development (EMD) contract in FY97 for the development of Block I JBPDS prototypes for all four services. Production is anticipated to start in 4QFY00, with first unit equipped in March 2002. 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 biological 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.

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 and Portal Shield ACTD). 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 Standoff Chemical Agent Detector (JSLSCAD)

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

Lightweight Standoff Chemical Agent Detector (LSCAD)
M21 Moving Background
Chemical Agent Remote Detection System (CARDS)
Stand-off Detector for Armored System Modernization (SD/ASM)

Rationale:

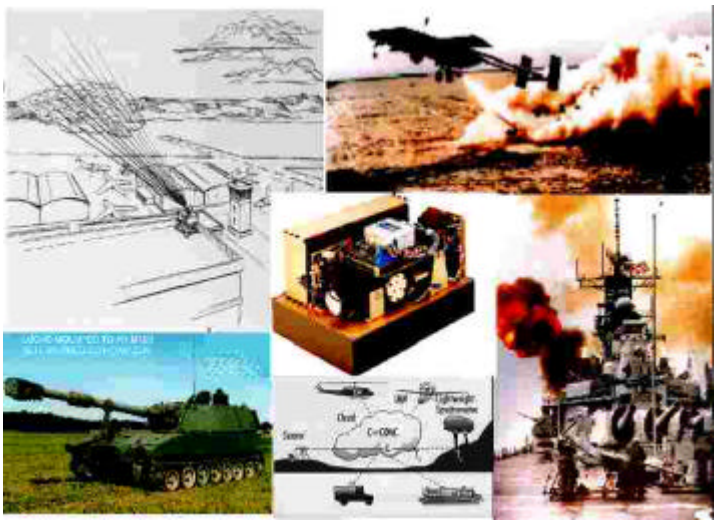
- Joint Army, Navy, Air Force, and Marine Corps requirement. (Army is lead Service)

Key Requirements:

- Automatically detect nerve, blister, and blood agents at a distance up to 5 km
- Lightweight and employed from manned and unmanned systems

- Capable of being data-linked with centralized hazard information data collection center
- 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 Warning and Identification LIDAR Detector (JSWILD)

JSWILD is a joint effort chartered to develop a chemical warning and identification system for the quad-services. JSWILD 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 and Air Force interest

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:

JSWILD 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 (km). In addition, JSWILD will provide similar but shorter range (1–5 km) capabilities in biological standoff detection as the Long Range Biological Standoff Detection System. The JSWILD

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
- Navy and Air Force 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
- Automated cloud discrimination
- Operating crew reduced to one operator
- 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 1,240 pounds and 2.3 cubic meters, has three major components: a diode pulsed IR laser transmitter operating at IR wavelengths; a receiver and telescope; and an information processor and display. This program, like 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). A total of 10 LR-BSDS P3I systems will be procured from FY00 to FY02 (3 per company with 1 training system). The NDI system is able to detect and track man-made aerosols out to 30 km, but is non-eyesafe out to about 2.5 km. The P3I LR-BSDS will be eyesafe, will have a longer operating range (50 km), and will be easier to operate. The first P3I LR-BSDSs will be fielded to the 7th Chemical Company (Biological Detection) in 1QFY01.

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)

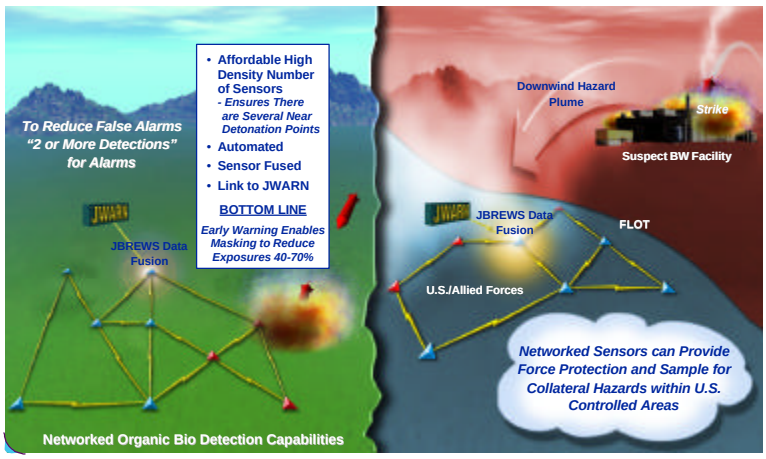
Rationale:

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

Key Requirements:

- JPO-BD is sponsoring a series of concept studies, including 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 formally started 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 may have legacy systems—BIDS, JBPDS, and standoff LIDAR systems such as the LR-BSDS—integrated with short range biological standoff detection systems (SR-BSDS) and 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) Production
M93A1 P3I Block II
Light NBC Reconnaissance System (LNBCRS)
Lightweight Reconnaissance System (LWRS)

Rationale:

- Joint Army, Air Force, and 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:

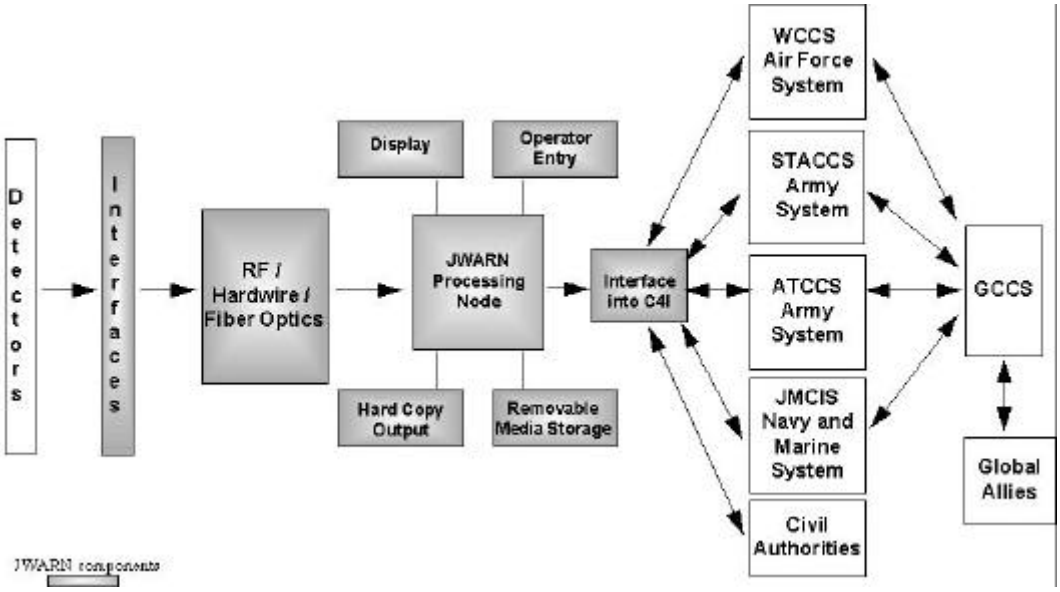
- Army, Navy, Air Force, and Marine Corps requirement

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 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 C^4I 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.



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Annex B

Non-Medical Protection Programs

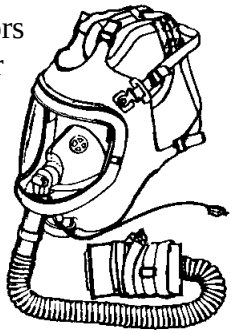
SECTION 1: FIELDED AND PRODUCTION ITEMS

RESPIRATORY

M17A2 Protective Mask

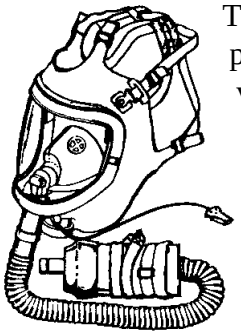
The M17A2 Protective Mask consists of a natural blend rubber face piece; two activated charcoal filters mounted within cheek pouches; a voicemitter to facilitate communications, a drinking tube; eyelens outserts to protect the mask's integral eyelens and reduce cold weather fogging; an impermeable hood; 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 Navy has replaced the M17A2 protective mask with the MCU-2/P. The Air Force replaced it with the MCU-2A/P, but retained limited quantities of extra small M17A2s for those situations where the MCU-2A/P short is too large.

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's oxygen supply system. The M24 is being replaced by the M45 and M49 masks.

M25A1 Tank Protective Mask



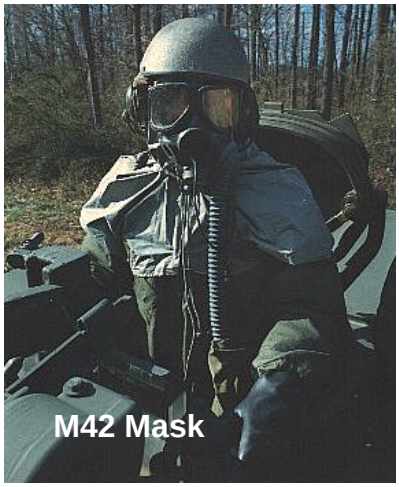
This protective mask provides the wearer protection from NBC aerosols and vapors both in the vehicle/aircraft, and on the ground. The mask consists of: wide view, clear plastic lens embedded in a butyl rubber face blank; an integral microphone; eyelens outserts; carrying case; anti-fog kit; and a hose 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 electronic voicemitter connections for improved communications.

M40/42 Series Protective Mask

The M40/42 series 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. The facepiece is covered with a chlorobutyl/EPDM second skin to provide optimum liquid agent protection for the masks. It accommodates NATO standard canisters, which can be worn on either cheek of the mask. The M40 series is designed for the individual dismounted ground warrior, while the M42 series is designed for combat vehicle crewmen. Recent improvements include a universal second skin, making the mask compatible with JSLIST and Saratoga overgarments, and ballistic/laser protective eye lens outserts. The mask facepiece has been made a spare part, which has resulted in a significant operation and support cost savings. Use of modular parts permits the M40 series to be used in both the M40 and M42 configuration. This has resulted in significant operational and support cost savings.



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 that 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

M48 Mask

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.

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.

CB Respiratory System (A/P22P-14(V) 1, 2, 3, & 4) NDI

The CB Respiratory System is a self-contained protective ensemble designed for all forward deployed rotary wing (Version 1 for USN) and fixed wing (Version 2–4 for USN and USMC) aircrew. The design incorporates 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 provides enhanced protection and offer anti-drown features.

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 Universal second skin provides liquid agent 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 activated 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 24 hours of chemical agent protection once contaminated and has a field durability of 22 days (extendable to 30 days at the discretion of Field Commanders).

JSLIST Overgarment

The JSLIST Overgarment will provide 24 hour protection after 45 days of wear and 6 launderings. The liner currently is based upon activated carbon bead technology, replacing the bulky activated carbon foam technology in previous garments. The JSLIST Overgarment is a two-piece jacket and trouser design with an integrated hood compatible with respective Service masks and second skins. It will be worn as an overgarment for the duty uniform or as a primary garment over underwear depending upon the environment and mission.

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 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. The Saratoga provides a 24 hour protection period and has a durability of 30 days continuous wear.

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

Joint Firefighter Integrated Response Ensemble (JFIRE)

JFIRE is a joint effort between the Air Force (lead agency) and the Army. The JFIRE Program has developed an ensemble that will protect the military firefighters IAW National Fire Protection Associated (NFPA) standards and provide CB protection during firefighting operations in a CB environment. JFIRE leverages the JSLIST overgarment for chemical protection, to be worn under aluminized proximity firefighting outergear and with a switchable filtered/supplied air mask with chemical warfare (CW) kit. A Commercial Off-the-Shelf (COTS) glove that can be used for both fire and CB protection will replace the need for CB gloves to be worn under standard proximity gloves. JFIRE meets several key requirements, including (1) providing 24 hours of CB agent protection against 10 g/m^2 liquid agent, (2) providing firefighters CB protection in both structural and crash fire fighting/rescue operation, (3) allowing firefighters to use mission essential tools and equipment in a CB environment, (4) providing resistance to water and all standard fire fighting chemicals (foam, CO_2, aircraft POL), and (5) is capable of being donned in 8 minutes.

Suit Contamination Avoidance Liquid Protection (SCALP)

The SCALP is worn over the BDO 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 provides OSHA level A protection for Army Chemical Activity/Depot (CA/D), Explosive Ordnance Disposal (EOD) and Technical Escort Unit (TEU) personnel. The STEPO is a totally encapsulating protective ensemble for protection against chemical and biological agents, missile/rocket fuels, POL, and industrial chemicals for periods up to four hours. The ensemble incorporates two types of NIOSH approved self-contained breathing systems (one hour and four hour configurations) and a tether/emergency breathing apparatus option, a battery powered Personal Ice Cooling System (PICS), a hands-free communications system, and standard Toxicological Agent Protective (TAP) boots and gloves. The suit is capable of being decontaminated for reuse up to 5 times after chemical vapor exposures. STEPO shares common, modular components with the ITAP and JFIRE ensembles simplifying logistics and reducing costs.

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 agent or moisture vapor protection during wet weather. The impermeable GVO/BVO provide protection against chemical agents for 12 hours and are durable for up to 14 days.

Multipurpose Overboot (MULO)
(JSLIST Boots)

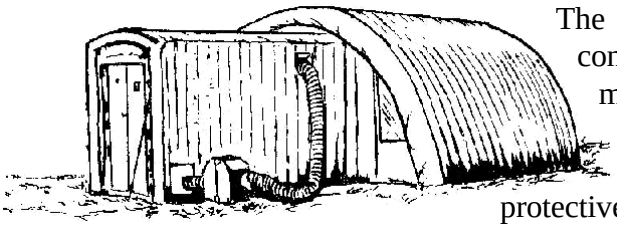
The MULO is a joint service program under the auspices of the JSLIST program and will replace the GVO/BVO. It is made of an elastomer blend and will be produced by injection molding. It is designed for wear over the combat boot, jungle boot, and intermediate cold/wet boot. The MULO provides more durability, improved traction, resistance to POLs and flame, and better donning and doffing characteristics over standard footwear.

Chemical Protective (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

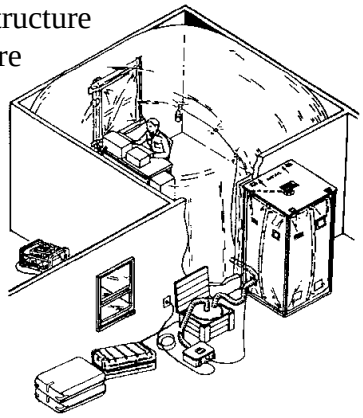
M51 Protective Shelter, CB



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 M51 utilizes outdated technologies and is being replaced with CBPS. Very few M51s remain serviceable and logistically supportable. 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 (C^3), medical treatment, 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 that provides a protected area in an existing structure; a collapsible, protective entrance that 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 preplanned product improvement (P^3I) 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

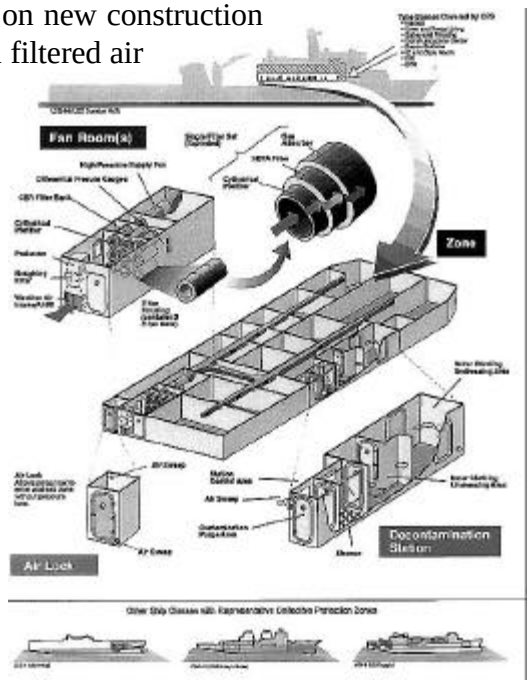
The Army's CP DEPMEDS program is a joint effort with the Air Force to provide environmentally controlled collective protection into field hospitals. The requirement is to be able to sustain medical operation for 72 hours in a chemical contaminated environment. Environmentally-controlled collective protection 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 provides air conditioning and the Army Space Heater provides heating. Both environmental control units are chemically protected through the addition of a CB kit. To sustain approximately 500 patients and staff, chemically protected latrines and water distribution systems have been developed.

Chemically/Biologically Hardened Air Transportable Hospital (CHATH) – Production

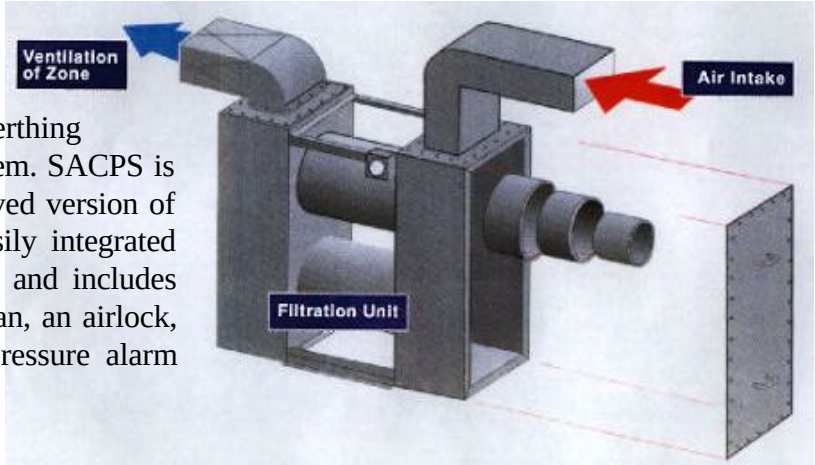
The Air Force's CHATH program is a joint effort with the Army to enable medical personnel to deploy and setup in chemical and biological threat areas and operate in chemically and biologically active environments. CHATH allows personnel to perform their hospital duties in a Toxic Free Area. CHATH upgrades the present Air Transportable Hospitals (ATHs) retaining the same medical equipment and personnel. CHATH uses existing and modified U.S. Army equipment to line the current ATH tents providing an airtight shelter. The Human Systems Program Office (HSC/YA) developed a Chemically/biologically Hardened Air Management Plant (CHAMP). The CHAMP filters chemically and biologically contaminated air, and recirculates and filters interior air to maintain a clean hospital standard, provides heating, cooling, and overpressurization to the hospital. The CHAMP can be operated from standard electrical sources or from its own internal generator. The CHAMP comes equipped with an Automatic Transfer Switch (ATS) to maintain power after Base power is shut off. The ATS starts the Diesel generator after three seconds of power interruption. The CHAMP allows the CHATH to be staged near warfighters in the field in a bare base environment. The CHATH can be deployed in increments of 10, 25, and 50 beds. This flexibility of the CHATH system helps ensure the best medical care as near the crisis area as possible.

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 water gage. 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.

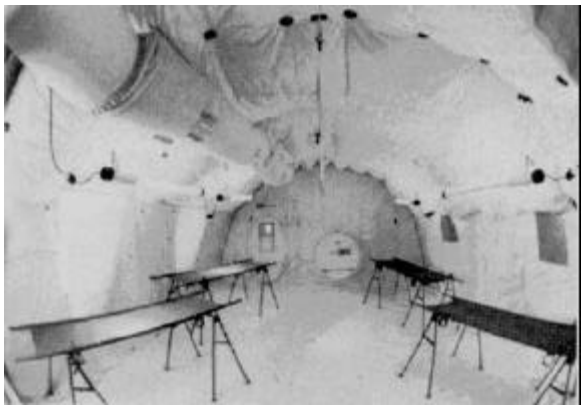


Selected Area Collective Protection System - Production



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 as a replacement for the M51. The system is self-contained and self-sustaining. The CBPS consists of a dedicated M1113 Expanded Capacity Vehicle (ECV), 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 ECV 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 ECV 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 limited production with fielding scheduled to initiate in 4QFY99.

Portable Collective Protection System

The transportability and ease of use of the Portable Collective Protection System (PCPS) permit mobility and flexibility in chemically 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

NBC filters are used to remove Nuclear and Biological particulates and Chemical aerosols and vapors from the air supplied to collective protection 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), CB Protected Shelter, 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

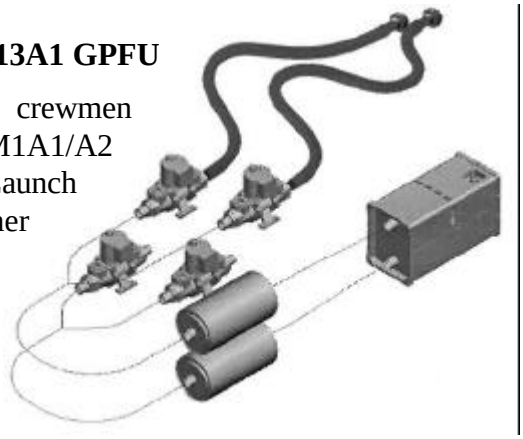
The following are modular NBC CP filtration systems which are applied to a wide variety of applications. They consist of an NBC filter, motor/blower unit, housings, and integration housings/ductwork. Some can be integrated into environmental control equipment.

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, and 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 is an integrated soldier defense system that 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:

- Joint Army, Navy, Air Force, and 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 it 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:

- Joint Army, Navy, Air Force, and 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 will also be compatible with existing aircrew life support equipment.

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. JSLIST is the first of a 3 phase program and supports a variety of Service suit and accessories. Previous chemical protective requirements from all Services are incorporated within the Joint ORD for JSLIST. 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 JSLIST Overgarment and Multi-purpose Overboot (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) JSLIST P3I

Rationale:

- Army and SOF requirement

Key Requirements:

- Provide 6 hours protection against 10 g/m^2 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 in^3 (300 desired)
- Reduce the physiological heat burden by at least 20% (30% desired) over that experienced when wearing the BDO.

Description:

The LCBPG is required to provide 6 hours of protection against all CB agents after moderate periods of 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.

60-Day Overgarment JSLIST P3I

Rationale:

- Joint Army, Navy, Air Force, Marine Corps, and SOF requirement

Key Requirements:

- Provide 24 hours of protection against 10g/m^2 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 60-day Overgarment JSLIST P3I 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 60-Day Overgarment JSLIST P3I will be a two-piece design with an integrated hood compatible with the M40 mask and second skin. The 60-Day Overgarment JSLIST P3I 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.

30-Day Overgarment JSLIST P3I

Rationale:

- Air Force requirement

Key Requirements:

- Provide 24 hours protection against 10 g/m^2 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
- Provide less than 20 percent 2nd degree burns at 2-2.5 gcal/cm^2/sec for two seconds

Description:

The 30-Day Overgarment JSLIST P3I 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 a two-piece suit with an integrated hood compatible with the MCU-2/P mask with second skin. The 30-Day Overgarment JSLIST P3I 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) JSLIST P3I

Rationale:

- SOF requirement
- Army, Air Force, and Marine Corps interest

Key Requirements:

- Provide 12 hours protection (24 desired) against 10 g/m^2 liquid; 10,000 CT vapor/ aerosols
- Provide 30 days field wear (minimum) in all geographical areas
- Retain chemical protection after 4 launderings (10 desired)
- Weigh less than 3 pounds
- Reduce the physiological heat burden imposed by the CPU

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.

Duty Uniform (JSLIST P3I)

Rationale:

- Marine Corps requirement
- Army, Air Force, and SOF interest

Key Requirements.

- Enhance existing capability with lighter, less thermal burdening ensemble

Description:

The Duty Uniform will be the primary NBC garment. It will be worn by all Marines, except those aircrew with special environmental or equipment interface requirements and those Marines who must deal with large volumes of liquid contamination. It will provide the wearer with protection from liquid, vapor, and aerosol hazards while reducing physiological stress.

Joint Service Aircrew Protective Ensemble (JPACE)

Rationale:

- Joint Army, Navy, Air Force, and Marine Corps Requirement (Navy lead)

Key Requirements:

- Provides Below-the-Neck (BTN) protection for rotary and fixed wing aircrew
- 30 day wear time
- Launderable
- Includes hand and foot protection
- Compatible with aircrew mounted aviation life support systems
- Ejection safe and water survivable

Description:

JPACE will be a chemical biological (CB) protective ensemble (including gloves and footwear) for all services' aviation communities. It will be a replacement for the Navy/Marine Corps MK-1 undergarment, Army ABDU-BDO system and AF CWU-66/P overgarment. Due to mission constraints and threat analysis, a separate garment may be considered for fixed wing versus rotary wing aircrew. JPACE started as a spin-off from JSLIST to address aviation specific CB requirements. Therefore, JSLIST and JSLIST P3I materials, designs, and documentation will be used to the maximum extent possible. This ensemble will be jointly tested and fielded with JSAM (Joint Service Aviation Mask) and will be used as a technical insertion to the Army Air Warrior program. JPACE will provide the fixed and rotary wing aviator with BTN protection against CB threats.

Multipurpose Protective Sock (MPS)
(JSLIST P3I)

Rationale:

- SOF requirement
- Army, Air Force, and Marine Corps interest

Key Requirements:

- Provide 12 hours of protection against 10g/m^2 liquid agent, (5000 mg-min/m^3 vapor/aerosols if boot is made of permeable material)
- Provide 30 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 12 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 P3I)

Rationale:

- Joint Army, Air Force, and Marine Corps requirement

Key Requirements:

- Provide 24 hours protection against 10 g/m^2 liquid agent
- Provide protection against POL and standard decontaminants
- Provide self-extinguishing flame resistance
- Provide 30 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:

Two candidates are being evaluated in the JSLIST P3I glove program. One is a general purpose glove for durability and the other is a high tactile glove for improved dexterity.

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/m^2 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 increasing personal protection and reducing the thermal burden on the wearer. ITAP will provide skin and respiratory protection both during peacetime and wartime for short term operations in Immediately Dangerous to Life and Health (IDLH) toxic chemical environments (up to 1 hr), emergency life saving response, routine Chemical Activity operations and initial entry and monitoring. ITAP shares common, modular components with the STEPO and JFIRE ensembles, simplifying logistics and reducing costs.

COLLECTIVE PROTECTION EQUIPMENT

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

Rationale:

- Army requirement
- 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 (shown mounted to an S788 Shelter on an M1097 HMMWV) is an NBC filtration system integrated with an environmental control unit and auxiliary power unit for combat systems. It uses a deep-bed carbon vapor filter for extended gas filter life. The combined components provide overall size, weight and energy reduction, and eliminate the need for additional electrical power from the host system.

Shipboard Collective Protection Equipment

Rationale:

- Navy Service-Unique requirement

Key Requirements:

- Provide protection against chemical and biological threat agents
- Provide a minimum of three year continuous operational life
- Provide more efficient, long life filters
- Provide quieter, more efficient supply fans
- Develop methods to counter new and novel threat agents

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 particulate 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.

Collective Protection System (CPS) Backfit

Rationale:

- Navy Service-Unique requirement

Key Requirements:

- Provides protection to forces operating ships within a chemical/biological threat environment
- Provides plans for backfitting existing non-CPS ships

Description:

Collective protection systems use filtered air to pressurize ship zones such that specified contamination-free spaces can remain functional for mission critical and sustaining operations within a chemical/biological threat or contaminated area. CPS backfit provides a means for retrofitting existing ships with required collective protection. Only ships with significant operational life beyond the FY05 through FY10 time frame will be considered for CPS Backfit.

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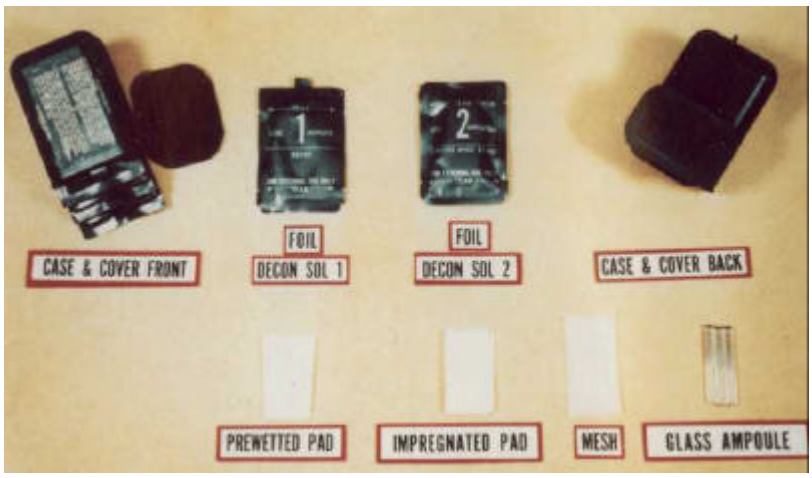
Annex C

Decontamination Programs

SECTION 1: FIELDED AND PRODUCTION ITEMS

PERSONNEL

M258A1 Skin Decontamination Kit (SDK)

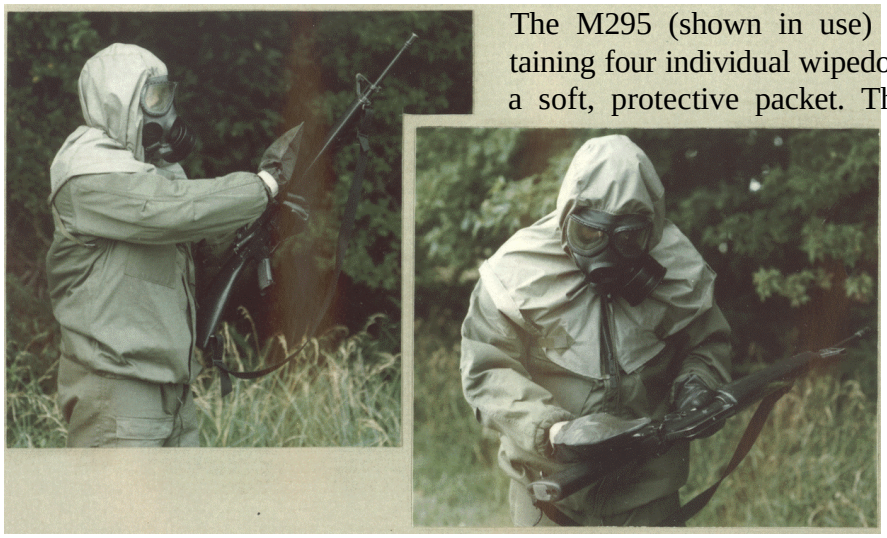


The M258A1 consists of a pocket-sized plastic case containing three sets of foil-packaged decontaminating wipes. The decontaminating sets consist of PACKET 1 containing an aqueous decon solution soaked gauze pad, and PACKET 2 containing a decon solution filled glass ampoule within a gauze pad. Personnel 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 (shown in use) 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 (shown in use) consists of a pouch containing four individual wipedown mitts, each enclosed in a soft, protective packet. The pouch assembly is designed to fit comfortably within the pocket of a 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.

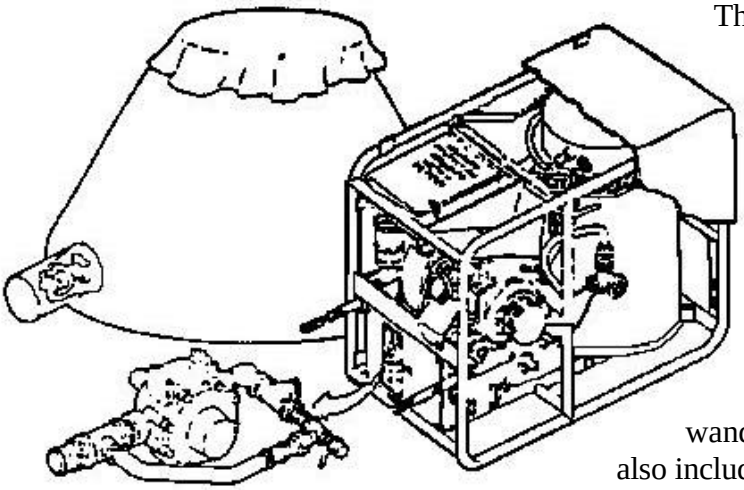
M13 Decontaminating Apparatus, Portable (DAP)

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 dismounted to facilitate air transport. The Marine Corps has replaced 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:

- Joint Service requirement

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 and Marine Corps requirement
- Navy and 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:

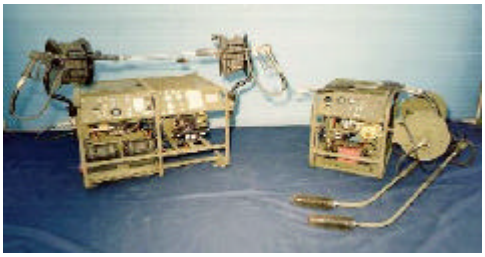
- Army requirement
- Navy, Air Force, and Marine Corps interest - no imminent requirement

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 battlefield. 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, reduces 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:

- Navy and Marine Corps requirement
- Air Force 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
- Decontaminate personnel, equipment and other material without an external power source and in coordination with a water tank or natural water resource.

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.

Joint Service Fixed Site Decontamination System

Rationale:

- Army, Air Force, and Marine Corps requirement; Navy to be determined

Key Requirements:

- Provide restoration capability at fixed site locations
- Provide improved/state-of-the-art NBC decontamination equipment
- Provide non-hazardous and environmentally safe NBC decontaminates

Description:

The Joint Service Fixed Site Decontamination program is a joint effort for the four Services. The system will provide a family of decontamination equipment to provide the capability to decontaminate ports, airfield, and rear-area supply depots.

Annex D

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 have provided a significant increase in military effectiveness in the past and present the potential for future enhancement of military operational effectiveness. Some fielded medical chemical defense R&D materiel and non-materiel solutions are:

Pharmaceuticals:

- Nerve Agent Antidote Kit (Mark I), 1983
- Skin Decontamination Kit (M291), 1990
- Nerve Agent Pretreatment (Pyridostigmine), 1985
- Convulsant Antidote for Nerve Agent (CANA), 1991
- Medical Aerosolized Nerve Agent Antidote (MANAA), 1994

MARK I, M291, Nerve Agent Pretreatment, and CANA

MANAA

Materiel:

- Test Mate® ChE (Cholinesterase) Kit, 1997 (*shown*)
- 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)

Decontaminable Patient Litter and CW Protective Patient Wrap

Technical Information and Guidance:

- Taxonomic Work Station, 1985
- U.S. Army Medical Research Institute of Chemical Defense (USAMRICD) Technical Memoranda on Chemical Casualty Care, 1990
- Field Manual (FM) 8-285, "Treatment of Chemical Agent Casualties and Conventional Military Chemical Injuries," 1990
- Handbook, "Medical Management of Chemical Casualties," 1995
- Field Management Handbook, "Medical Management of Chemical Casualties," 1996
- Technical Bulletin (TB) Medical (MED) 296, 1996
- Compact Disk - Read-Only Memory (CD-ROM) on "Management of Chemical Warfare Injuries," 1996

D.1.2 Medical Chemical Defense R&D Accomplishments

The medical chemical defense R&D technical barriers and accomplishments during FY98 are grouped by medical chemical defense strategies, which include the following:

- Prophylaxes
- Pretreatment
- Therapeutics
- Diagnostics

Today's chemical threat, however, is not restricted to commonly accepted classical agents, such as vesicants [sulfur mustard (HD)], nerve agents (soman, sarin, tabun, and VX), respiratory agents (phosgene), or blood agents (cyanide). Potential adversaries may develop novel threat agents. The ability to provide timely and effective medical countermeasures to new threats depends upon maintaining a high level of technological capability.

Countermeasure strategies to the classic and novel 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 also 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.*, prophylaxes or pretreatment).
- Far-forward treatment upon exposure to chemical warfare threats (*e.g.*, antidotes).
- Chemical casualty care (*e.g.*, therapy and management).
- Rapid diagnosis of chemical agent exposure.

Research Category: Prophylaxes/Pretreatments

The countermeasures, technical barriers, and accomplishments in the medical chemical defense research category of prophylaxes/pretreatments are outlined below.

Countermeasures:

- Reactive topical skin protectant (rTSP) for chemical agents.
- Pretreatment regimen that protects against rapid action and incapacitating effect of chemical threat category of nerve agents and novel threat agents.
- Pharmaceutical/biological pretreatments, treatments, antidotes or decontaminants/protectants.

Technical Barriers:

- Lack of appropriate model systems for testing treatment efficacy and safety in humans.
- Lack of pretreatments/antidotes that are quick acting, long lasting, easy to carry and use on the battlefield.
- Lack of appropriate experimental model systems to predict pretreatment or treatment efficacy and safety in humans.
- Lack of detailed molecular model of novel threat agents to understand the origin of their unique chemical properties.
- Potential performance decrement with pretreatment under investigation unless effects are closely monitored during administration.

Accomplishments:

- Observed that neonatal mice fail to develop HD lesions comparable to those seen in weanling mice.
- Identified a prototype formulation for rTSP that dramatically increases protection against HD vapor.
- Developed a method for preparing crystals of *T. californica* acetylcholinesterase (AChE) inhibited with sarin, soman or diisopropylfluorophosphate. Refinement of three-dimensional structure is almost complete (collaboration with the Weizmann Institute, Israel).
- Examined inhibition rates of butyrylcholinesterase (BuChE) mutants having organophosphorus (OP) anhydrolase activity by carbamates and determined that slow reactivity of BuChE mutants with OP probably results from interference of transition state stabilization by the bulky histidine sidechain that was introduced.

- Elucidated control mechanism of *in vitro* secretion of carboxylesterase (CaE) by mutagenesis of C-terminal of CaE.
- Expressed human CaE for use as an exogenous scavenger for OP agents.
- Made four double mutants of CaE each with altered C terminal residues; of these, two had a histidine introduced near the active site and two had a glutamine introduced near the active site.
- Observed that cholinesterase (ChE) attached to a solid support has enhanced stability over soluble forms of the enzyme.
- Found that differences in terminal elimination rates of soman in guinea pig and marmoset *vs*. rat correlated with differences in the levels of soman binding sites in liver of these species.
- Found that tissue/plasma partition coefficients of soman in rat, guinea pig, and marmoset were essentially equal suggesting that the pharmacokinetic distribution of soman in these species should be quite similar (collaboration with Prins Maurits Laboratory, TNO).
- Standardized the Chinese hamster ovary expression system for BuChE and CaE expression.
- Developed a more sensitive and safe method to determine partition coefficients of nerve agents.
- Found differences in the oligosaccharides of native and recombinant CaEs with regard to the total carbohydrate content and charge- and size-based oligosaccharide profiles.
- Determined that neither the carbohydrate composition nor the oligosaccharide profile could be completely correlated with the pharmacokinetic parameters of these enzymes.
- Explored synthesis of a monoclonal anti-soman antibody for further development as a ‘dip-stick’ diagnostic product (collaboration with Army Research Laboratory).
- Created a database for physiologically based pharmacokinetic (PB/PK) parameters for rat, guinea pig, monkey, and human; these parameters are being evaluated for allometric consistency to develop a simplified PB/PK model that can predict nerve agent toxicokinetics regardless of species (collaboration with Prins Maurits, TNO).
- Developed a PB/PK computer model for inhalation exposure to soman (collaboration with Prins Maurits, TNO).
- Determined percutaneous median lethal doses of five novel threat agents in guinea pigs.
- Measured the rates of absorption of three novel threat agents administered by subcutaneous and percutaneous routes in guinea pigs.
- Evaluated the distribution of three novel threat agents in rodents after subcutaneous administration.
- Measured the physiological effects of five novel threat agents on electrocorticographic, respiratory, electromyographic, and cardiovascular parameters in guinea pigs.
- Demonstrated that the mechanism of toxicity of novel threat agents was due to their inhibition of AChE and the resulting elevation of acetylcholine (ACh) levels in the nervous system.
- Physicochemical measurements revealed that novel threat agents were not ionized under physiological conditions and were hydrolyzed at a slower rate than conventional nerve agents.
- Demonstrated that carbamate pretreatment was required for significant protection by current medical countermeasures against three of the novel threat agents.

- Elucidated the structural/functional relationship between the glycosylation and the pharmacokinetic behavior of ChEs. Successful application of native and recombinant ChEs as detoxifying drugs largely depends on their ability to remain at therapeutic plasma levels for prolonged periods. Variations in ChE charge, structure, and oligosaccharide content are factors in establishing ChE mean residence time *in vivo*.
- Demonstrated that serum- and tissue-derived AChEs are more effective bioscavangers than recombinant DNA-derived AChEs as potential candidates for pre- or postexposure treatment for OP toxicity.
- Demonstrated that reinhibition of organophosphate-inhibited AChE by phosphoryl oxime depends on the structure of the oxime reactivator and the organophosphate used.
- Established that in simultaneous acute exposure to DEET, permethrin, and pyridostigmine, there was no synergistic inhibition of binding to muscarinic or nicotinic receptors or inhibition of cholinestrase activity.
- Demonstrated differences in the active-site gorge dimensions of AChEs and BuChEs using data gathered from inhibition studies with BuChE.
- Elucidated the complete amino acid sequence of equine serum BuChE, a protein of 574 amino acids.
- Showed that monoclonal antibodies that inhibit catalytic activity of AChE do so, in part, by allosterically affecting the orientation of tryptophane 86, located at the base of the active-site gorge.

Research Category: Therapeutics/Diagnostics

The countermeasures, technical barriers, and accomplishments in the medical chemical defense research category of therapeutics/diagnostics are outlined below.

Countermeasures:

- Products that prevent or moderate vesicant injury.
- Medical countermeasures to minimize lethality, morbidity, and incapacitation of these agents.
- Specific casualty management techniques to improve survival and minimize lost duty time.
- Pharmaceutical/biological pretreatments, treatments, antidotes, or decontaminants/ protectants.

Technical Barriers:

- Need for quick-acting and long-lasting antidotes that are deployable.
- Lack of appropriate experimental model systems for treatment efficacy and safety in humans.
- Need for detailed molecular model of novel threat agents to understand the origin of their unique chemical properties.

Accomplishments:

- Determined that the cytokines IL-1b, IL-6, TNF-alpha, and MIP-1a mRNA levels are dramatically increased following cutaneous HD exposure in the mouse ear.

- Showed that two precursor enzymes for substance P are elevated following cutaneous HD exposure in the mouse ear.
- Found a weak but positive signal for the presence of NFkB, an inflammatory response regulator, in lung tissue within 6 hours after HD exposure.
- Observed that inhalation exposure to HD in rats results in a significant leukocyte suppression at 24 hours after the exposure.
- Developed a mathematical model of anaerobic glycolysis that was used to test the hypothesis that HD-induced inhibition of glycolysis is mediated by NAD+ depletion.
- Using a monoclonal antibody against DNA ligase I, affinity column chromatography confirmed that activation of DNA ligase following HD exposure is through phosphorylation.
- Showed upregulation of 100 gene transcripts including multiple inflammatory protein transcripts such as intracellular adhesion to molecule-1 and interleukin-8 following HD exposure.
- Modified the single cell comet assay for DNA strand breakage for detection of the effects of HD crosslinking on the demonstration of strand breaks caused by H_2O_2.
- Demonstrated that exposure of keratinocytes to HD leads to cytotoxicity involving terminal differentiation and apoptosis via a calcium-calmodulin and caspase-dependent pathway.
- Assessed the toxicokinetics of HD in the hairless guinea pig following IV administration of 0.3 LD_{50} using gas chromatography coupled with PFPD and showed that the half-lives of distribution and elimination were 0.7 and 152 minutes, respectively.
- Found 17 candidate medical countermeasures that provide significant reduction in HD-induced edema, histopathology, or both in the mouse ear assay.
- Determined that 6 of the compounds showing a statistical reduction of injury in the mouse ear assay produced greater than 50% reduction of edema or histopathology.
- Measured the ability of oximes to reactivate enzymes inhibited by novel threat agents and correlated the refractoriness of novel threat agents to medical countermeasures with the inability of oximes to reactivate novel agent-inhibited AChE.
- Established nonhuman primate electroencephalographic (EEG) recording model to assess anticonvulsant action of current treatment (diazepam) *vs.* proposed new anticonvulsant therapies for nerve agent-induced seizures.
- Determined that the benzodiazepine, midazolam, provides more rapid and more potent anticonvulsant action against nerve agent-induced seizures than the current therapy diazepam.
- Established that certain anticholinergic drugs in combination with benzodiazepines provide more potent anticonvulsant action against nerve agent seizures than either class of drug by itself.
- Determined that two neuroactive steroids with purported anticonvulsant activity could neither prevent nor stop nerve agent seizures.
- Demonstrated that the anticholinergic drug biperiden provides potent anticonvulsant activity against all nerve agents to include the novel threat compounds.
- Established that the drug baclofen, a compound that acts preferentially at GABA-B receptor sites, is not effective as an anticonvulsant against nerve agent-induced seizures.
- Identified compounds that can act as neuroprotectant agents against brain damage pro-

duced by nerve agent seizures. These compounds may act by preventing destabilization of calcium homeostasis, or as free radical scavengers, or both. Some are able to prevent the seizure-induced damage without influencing the severity or duration of seizure activity. Such compounds could be used in addition to traditional anticonvulsant drugs to protect severely poisoned casualties against the neurotoxic effects of nerve agent exposure.

- Determined that calcium channel blockers such as nifedipine do not increase survival rates of mice exposed to phosgene.
- Developed a mouse model that allows for the determination of arterial blood gas and electrolyte status over 24 hours in mice after exposure to phosgene.
- Determined that there are increases in blood potassium, hematocrit, hemoglobin, ionized calcium, and sodium in mice exposed to phosgene.
- Developed a porcine model to investigate the use of positive end expiratory pressure in the treatment of phosgene exposure.
- Found that 6 hours after exposure of lung tissue to HD, there was a dose-response change in the concentration of protein, an early marker of acute lung injury in the bronchoalveolar lavage.
- An antisense oligodeoxynucleotide construct based on amino acid sequence of HD-stimulated protease prevents protease mRNA expression induced by HD.
- Performed rat EEG studies and determined that the muscular tremor and high-dose lethal effects of huperzine, a potential nerve agent antidote and anticonvulsant, are not associated with cortical brain seizure activity.
- Evaluated the possible utility of kainic acid-induced sustained cortical EEG seizures and status epilepticus as a preclinical rat model mimicking agent-like, antiepileptic drug-resistant brain seizures.
- A study was undertaken to determine if abnormally low blood ChE activity, abnormal red blood cell acetylcholinesterase (RBC-AChE), PB inhibition kinetics, and/or unusually high frequencies of the atypical phenotype of plasma BuChE could explain some of the symptoms exhibited by Gulf War veterans or represent a risk factor for adverse effects after PB exposure. Sampling of Gulf War veterans showed no evidence of unusually low ChE activity or altered RBC-AChE kinetics, as evaluated by determination of spontaneous reactivation time after PB inhibition.
- Developed a prototype, noninvasive finger-cuff optical probe to simultaneously monitor continuous measurements of oxyhemoglobin, deoxyhemoglobin, methemoglobin and carboxyhemoglobin for use in cyanide exposure.
- Demonstrated that ChE ‘sponges’ could neutralize nerve agents and then be reused up to five times after oxime regeneration with only a 30% loss of initial activity.
- Established a laboratory for 24-hour EEG monitoring for cholinergically induced seizures in freely moving rats, to permit high-throughput screening for novel anticonvulsants.
- Developed noninvasive technique (Dynamic Area Telethermometry) to evaluate mustard and other exposures (*i.e.*, nerve gas) to the skin.
- Conducted experiments to calibrate and verify noninvasive optical probe monitor used to monitor pretreatment decrements. Preliminary analysis showed efficacy to be comparable to the oximeter instrument (OSM3) currently employed.

- Showed that postexposure therapy with bioscavenger ChE was effective against residual anticholinesterase activity produced by chlorpyrifos exposure as much as four hours earlier.
- Developed a product composed of ChEs, oxime, and polyurethane foam for removal and decontamination of OP compounds from biological surfaces such as skin that also can be used to develop methods for safe disposal of stored OP nerve agents.
- Characterized the interaction of anti-Alzheimer drugs, huperzine A and E2020 (Aricept®), with ChEs, showing that both inhibitors display a high level of selectivity for AChE over BuChE and that major interactions are with aromatic residue Tyrosine 337 in the active-site gorge of AChE.
- Concluded that huperzine A may interfere with and be beneficial for excitatory amino acid overstimulation, which has been postulated to cause neuronal cell death.
- Showed that stable complexes formed by AChE and amyloid-β-Peptide may increase the neurotoxicity of Aβ fibrils and thus may determine the selective neuronal loss observed in Alzheimer's brain.
- Found that a monoclonal antibody directed against fetal bovine serum AChE inhibited promotion of Alzheimer amyloid fibril formation triggered by AChE (collaboration with Pontificia Universidad Católica de Chile).

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, vaccines, and devices. 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 [AMEDD C&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 nontoxic, nonirritating 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 TSP.
- Demonstrated extended stability of the TSP.
- Validated production/manufacturing capability for the TSP.

- Awarded a manufacturing development contract.
- NDA 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 preclinical toxicology and drug distribution studies.
- Developed dose parameters and performance assessments.
- Concluded animal toxicology studies for cyanide pretreatment.
- Completed preparation of IND 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 have provided a significant increase in military effectiveness in the past and present the potential for future enhancement of military operational effectiveness. Some of the materiel and non-materiel solutions developed for use in medical biological defense R&D include the following:

Vaccines and Antisera:

- Anthrax Vaccine (licensed)
- Plague Vaccine (licensed)*
- Smallpox Vaccine (licensed)
- Botulinum Toxoid Vaccine, Pentavalent (IND #3723)
- Botulinum Type F Toxoid Vaccine (IND #5077)
- Botulinum Antitoxin, Heptavalent Equine (Types A, B, C, D, E, F, and G) (IND #3703)
- Botulism Immune Globulin, Human (IND #1332)
- Botulism, Antitoxin, Heptavalent Equine, Types A, B, C, D, E, F, and G (IND #5077)
- 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 Encephalitis Virus Vaccine, TC-83 (IND #142)
- Eastern Equine Encephalitis Virus Vaccine (IND #266)
- Western Equine Encephalitis Virus Vaccine (IND #2013)

**Plague vaccine is licensed against bubonic plague but is probably not effective against aerosolized* Yersinia pestis *(Plague)*

Technical Information and Guidance:

- Handbook "Medical Management of Biological Casualties," 1998.
- In FY98, U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID), in collaboration with the Centers for Disease Control and Prevention, broadcast a live, interactive satellite distance learning course entitled "Medical Response to Biological Warfare and Terrorism" to 17,319 military and civilian health professionals and first responders at 500 sites across the United States. This 3-day course proved to be very cost-effective, as the cost was $69 per student trained; whereas, it costs an estimated $1,000 to train a health care provider at USAMRIID's resident in-house course, which is

given four times yearly to 76 students per course. This satellite distance learning course represented a new era in cooperation with a civilian government agency to provide important information to all who may confront threats from biological agents.
- CD-ROM on "Management of Biological Warfare Casualties" late fall 1999.

D.2.2 Biological Defense Research and Development Accomplishments

The biological defense research and development technical barriers and accomplishments during FY98 are grouped by biological threat category, which include the following:

- Bacterial (and rickettsial) agents.
- Protein toxins.
- Viral agents.

In addition, research and development accomplishments in the area of confirmatory diagnostic assays for biological warfare threat agents are presented at the end. The objective of this effort is to sustain and enhance the capability to confirm in biological samples the initial field diagnosis/identity of a biological warfare threat agent indicated by initial field screening.

Several projects and technologies are shared with other agencies, including the Department of Energy (DOE) and the Defense Advanced Research Projects Agency (DARPA). The DOE projects tie into the strengths of the DOE laboratories in developing advanced technologies in order to enable rapid detection of and response to a chemical or biological agent incident. DOE is not involved directly in protection and treatment of personnel, but actively assists DoD with drug/chemical database searches, DNA sequencing, advanced protein chemistry and modeling/simulation projects. Successful sequencing of plasmids found in the causative agents of plague and anthrax helped create the "lab on a chip" that is a hand-held chromatography laboratory. The extensive knowledge and databases available to DOE allow application of computational tools to predict sites of intervention by novel therapies against threat agents.

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 programs for FY98 include the following:

Medical Countermeasures Research and Development by DARPA:
- 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 genetically engineering 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.
- Identified a synthetic SEB peptide capable of blocking binding of SEB to human MHC class II antigen.
- Demonstrated that monoclonal antibodies to TNF alpha and interferon gamma protect mice from lethal SEB challenge.

- Evaluated the role of antibodies in mice in mediating alphavirus vaccine interference. Found that non-neutralizing antibodies may act at the surface of infected cells to reduce the hose response to live alphavirus vaccines.
- Concluded a study on the efficacy in guinea pigs of anthrax vaccine against a trans of *B. anthracis* from numerous geographic areas.

Advanced Medical Diagnostics:

- Began studies to determine the feasibility of using exhaled nitric oxide (NO) as an early marker of infection of BW exposure.
- Developed an integrated sample preparation cartridge (to extract DNA from a biological sample) for connection to a miniature automated PCR apparatus.

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.

The following are accomplishments of medical biological defense research conducted by USAMRMC laboratories and/or their contractors.

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.
- Antimicrobials for treatment of bacterial diseases.
- Forward deployed diagnostic systems.

Technical Barriers:

- Incomplete genetic information for all the threat agents.
- Lack of appropriate animal model systems for investigation of some bacterial threats and countermeasures.
- Limited capability to produce large bulk Good Manufacturing Practice (GMP) lots of vaccine candidates.
- Lack of suitable epidemiological situations in which to perform human clinical trials to evaluate efficacy of vaccines.
- Difficulty in field testing rapid identification kits under natural conditions.
- Difficulty in defining surrogate markers of protection.

Accomplishments:

- Found that all *B. mallei*/glanders strains were closely related antigenically.
- Determined antibiotic susceptibilities of *Burkholderia* (glanders) in mice and found that tetracycline was the most effective antibiotic, followed by ciprofloxacin and tobramycin.
- Demonstrated that killed *B. mallei* partially protected hamsters challenged with virulent organisms.
- Demonstrated two anti-spore activities of anti-PA antibodies-enhancement of phagocytosis by macrophages and inhibition of spore germination.
- Determined that serologic data suggest that endpoint ELISA titers do not correlate with predicting immunity to lethal plague challenge, but that other, more specific antibody subtypes may be useful as surrogate markers.
- Demonstrated that the assay for neutralization of anthrax toxin was useful in predicting the probability of survival in rabbits immunized with anthrax vaccine and challenged by the aerosol route.
- Completed sequencing of the GroES protein of *Rickettsia typhi*.
- Patent awarded for gene and protein applicable to the preparation of vaccines for *Rickettsia prowazekii* and *Rickettsia typhi* and the detection of both.
- Developed a nonhuman primate model for aerosolized Brucella, demonstrated that Rhesus monkeys develop bloodstream infection after aerosol challenge with as few as 100 colony forming units of *B. melitensis*.
- Improved a candidate Brucella vaccine strain of *purE*201 by eliminating its antibiotic resistance using gene replacement.
- Established an oral immunization regimen in mice using rough mutants of *B. melitensis*.
- Demonstrated that candidate vaccine strain, a mutant *purE*201, is cleared slowly from profoundly immunodeficient Rag-1 mice, indicating a role for nonspecific host defense in protection against this attenuated strain.
- Determined the DNA sequence of the *Yersinia enterocolitica* large virulence plasmid for comparison with similar plasmid found in *Y. pestis*. Determined that ribotyping is the best method for comparing strains.
- Initiated effort to isolate, characterize and detect ciprofloxacin-resistant *Y. pestis* mutants. Determined the wild-type sequence for genes known to be involved in resistance and characterized 20 resistant mutants.
- Evaluated numerous approaches to identify the enzymatic activities and targets of putative immunosuppressive effects of plague infection *in vivo*.
- Characterized inhibition of neutrophil migration as a potential biological activity of the V antigen of *Y. pestis*.
- Concluded a study on the efficacy in guinea pigs of anthrax vaccine against strains of *B. anthracis* from numerous geographical areas.

Protein Toxins

The countermeasures, technical barriers, and accomplishments in the biological threat category of 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:

- Limited capability to produce large bulk GMP pilot lots of vaccine candidates.
- Lack of suitable epidemiological situations to perform human clinical trials to prove efficacy of vaccines and antitoxins.
- Difficulty in field testing diagnostic assays for toxins under natural conditions.
- Difficulty in producing polyvalent toxoid vaccines effective against classes of toxins.
- Lack of appropriate animal model systems for investigation of some protein toxin threats and countermeasures, or for testing treatment efficacy and safety in humans.
- Difficulty in defining surrogate markers of protection.

Accomplishments:

- Developed first pilot lot for expressing in yeast the C-fragment of BoNT/B made in compliance with the cGMP FDA regulations. This and other C-fragment candidates will be transitioned as potential vaccines.
- Completed the lot release and preclinical testing of the rBoNT/B(Hc) vaccine.
- Developed the fermentation and purification processes for the production of the rBoNT/A(Hc) vaccine.
- Obtained the first x-ray crystal structures for type A BoNT and for the C-fragment of tetanus toxin, a closely related clostridial neurotoxin.
- Determined spectroscopically that the secondary structure of BoNT/A & /B C-fragments in aqueous solution is predominantly composed of negative-strand elements, a result that is consistent with the x-ray diffraction data and with molecular modeling predictions. This information will be useful in the structural characterization of these candidate vaccine products.
- Developed and successfully tested a proof-of-concept DNA vaccine candidate for BoNT/A
- Modeled the secondary structural elements for BoNT/A-G.
- Successfully applied secondary structure and solvent accessibility predictive algorithms to the design of peptides for BoNT/A antibody response.
- Developed in-house the first sets of monoclonal antibodies that neutralize either BoNT/A or BoNT/B.
- Synthesized a potent polypeptide inhibitor for BoNT/A that will be used as a lead compound in future combinatorial chemistry syntheses.
- Screened a variety of thermolysin (the prototypic metalloprotease) inhibitors; effective concentration for the best compound was 20 μm against BoNT/B. This may become another lead inhibitory compound.
- Developed a novel *in vitro* system using biological membranes to examine the physiological activity of BoNT-induced ionic channels and their potential role as a target for chemotherapies to counteract the internalization of the toxin.

- Developed cell-free *in vitro* assays to study the actions of candidate metalloprotease inhibitors on the catalytic activity of botulinum toxin light chain. These systems monitor the rate of cleavage of the substrates synaptobrevin (serotype B) and SNAP-25 (serotype A) by capillary electrophoresis. Emphasis will be placed on greater assay automation and on faster separation of cleavage products.
- A primary mouse spinal cord culture system was examined for its suitability as a cellular model for botulinum toxin research. The cultures were found to be highly sensitive to serotypes A and B but relatively insensitive to serotype E, can be used to study the mechanisms of action of botulinum toxin, and to test therapeutic agents.
- Tested extensively the isolated mouse phrenic nerve hemidiaphragm preparation and found it to be highly suitable for evaluating botulinum toxin antagonists.
- Developed a synthetic approach and began the synthesis of a potential botulinum antidote.
- Maintained Chemical Repository so that putative drugs could be sent for testing against threats, *i.e.*, selected and sent 50 putative antibotulinum toxin agents to USAMRICD, for testing.
- Work on mechanisms of botulinum toxin A and on protectants performed completely *in vit*ro, thereby generating scientific progress without performing animal experiments.
- Described the use of a natural peptide, Buforin 1, to inhibit the toxic enzymatic activity of botulinum toxin B, making it a potential drug for counteracting botulinum toxicity.
- The SEB toxoid proteosome vaccine was found to be effective in protecting monkeys from SEB aerosol challenges (10-18 LD_{50}). A comparison study was conducted recently in monkeys for the efficacy of the new soluble SEB toxoid, the SEB toxoid-containing microspheres, and the SEB toxoid formulated with proteosomes.
- Chemically modified histidines of the SEB molecule and studied its biological activities. Used methods of genetic engineering to change the histidine codons of SEB genes by site-directed mutagenesis and cloned the mutated genes in *E. coli*. These SEB mutant proteins are under investigation for use as intranasal vaccines and as therapeutics.
- Completed ultrastructural studies to assess the effect of an incapacitating dose of SEB on Rhesus monkeys following an aerosol exposure. Demonstrated that the chosen SEB dose induced blastogenesis in 52%-57% of lymphocytes indicating high superantigenic activity of the toxin.
- Developed a primate test battery to assess behavioral incapacitation induced by nonlethal exposure to SEB as part of a collaborative effort with Division of Pathology [Walter Reed Army Institute of Research (WRAIR)] and Division of Toxinology (USAMRIID). This accomplishment earned 1998 Army Research and Development Awards for the two WRAIR scientists who directed this project.
- Extended the primate test battery to a touchscreen platform that greatly increases the flexibility and utility of the behavioral assessment capability.
- Demonstrated effectiveness of a newly developed, multi-channel telemetry device that assesses physiological parameters associated with SEB toxicity.
- Established a sublethal SEB exposure time course for dose-dependent production of eicosanoids, neuropeptides and cytokines.
- Identified three potential therapeutic agents against the toxic effects of SEB.
- Began cGMP vaccine recombinant SEB (rSEB) pilot lot, including seed stock,

fermentation, purification, formulation/vialing, QC testing and documentation, identity and rSEB/cGMP vaccine stability, safety, and reactogenicity.

- Standardized a potency assay for rSEB vaccine.
- Developed surrogate endpoint in animal models that will be used to evaluate the immune response in humans following vaccination for protection against the BW threat.
- Produced a lot of GMP SEB toxin to be used as a reference standard (Battelle/Centre for Applied Microbiology and Research, U.K.).
- Successfully completed bivalent (SEA/SEB) recombinant vaccine 12-month immunogenicity study in nonhuman primates.
- Initiated studies evaluating the effectiveness of SEB vaccines (both toxoid and rSEB) against lethality and incapacitation: nonhuman primate study of toxoid and rSEB vaccines.
- Correlated the structural features of SEB with its functional properties by designing and synthesizing 26 site-specific mutant proteins, sets of synthetic peptide fragments and truncated proteins.
- Identified several peptide fragments of the SEB molecule which in turn were developed into vaccine candidates that elicited neutralizing antisera production without associated effects of SEB toxicity.
- Initiated development of a transgenic mouse model of SE intoxication/incapacitation based on expression of higher affinity human receptor molecules.
- Developed a new and powerful computational method for the rapid prediction and assessment of protein-protein binding modes and their affinities for the genetically engineered mutants of the SEs.
- Predicted the binding characteristics of the rSEB and rSEA proteins with MHC class II molecules, and their oligomerization with T-cell receptors.
- Identified a synthetic SEB peptide capable of blocking binding of SEB to human MHC class II antigen.
- Demonstrated that monoclonal antibodies to TNF alpha and interferon gamma protect mice from a lethal SEB challenge.
- Demonstrated that chlorpromazine, an FDA-approved tranquilizer, protects mice from a lethal SEB challenge, and that pentoxifylline diminished the lethal effects of SE in mice.
- Demonstrated that SEB-induced production of mediators were centrally controlled by a battery of selected protein kinases and inhibitors of several kinase pathways blocked SEB's biological effects and abrogated SEB-induced lethality in a mouse model.
- Developed a potency assay for deglycosylated A-chain ricin vaccine and submitted a validation plan for this assay for approval.
- Determined that lyophilized deglycosylated A-chain ricin vaccine is chemically stable and maintains its potency for at least 18 months. (PerImmune, Inc.).
- Determined optimum vaccine schedule protecting mice and rats in a lethal aerosol challenge model for ricin.
- Conducted successful general and acute GLP safety testing on deglycosylated A-chain ricin vaccine (PerImmune Inc.).
- Produced a pilot lot of deglycosylated A-chain ricin vaccine in collaboration with an industrial partner (IntraCel).
- Determined high-dose and longevity safety parameters in a mouse model for the

deglycosylated A-chain ricin vaccine.
- Identified surrogate markers for immunological protection against aerosolized ricin.
- Determined the sequence-specific interactions of the ricin-rRNA binding determinant critical for the design of selective N-glycosidase inhibitors.
- Modeled *de novo* designed ricin inhibitors based on substrate analogs.
- Developed a synthetic method and commenced the synthesis of the ricin inhibitor.
- Tested *C. perfringens* iota toxin (a binary, lethal enterotoxin) and found that it does not elicit proinflammatory cytokines from human peripheral blood lymphocytes *in vitro*, unlike other bacterial enterotoxins (*i.e.*, staphylococcal enterotoxins [SE]) that represent BW threats and are very active at inducing a lethal cytokine cascade.
- Began receptor binding studies for iota toxin on various tissue culture cell lines and additional studies are ongoing to characterize the surface receptor on susceptible African green monkey kidney cells.
- Conducted aerosol challenge in rats using spores of *C. perfringens* and determined that this animal species is not susceptible to infection/intoxination by this route.

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 antiviral drugs for treatment of viral disease.
- Devices and technologies for diagnosis of viral disease.

Technical Barriers:
- Lack of appropriate animal model systems for investigation of viral threats and countermeasures.
- Limited capability to produce large bulk GMP pilot lots of vaccine candidates
- Lack of suitable epidemiological situations in which to perform human clinical trials to evaluate efficacy of vaccines.
- Need for production of multivalent vaccines against heterologous viral agents.
- Difficulty in optimizing and comparing different expression vectors for recombinant products (vaccines and antibodies).
- Need for rapid virus identification technology.
- Difficulty in defining of surrogate markers of protection.

Accomplishments:
- Demonstrated that fibroblastic reticulum cells of lymphoid tissue are the early target cells of Ebola virus.
- Discovered that nonlethal infection of Ebola virus confers protective immunity to intraperitoneal (IP) challenge by a subsequent lethal dose of virus.
- Identified a reverse genetic system for Ebola virus in which virus is rescued from a clone copy of the viral genome. This allows manipulation of the genome to create attenuated

viruses for purposes of vaccination.

- Protected a mouse model against filovirus challenge using replicon Ebola virus RNA expressed in the VEE replicon system.
- Demonstrated protection against Marburg virus challenge in guinea pigs immunized using Marburg DNA cloned into a plasmid and delivered using a "gene gun".
- Demonstrated the first successful protection of non-human primates from lethal Marburg virus challenge after immunization with a genetically constructed replicon Marburg virus vaccine.
- Refined animal models of filovirus infection using conjunctival, oral, and aerosol routes of challenge.
- Discovered that a key pathogenic event in Ebola virus infection is destruction of mononuclear phagocytes.
- Discovered that serum from mice immunized against an adapted Ebola virus passively protects naïve mice from lethal disease.
- Identified candidate prophylactic agents for filoviruses, a group of hydrolase inhibitors, to be evaluated in a nonhuman primate challenge model.
- Designed and characterized novel monoclonal antibody complexes, targeting bound Marburg virus, for hepatic immune system clearance.
- Initiated development of an *in vitro* model system of Ebola virus replication that can be used to better understand early stages of virus infection as well as to investigate potential therapeutic compounds.
- Synthesized the enantiomers of 9-(trans-2′,trans-3′-dihydrocyclopent-4-yl)-3-deazadenine for evaluation as potential chemotherapeutic agents against Ebola and Marburg viruses.
- Established purity, stability, and reversion database for the deletion-mutant VEE vaccine candidate, V3526.
- Evaluated three VEE virus vaccines in laboratory mice. Three candidates, formalin-inactivated C-84, live-attenuated TC-83, and deletion-mutant V3526, were evaluated for efficacy and onset and duration of immunity. The V3526 was shown to be more attenuated and more immunogenic in protecting nonhuman primates than TC-83.
- Completed histopathological evaluation of CNS tissue of VEE exposed, susceptible and immunized mice. CNS invasion by VEE challenge is prevented in mice vaccinated with TC-83 or V3526. The deletion mutant V3526 showed significantly less neurovirulence in mice than the TC-83 preparation.
- Demonstrated inability of deletion-mutant V3526 to revert to wild-type VEE in the natural mosquito vector.
- Applied deletion-mutant technology to formulate WEE and EEE vaccine candidates. For WEE the best candidate, WE2102, elicited high serum neutralizing antibody titers in mice, reduced mortality, but did not affect morbidity.
- Generated a live-attenuated molecular clone of VEE subtype IE that appeared to be nonvirulent, immunogenic, and protective in animal models. It may serve as the basis for further development of a vaccine candidate.
- Evaluated the role of antibodies in mice in mediating alphavirus vaccine interference. Found that non-neutralizing antibodies may act at the surface of infected cells to reduce the host response to live alphavirus vaccines.

- Determined in animal models that deletion-mutant V3526 VEE vaccine candidate was less susceptible to interference by pre-existing alphavirus antibodies than the existing TC-83 vaccine.
- Developed a monkeypox model using nonhuman primates to evaluate efficacy of both the licensed and cell-culture-derived replacement vaccines against variola. Both vaccines showed protection against high dose aerosol challenge of monkeypox.
- Demonstrated ability to clone vaccinia glycoprotein genes into an alphavirus (VEE) replicon vector to assess this approach to a genetically engineered smallpox vaccinia.
- Mice immunized with L1R immunogen derived from vaccinia virus and delivered using a "gene gun" were completely protected against a lethal dose challenge of vaccinia.
- Demonstrated efficacy of DNA-polymerase inhibitors against variola virus.
- Demonstrated that monoclonal antibodies specific to L1R of vaccinia virus neutralized the virus in cell culture.
- Conducted histopathologic examination of monkeypox aerosol-challenged nonhuman primates, documenting fibrinonecrotic bronchopneumonia and diffuse dispersal of antigen in airway epithelium and surrounding interstitium.

Diagnostic Assays for Biological Warfare Threat Agents

The accomplishments in the diagnostic 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.

Technical Barriers:

- Difficulty in field testing rapid identification kits under natural conditions.
- Lack of rapid confirmatory assays with "gold standard" sensitivity and specificity.
- Limited rapid deployable identification technology.

Accomplishments:

- Evaluated two molecular diagnostic approaches to identify pathogenic orthopoxviruses. These two assays will allow delineation between strains of orthopoxviruses including those that may have been genetically manipulated.
- Developed a specific and sensitive ELISA for *C. perfringens* alpha toxin, a lethal protein produced by all *C. perfringens* strains and intimately linked to the pathogenesis of this microorganism.
- Designed primers for cloning putative genes involved in regulation of iron binding proteins (*tonB*), murein biosynthesis (*murE*), methionine biosynthesis (*metL*, *thrA*), the chaperonins involved in protein translocation to the periplasm (*secE*), and transcription termination (*nusG*).
- Developed strategies and techniques to analyze lymphoid cells exposed (*in vitro* or *in vivo*) to biological or chemical threat agents to catalogue unique patterns of alterations in gene expression to use as surrogate markers of exposure to specific BW agents and predict patterns of impending illness.
- Developed monoclonal antibodies specific for Q fever (phases 1 and 2) to replace existing polyclonal antibodies in existing antigen capture ELISA.

- Developed improved monoclonal antibodies to VC 01 serotypes and developed antigen capture ELISA with improved sensitivity and specificity.
- Developed a monoclonal antibody to *Burkholderia mallei* to replace existing polyclonal antibodies in antigen capture ELISA.
- Developed methods for subtyping *Bacillus anthracis*.
- Developed and optimized methods for the isolation of viral RNA from environmental and clinical specimens.
- Developed an antigen capture ELISA for poxviruses.
- Developed a monoclonal antibody specific for botulinum toxin B to be used in the development of an antigen capture ELISA.
- Developed rapid PCR system for the detection of BW agents to be incorporated into a field deployable laboratory. Successfully field-tested this system for the detection of bacterial agents in aerosol collections.
- Transferred immunochromatographic hand-held assay technology to a selected commercial company for production quantity in service of the Joint Program Office for Biological Defense. Developed a prototype hand-held assay housing for its portability.
- Developed SEB, Ricin, *B. anthracis*, botulinum toxins A and B, and *F. tularensis* detection assays using the Bidiffractive Gating Biosensor.
- Constructed database of known DNA sequences relating to organisms of biological warfare concern. Currently includes over 4,800 genes. Continuing to add new DNA sequences and other capabilities to the database.
- Developed rapid, sensitive and specific immunochromatographic hand-held assays for SEA, SEC, Q fever, and *Y. pestis* non-F1.
- Developed rapid, single step PCR assays for the following agents: *B. anthracis*, *Y. pestis*, *Vibrio cholerae*, *Clostridium botulinum* A, *Clostridium botulinum* B, orthopox virus, and Venezuelan equine encephalitis (VEE) virus. These rapid PCR assays use fluorescent biosensor detectors capable of detection of BW agents in less than 25 minutes.
- Identified in collaboration with Lawrence Berkeley National Laboratory a new, chromosomal DNA marker for the identification of *B. anthracis* and developed PCR assays using that marker.
- Developed rapid, sensitive and specific immunochromatographic hand-held assays for VEE, pox, and Ebola viruses.
- Developed recombinant antibodies to ricin and botulinum toxin E that are being incorporated into diagnostic assays.

D.2.3 Advanced Development Accomplishments

The Joint Program Office for Biological Defense (JPO-BD) is a DoD chartered agency to provide intensive centralized management of medical and non-medical programs to expedite materiel solutions for validated biological defense deficiencies. Vaccine products will be further developed by the Joint Vaccine Acquisition Program (JVAP) under the auspices of the JPO-BD. Medical devices, diagnostics, and therapeutics will continue to be developed by USAMMDA. Vaccines directed against high threat agents will be produced and stockpiled to fulfill a 1.2 million Troop Equivalent Doses (TEDs) requirement [TED = the amount of vaccine required to

immunize a service member to protect against a biological warfare agent] . Vaccines against low threat agents will be produced to fulfill a 300,000 TEDs requirement.

The following products have transitioned from Tech base R&D to advanced development and are managed and funded by JPO-BD.

D.2.3.1 Botulism Immune Globulin (Human), Pentavalent (IND #1332)

- The IND remains open to accommodate emergency treatment requirements for exposure or possible exposure to botulinum toxin types A, B, C, D, or E.

D.2.3.2 Botulinum Type F Toxoid Vaccine (IND #5077)

- Completed 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 and route of vaccination that is safe and maximally immunogenic.
- The 12-month serology after the primary three-inoculation series of vaccinations has was drawn from the last cohort in the Phase 2 study and demonstrated that the immunogenicity of the purified Botulinum Type F Toxoid.
- The 1-year booster phase of the Phase 2 study is complete and 142 sera were above 0.25 IU/ml of antibody demonstrating the effectiveness of this vaccine.
- Provided product for a laboratory comparison of F toxoid with recombinant Fc product in animal efficacy experiments.

D.2.3.3 Anthrax Vaccine Human Adsorbed

- The sale of Michigan Biologic Products Institute (MBPI) by the state of Michigan was finalized. MBPI was purchased by BioPort that consists of the management team from MBPI and outside capital; it is a private sector entity without state of Michigan affiliation.
- Managed and funded efforts leading to the submission of a PLA amendment to the FDA for Anthrax Vaccine Adsorbed. The data was submitted to reduce the current schedule of six doses to a five-dose schedule that will provide protection against aerosol exposure to anthrax.
- Managed the anthrax vaccine production and stockpile to ensure sufficient vaccine is available to support the Secretary of Defense's anthrax immunization efforts.
- DoD continued to provide technical assistance to MBPI/BioPort to identify and correct FDA compliance deviations.
- Funded and provided oversight of production facility upgrades and ancillary support function renovation at BioPort that are critical to maintaining anthrax vaccine availability

D.2.3.4 Botulinum (Pentavalent) Toxoid Adsorbed (ABCDE) (IND#3703)

- Indemnification was granted for the conduct of the pivotal clinical trial for product approval.

- Protocol written and approved for pivotal clinical study. This protocol was briefed to the FDA April 1998 and accepted after coordination.
- Animal studies were completed demonstrating the equivalence of intramuscular (IM) and IP administration of toxin challenge doses. This study validated the use of the IP route of administration.
- Final reports were submitted to the FDA documenting (1) the validation of assays and the passive transfer of human antibody to an animal model (*i.e.*, guinea pig) in support of the Pentavalent Botulinum Toxoid vaccine licensure.
- A study demonstrating the effectiveness of human toxin neutralizing antibodies as a surrogate correlate of efficacy/protection against aerosol challenge with botulinum toxin was successfully completed.
- A botulism IM challenge study demonstrating the protective efficacy of human neutralizing antibodies transferred to guinea pigs was completed. This study will provide the data for the protective geometric mean titers for each of the botulinum serotypes.

D.2.3.5 Botulism Immune Globulin $F(ab')_2$, Heptavalent, Equine, Types A, B, C, D, E, F, & G IND (#7451)

- Contracted for continued stability testing of the product.
- Filed IND with the FDA.
- Initiated Phase 1 Safety and Pharmacokinetics clinical study.
- Provided Botulinum Antitoxin Standards to Battelle Medical Research and Evaluation Facility used for the development of the Pentavalent Botulinum Toxoid (ABCDE).
- Manufactured 4,913 doses of cGMP Botulism Immune Globulin.

D.2.3.6 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 toxin types A, B, C, D, or E.

D.2.3.7 Botulinum Type F Toxoid Vaccine (IND #5077)

- Completed 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.
- Provided product for a laboratory comparison of the F toxoid with a recombinant Fc product in animal efficacy experiments.

D.2.4 Joint Vaccine Acquisition Program (JVAP) Accomplishments

D.2.4.1 Prime Systems Contract

- The JVAP was initiated to consolidate all required manufacturing, testing, human clinical trial, logistical and regulatory expertise necessary to develop and license vaccines to protect against validated biological warfare agent threats.
- The JVAP prime system contract was awarded to DynPort Limited Liability Corporation (LLC) on 7-Nov-97. The basic contract consists of the storage, distribution and testing of the DoD contingency stockpile of Biological Defense (BD) vaccines and the development and licensure of 3 BD vaccines: Q-fever vaccine, Tularemia vaccine, and Vaccinia Virus vaccine. The contract has options for the development and licensure of an additional 15 BD vaccines. These options will be exercised as promising vaccine candidates transition into advanced development.
- Began work 2-Mar-98 after GAO resolution of contract award protest.
- Continued advanced development of these BD vaccine candidates through DynPort's use of government laboratories and facilities as DynPort's application for indemnification of unusually hazardous risks was being processed.
- DynPort is participating with government tech-base to help vaccine candidates transition into advanced development faster with reduced risk.
- Coordinated and conducted a meeting with the FDA to update Center for Biologics Evaluation and Review staff on the JVAP, to introduce the JVAP-Project Management Office and their Prime Systems Contractor (DynPort) and to describe the current vaccines included in the program.

D.2.4.2 Contingency Stockpile of Biological Defense (BD) Vaccines

- Transfer of the contingency stockpile of Biological Defense vaccines from the Salk Institute Biologics Development Center to McKesson BioServices was completed. McKesson BioServices is the DynPort sub-contractor for vaccine storage and distribution. McKesson BioServices has a state of the art facility dedicated to the storage of the BD investigational new drug (IND) contingency stockpile. The facility features redundant security systems, fully automated temperature monitoring, back up power system that ensures fully automatic transfer to a natural gas generator, and the capacity to meet the current and projected stockpile storage requirements.

D.2.4.3 Advanced Development of the Tularemia Vaccine

- Reviewed historical records and identified technical and regulatory issues to form the basis for a scientifically sound, feasible plan for the advanced development of a live attenuated tularemia vaccine.
- Selected a National Drug Company vaccine candidate as parent seed for development of the new vaccine for tularemia.
- Initiated process definition studies at the Life Science Division, Dugway Proving Ground to characterize large scale manufacturing procedures for the new tularemia vaccine.

D.2.4.4 Advanced Development of the Q-fever Vaccine

- Reviewed historical records and identified technical and regulatory issues to form the basis for a scientifically sound, feasible plan for the advanced development of a Q-fever vaccine.
- Met with a potential manufacturing subcontractor to discuss how their product meets our user's requirement.
- JVAP has received concurrence from our user about the suitability of this vaccine candidate.

D.2.4.5 Advanced Development of the Smallpox Virus Vaccine (Vaccinia Virus)

- Reviewed historical records and identified technical and regulatory issues to form the basis for a scientifically sound, feasible plan for the advanced development of a cell culture vaccinia vaccine for smallpox.
- Prepared a clinical protocol to evaluate the candidate vaccines administered by scarification.
- Guided protocol through all internal review boards and FDA review.
- Initiated process definition studies to evaluate large-scale production methods.
- Began discussions with the Department of Health and Human Services about the feasibility of scale-up production for the DoD vaccine to obtain for a civilian stockpile.
- Clinical protocol has stalled due to regulatory concerns about Vaccinia Immune Globulin, which is required before immunizations can take place.
- Baxter, current license holder for VIG, no longer plans to manufacture this product. JVAP market survey information from potential manufactures is being forwarded to DynPort to manage a new manufacturing and licensure effort for this product.

D.2.4.6 International Cooperative Research and Development

- The JVAP-Project Management Office conducted technical discussions with representatives of the United Kingdom and Canada about cooperative research and development agreements for Biological Defense vaccine products. A conceptual approach to tri-national cooperative research and development has been developed and is under review by the JPO-BD.
- Proposed recombinant plague vaccine candidates from the U.S. and United Kingdom recently underwent a pre-IND review at the FDA. This collaborative approach between the two countries leverages tech-base and advanced development efforts to provide a safe and effective vaccine protecting against aerosol exposure to *Yersinia pestis*.

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 illness 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 have provided a significant increase in military effectiveness in the past and present 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:

- Cytokine-based therapeutic applications to prevent the two major fatal syndromes—sepsis and uncontrolled bleeding—following acute radiation injury.
- Cytogenetic biodosimetry service operating to measure individual radiation exposure using blood samples.
- NATO Handbook on the Medical Aspects of NBC Defensive Operations, Volume 1-Nuclear (AMedP-6).
- Medical Effects of Ionizing Radiation (MEIR) Course—Training for approximately 660 Medical Department personnel in FY98.
- Videotapes and CD-ROM of MEIR course lectures produced for distribution to military medical units.

D.3.2 Nuclear Defense Research and Development Accomplishments

The nuclear (or radiological) defense research and development technical barriers and accomplishments during FY98 are grouped in the following threat categories:

- Prompt high-dose radiation.
- Protracted low-dose radiation.
- Combined radiation and chemical or biological agents.
- Embedded Depleted Uranium.

"*Prompt high-dose radiation*" refers to the deposition of high-energy radiation in biological tissues in very short periods of time. Sources of high-energy radiation include emissions within the first 60 seconds of a nuclear weapon detonation and "criticality events" that occur when a nuclear reactor achieves peak energy output either accidentally or through an intentional act. The high linear-energy-transfer imparted by the neutrons of these sources causes significant

tissue injury within seconds of exposure, resulting in both short- and long-term health consequences.

"*Protracted low-dose radiation*" refers to the deposition of low-energy radiation in biological tissues over extended periods of time. Sources of low-energy radiation include fallout from nuclear weapon detonations, radiological dissemination devices, and any other source of environmental radiation contamination. Health consequences are generally intermediate- to long-term and result from cumulative tissue injury accruing over time due to chronic exposure. Health consequences can be exacerbated further when radionuclides are deposited internally by ingestion, inhalation or through open wounds in the external integument.

"*Combined radiation and chemical or biological agents*" refers to the amplified health consequences when chemical or biological insults are incurred in conjunction with radiological injury. Both clinical and subclinical exposures to ionizing radiation compromise host defenses against a variety other stressors, including infectious agents and chemical toxicants. Exposures to doses of radiation and infectious or chemical agents that are by themselves sublethal can produce mortality rates of nearly 100% when combined.

"*Embedded Depleted Uranium*" refers to the metal used in penetration munitions and armor and the resultant radiological and toxicological consequences to personnel injured by embedded fragments of these munitions. Because of the unique and poorly understood radiological and toxicological properties of embedded depleted uranium, knowledge of the immediate and long-term risks is limited. Current treatment strategies are not well developed for personnel with tissue embedded depleted uranium and conventional diagnostic capabilities make it difficult to ascertain that personnel are injured with embedded depleted uranium.

The Medical Radiological Defense Research Program focuses on developing medical countermeasures to the health consequences of both prompt high-dose and protracted low-dose exposures to ionizing radiation. It also develops experimental data detailing combined NBC medical effects needed by computer modeling programs for casualty prediction. Specific research on medical countermeasures includes work on prophylactic and therapeutic drugs, drug delivery devices to enhance efficacy and simplify administration under field conditions, and combined prophylactic/therapeutic protocols to further enhance efficacy. Work also focuses on developing novel biological dosimetry techniques to measure individual absorbed doses. Knowledge of the dose of radiation absorbed helps guide medical treatment decisions and saves lives. It also provides field commanders with an assessment of the radiological health of deployed forces and leads to better-informed operational decision making.

Threat Category: Prompt High Dose Radiation

The countermeasures, technical barriers, and accomplishments in the threat area of prompt high dose 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 and vomiting.
- Biological dosimetry techniques for rapid injury assessment needed to guide medical treatment decisions and assessment of radiological health of combat units.

Technical Barriers:

- Need for reduction of the performance-degrading toxicity of prophylactic drugs that otherwise have good efficacy for the prevention of radiological injury.
- Need to advance knowledge of cellular, sub-cellular and molecular mechanisms of radiological injury to improve rational development of prophylactic and therapeutic drugs.
- Need for extending the stability of a prophylactic drug to allow its use in a slow-release delivery device for extended bioavailability and enhanced efficacy.
- Difficulty in identifying and calibrating biological markers that can both indicate the amount of absorbed radiation dose and differentiate whole-body from partial-body exposure.
- Inability to automate sample preparation and reducing sample preparation times of cytogenetic biodosimetry tests.

Accomplishments:

- Completed pilot demonstration of improved clinical support protocol (modified antibiotic and platelet transfusion regimens) for acute, potentially fatal radiation injury.
- Continued assessment and optimization of a combined radioprotectant, cytokine, and clinical support treatment modalities for enhancing survival following acute, lethal irradiation.
- Developed new prophylactic strategy for reducing acute radiation injury based on (a) apoptotic and reproductive mechanisms-based tissue injury and pathology, (b) low-toxicity drug selection, (c) pharmacologic quenching to further reduce toxic side effects, and (d) new drug delivery alternatives.
- Simplified sample preparation procedure used in cytogenetic assays to assess biologically absorbed radiation dose.
- Completed initial studies extending the application of radiation dose measuring protocols to exposure scenarios involving incremental doses of gamma and fission neutrons.

Threat Category: Protracted Low Dose Radiation

The countermeasures, technical barriers, and accomplishments in the threat area of protracted low dose radiation from nuclear fallout, radiological explosive devices, etc., are outlined below.

Countermeasures:

- Advanced medical treatment strategies for protracted radiation to mitigate 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 pharmacologic intervention strategies that protect against both early and late health effects arising from cellular and molecular damage caused by ionizing radiation.
- Improved techniques to detect and remove internally deposited sources of radioactivity
- Improved drug delivery systems that provide non-encumbering protection during the entire period of radiation exposure.
- Enhanced biodosimetry technique that can differentiate prior from recent exposures to radiation.

Technical Barriers:

- Lack of suitable radiation sources to study the effects of chronic exposure at relevant doses.
- 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. Limited knowledge of DNA damage surveillance and repair mechanisms under protracted exposure conditions hinders development of pharmacologic agents to prevent late-arising cancers.
- Need to reduce the toxicity of heavy metal chelating agents while maintaining their efficacy.
- Need to extend bioavailability of prophylactic drugs to achieve maximum long-term protection.
- Potential cumulative toxicity of prophylactic drugs (antimutagenic and anticarcinogenic agents) when used for extended periods.
- Lack of a sustained drug delivery system of radioprotectants.
- Microbial resistance to antibiotics.

Accomplishments:

- Developed new prophylactic strategy for reducing chronic radiation injury based on (a) improved understanding of tissue damage and repair and subsequent late-arising disease, (b) selection of low-toxicity drugs that enhance tissue repair and minimize gene mutations, and (c) new slow release drug delivery systems that extend the radioprotective window.
- Established therapeutic drug assay to monitor blood levels of prophylactic drugs in support of studies to develop sustained drug delivery systems.
- Demonstrated use of implanted capsules as possible approach to provide sustained efficacious delivery of prophylactic drugs.
- Developed novel protocols using a fluorometric PCR for precise quantifiable measurements of molecular responses to radiation (oncogene expression, mitochondria DNA deletions) that can provide advanced biological markers for radiation dose assessments.
- Observed that ionizing radiation induces a specific deletion in mitochondrial DNA and alterations in oncogene mRNA expression, both of which appear to occur in dose-

dependent fashions.

Threat Category: Combined Radiation and Chemical or Biological Agents

The countermeasures, technical barriers, and accomplishments in the threat area of combined effects of nuclear ionizing radiation with trauma, burns, infection, or chemical toxicants 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 or chemical toxicants.
- Radioprotective drugs designed to harden the soldier against the effects of radiation in combination with trauma, burns, infection, or chemical toxicants.
- Combined therapeutic agents designed to decrease morbidity and mortality from combined exposures and to enhance innate immune responses.
- Computer models for predicting casualties following combined exposure to low levels of ionizing radiation and biological warfare/chemical warfare agent aerosols.

Technical Barriers:

- No surrogate models for extrapolating data to humans.
- Limited animal models that are optimum for both radiation and a biological warfare or chemical warfare agent.
- Need to gain access to radiation sources and biological containment facilities in order to complete full range of experiments on combined effects of radiation and BW agents.
- Growing number of microbial organisms resistant to antibiotics.
- Accounting for variability in sensitivities of biological systems to different radiation qualities (*e.g.*, neutron *vs.* gamma radiation).
- Mechanism of action of cell-growth factors is not well understood.
- Sensitivity of bone marrow progenitor cells to low doses of ionizing radiation.

Accomplishments:

- Quantified increased mortality rates in irradiated mice infected via pulmonary route with *Bacillus anthracis* (Sterne) spores.
- Initiated studies to assess effects of radiation on immune status after vaccination with anthrax vaccine.
- Established in vitro and in vivo model systems to assess radiation/viral interactions.
- Established capability to integrate health consequences of radiation/biological warfare agent interactions, extrapolated from animal model studies, into the Consequence Assessment Tool Set (CATS).
- Identified synergistic consequence of combined exposure to sublethal radiation and therapeutic levels of PB resulting in redistribution of blood flow.
- Developed enhanced treatments for radiation-associated infections using immune system stimulators.

Threat Category: Embedded Depleted Uranium

The countermeasures, technical barriers, and accomplishments in the threat area of embedded depleted uranium are outlined below.

Countermeasures:

- Rapid assessment clinical analyses to identify personnel wounded with embedded depleted uranium.
- Safe and effective treatment strategies to minimize long-term health risks.

Technical Barriers:

- Determining the redistribution and toxicological consequences of exposure to embedded fragments of depleted uranium.
- Developing the reagents needed to improve sensitivity of tests to detect uranium.
- Developing or modifying pharmacological treatments to increase efficacy and reduce toxicity.

Accomplishments:

- Determined from studies designed to simulate embedded depleted uranium that depleted uranium from embedded fragments distributes to tissues far from the site of implantation.
- Described preliminary findings of carcinogenicity, neurotoxicity, and immunotoxicity of embedded depleted uranium fragments.
- Developed a new method for the colorimetric measurement of urinary uranium concentration.
- Developed a new method for the identification of uranium fragments in wounds.

D.3.3 Predevelopment Products

Technical developments in predevelopment products for medical radiological defense include the following:

- *Iloprost/Misoprostol/3D-MPL/WR-3689*
- "Slow release" radioprotectant for longer protection time for individuals at risk of high, potentially lethal levels of ionizing radiation.
- Nontoxic immune system stimulator for protection against radiation-induced immunosuppression and associated infection.
- CATS model enhancements to incorporate radiation/BW interactions.
- Product improvement of the cytogenetic biodosimetry system by automation of satellite scoring subsystem to increase sample throughput.
- Rapid and sensitive method to measure urinary uranium concentration.

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Annex E

Joint Nuclear, Biological, and Chemical, Defense Program Funding Summary

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**	FY04**	FY05**
0601384BP - Basic Research	26.492	28.372	25.263	29.500	31.386	31.332	29.705	30.245	31.256	32.286
0602384BP - Applied Research	68.571	70.823	69.329	63.992	64.780	68.024	81.787	83.159	74.556	77.226
0603384BP - Advanced Tech. Dev.	33.727	41.693	43.517	52.212	40.910	44.881	52.169	61.227	81.949	79.738
0603884BP - Demonstration/Validation	29.184	44.747	51.886	60.227	62.033	89.510	65.830	73.463	72.073	47.004
0604384BP - EMD	87.229	97.468	120.624	110.943	116.365	100.296	165.639	172.041	110.967	79.050
0605384BP - Management Support	6.954	17.936	21.441	24.849	24.043	24.054	24.692	25.211	24.892	25.637
0605502BP - Management Support/Small Business Innovative Research (SBIR)	0.000	0.000	5.612	0.000	0.000	0.000	0.000	0.000	0.000	0.000
RDT&E Subtotal	**252.157**	**301.039**	**337.672**	**341.723**	**339.517**	**358.097**	**419.822**	**445.346**	**395.693**	**340.941**
Procurement	135.647	232.952	233.943	303.656	377.396	399.673	417.170	426.827	484.852	524.167
CB Defense Program Total	**387.804**	**533.991**	**571.615**	**645.379**	**716.913**	**757.770**	**836.992**	**872.173**	**880.545**	**865.108**

‡ Total Obligation Authority (TOA)
* 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†	FY98†
0601384BP - Basic Research	25.353	24.939	18.153
0602384BP - Applied Research	63.411	59.150	36.582
0603384BP - Advanced Technology Development	31.131	39.250	17.603
0603884BP - Demonstration/Validation	28.549	22.673	25.614
0604884BP - Engineering & Manufacturing Development	77.581	68.413	48.940
0605384BP - Management Support	5.236	16.657	13.819
0605502BP - Management Support/SBIR	0.000	0.000	0.437
RDT&E Subtotal	**231.261**	**231.082**	**161.148**
Procurement	109.080	130.508	36.261
CB Defense Program Total	**340.341**	**361.590**	**197.409**

† Expenditures as of September 30, 1998.

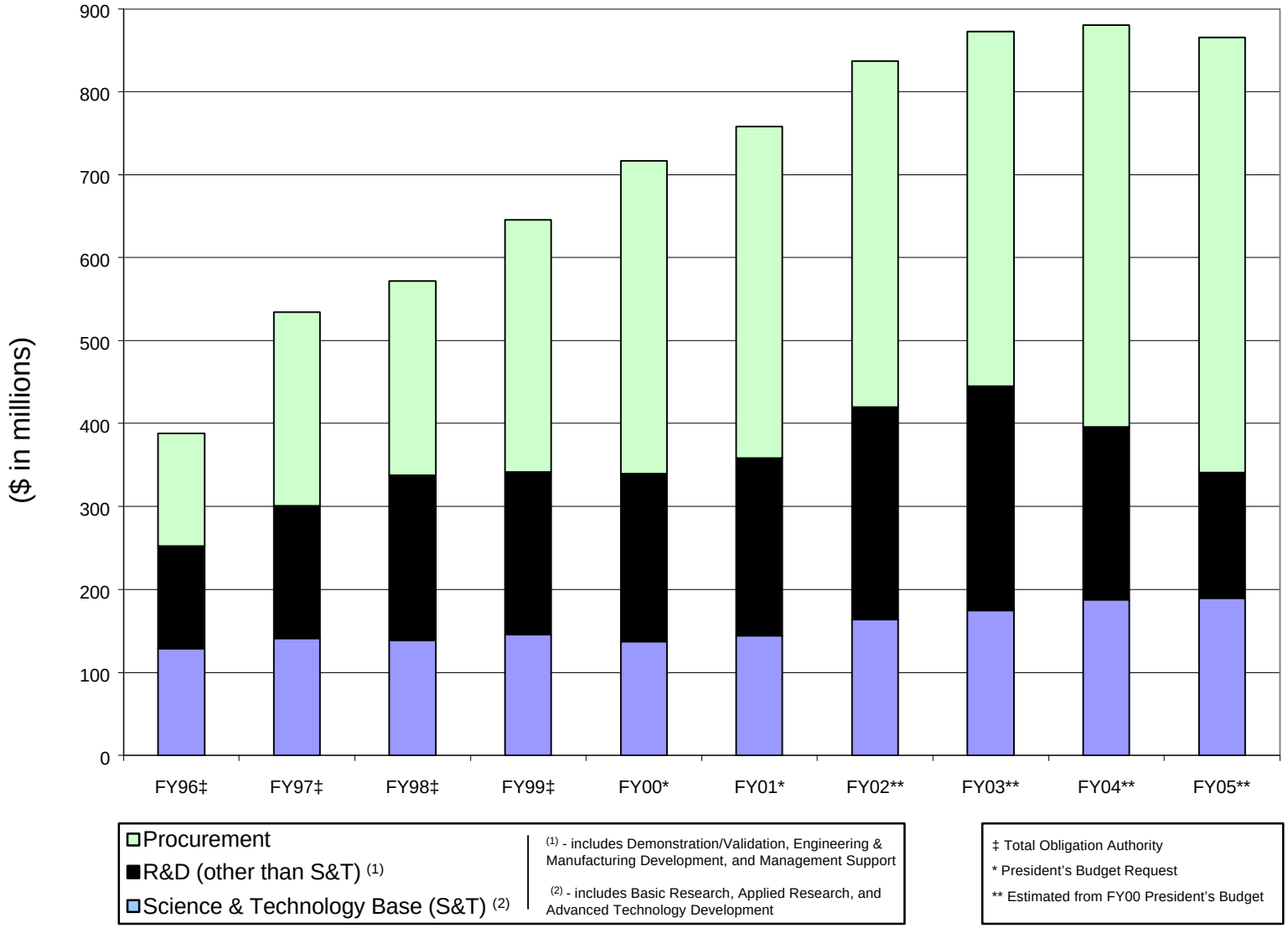

Figure E-1. Chemical and Biological Defense Program Appropriations Summary

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Annex F

Nuclear, Biological, and Chemical Defense Internet Sites

Following is a list of selected locations on the internet that nay 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 January 1, 1999.

DefenseLink
http://www.defenselink.mil/
The official home page of the Department of Defense. Includes numerous reports and links to DoD organizations.

Defense Threat Reduction Agency
http://www.dtra.mil
Home page of the Defense Threat Reduction Agency). Includes information on each of the major mission areas and Directorates at DTRA.

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 Soldier and Biological Chemical Command Information Server
http://www.sbccom.apgea.army.mil/
Home page of the U.S. Army Soldier and Biological Chemical Command.

Edgewood Research, Development and Engineering Center (ERDEC) Home Page
http://www.sbccom.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.afrri.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).

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.

Joint Vaccine Acquisition Program
http://www.Armymedicine.army.mil/jvap
Home page of the Joint Vaccine Acquisition Program Office, provides program history, programmatic information concerning the DoD efforts to produce vaccines against biological warfare agents

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.

Joint Program Office for Biological Defense
http://www.jpobd.net
Home page of the Joint Program Office for Biological Defense. The site is currently being developed and will include information concerning the DoD biological defense acquisition programs managed by the Joint Program Manager for Biological Defense to include enhanced detection systems, Hand Held Immunochromatographic Assays (HHAs), the Joint Field Trials (JFTs), medical products and vaccines.

Annex G

Statement Regarding Chemical and Biological Defense Programs Involving Human Subjects

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 H

Congressional Reporting Requirement: 50 USC 1523

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 the House National Security Committee added the following reporting requirements for this report(HNSC H. Rpt. 105-532, H.R. 3616; p. 209):

Stated that the budget request for CBDP also included $88.0M in PE 62383E for DARPA's component of the bio warfare defense program. The committee has repeatedly expressed its concerns about the need for a strong CBDP to meet the potential threat posed by the proliferation of CBW in the post-Cold War world. The committee has strongly supported and insisted upon a coordinated and integrated CBDP and the need for joint coordination and oversight of the program. The committee notes ongoing R&D activities by the DoE national laboratories that are addressed elsewhere in this report, including $17.0M for the DoE Deterrence and Detection Technologies Program and $56.5M for the DoE Proliferation Detection Program. The committee believes that increased and continuing emphasis should be given to the development of advanced stand-off detectors that employ a range of potential sensing technologies capable of detecting NCB weapon proliferation effluents and agents. The committee also believes that the CBDP must incorporate the best efforts of the military services' R&D establishment, defense agencies, national laboratories, federally funded R&D centers, and industry. The committee directs that the SecDef address this issue, including plans for developing a more fully integrated program with the DoE, as a specific item of interest in the next annual report to Congress on DoD's NCB Defense Program.

Annex I

Acronyms and Abbreviations

–A–

AAAV – Advanced Amphibious Assault Vehicle
AAR – after action report
ACAA – Automatic Chemical Agent Alarm
ACADA - Automatic Chemical Agent Detector
ACC – Air Combat Command
ACES – Air Force Command Exercise System
Ach - acetylcholine
ACOM – Atlantic Command
ACPLA - agent containing particle per liter of air
ACPM - Aircrew Protective Mask
ACTD - Advanced Concept Technology Demonstration
ADS - Area Detection System
AERP - Aircrew Eye/Respiratory Protection
AFMAN – Air Force Manuel
AFMS – Air Force Medical Service
AFRRI - Armed Forces Radiobiology Research Institute
AG - Australia Group
AICPS - Advanced Integrated Collective Protective System
AIDET - Aircraft Interior Detector
AIT – Aeromedical Isolation Team
ALAD – Automatic Liquid Agent Detector
ALSA – Air Land Sea Application Center
AMAD - Automatic Mustard Agent Detector
AMC - U.S. Army Materiel Command
AMEDDC&S - Army Medical Department Center and School
ANCOC – Advanced NCO Course
AN/VDR-2 - Portable dose-rate gamma/beta radiation meter
AN/VDR-13 - Compact, digital whole body radiation meter
APODS – Aerial Port of Debarkation
ARTEP – Army Training and Exercise Plan
ASA(RDA) - Assistant Secretary of the Army for Research, Development and Acquisition
ASBREM - Armed Services Biomedical Research Evaluation and Management
ASCC – Air Standardization Coordinating Committee
ASD(HA) - Assistant Secretary of Defense for Health Affairs
ATD - Advanced Technology Demonstration
AT/FP – Antiterrorism Force Protection
ATG – Airfloat Training Group
ATH – Air Transportable Hospital
ATP - Adenosine Triphosphate
ATSD(NCB) - Assistant to the Secretary of Defense for Nuclear and Chemical and Biological Defense Programs
ATSO – Ability to Survive and Operate

–B–

B. anthracis - *Bacillus anthracis*
BCTP – Battle Command Training Center
BD - biological detector (also, biological defense)
BDO – Battledress Overgarment
BDU – Battledress Uniform
BES - Budget Estimate Submission
BIDS - Biological Integrated Detection System
BNCOC - Basic Non-Commissioned Officer Course
BOG - Board of Governors
BoNT - Botulinum Neurotoxin
BoNT/A - Botulinum Neurotoxin A
BoNT/B - Botulinum Neurotoxin B
BRP – Basic Research Plan
BTN – below the neck
BuChE - butyrylcholinesterase
BVO/GVO – black vinyl overboot/green vinyl overboot
BW - biological warfare
BWC - Biological Weapons Convention

–C–

C^4I – command, control, communication, computer, and intelligence
CA – Commodity Area
CAA – Center for Army Analysis
CA/D – Chemical Activity/Depot
CaE - carboxylesterase
CAM – Chemical Agent Monitor
CANA - Convulsant Antidote, Nerve Agent autoinjector

CANE - Combined Arms in a Nuclear/Chemical Environment
CAPDS – Chemical Agent Point Detection System
CARDS- Chemical Agent Remote Detection System
CASTFOREM – Combined Arms and Support Task Force Evaluation Model
CatOx – catalytic oxidation
CAWM - Chemical Agent Water Monitor
CB - chemical and biological (also C/B)
CBAT – Chemical Biological Augmentation Team
CBAWM - CB Agent Water Monitor
CBD - chemical and biological defense
CBDCOM - Chemical Biological Defense Command (U.S. Army)
CBDP – Chemical/Biological Defense Program
CBIRF – Chemical Biological Incident Response Force
CBM&S – Chemical/Biological Modeling & Simulation
CBMS - CB mass spectrometer
CBPS- CB Protective Shelter
CBR - chemical, biological, and radiological
CBR-D - chemical, biological, radiological defense
C/B-RRT – Chemical Biological Rapid Response Team
CBSD - Chemical Biological Stand-off Detector
CBW - chemical and biological warfare
CCD – Camouflage, Concealment, and Deception
CDC - Centers for Disease Control and Prevention
CD-ROM - Compact Disk - Read Only Memory
CDTF - Chemical Defense Training Facility (at the U.S. Army Chemical School)
CEM – Concept Evaluation Model
CENTCOM – Central Command
CFM - cubic feet per minute
CFR – Code of Federal Regulations
CHAMP – Chemically/biologically Hardened Air Management Plant
CHATH - Chemically/Biologically Hardened Air Transportable Hospital
ChE - cholinesterase
CINC – Commander – in – Chief
CINCCENT – Commander-in-Chief Central Command
CINCPAC – Commander-in-Chief Pacific Command
CJCS – Chairman of the Joint Chief of Staff
CM - Chloroform-Methanol (also, consequence management)
CMR - Chloroform-Methanol Residue
CMTC – Combat Maneuver Training Center
CNS - Central Nervous System
COBC – Chemical Officer Basic Course
COMMZ – Communications Zone
COMPTUEX – Composite Training Unit Exercise
CONOPS – Concept of Operations
CONUS – continental Untied States
COTS – Commercial Off-the-Shelf
CP - chemical protective (also, collective protection, or counterproliferation)
CPE - Collective Protection Equipment
CPO – Chemical Protective Overgarment
CPRC – Counterproliferation Review Council
CPS - Collective Protection System
CPU - Chemical Protective Undergarment
CRG – Compliance Review Group
CSST – Chemical Casualty Site Team
CTC – Combat Training Center
CTR - Cooperative Threat Reduction
CVC – Combat Vehicle Crewmen
CVIP – Chemical Vision Implementation Plan
CW - Chemical Warfare
CWC - Chemical Weapons Convention
CWCIWG - Chemical Weapons Convention Implementation Working Group
CWDD - Chemical Warfare Directional Detector (AN/KAS-1A)
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
DCSOPS - U.S. Army Deputy Chief of Staff for Operations
DDR&E - Director, Defense Research and Engineering
DEPMEDS - CB Protected Deployable Medical Systems
DEST – Domestic Emergency Response Team
DLA - Defense Logistics Agency
DNA - Deoxyribonucleic Acid
DoD - Department of Defense
DoE – Department of Energy
DPE – Demilitarization Protective Ensemble
DPG - Defense Planning Guidance; Also Dugway Proving Grounds
DRB - Defense Review Board (also, Defense Resources Board, or Division Ready Brigade)
DRI – Defense Reform Initiative
DS2 - Decontamination Solution 2
DSCP – Defense Supply Center Philadelphia

DSO – Defense Sciences Office
DTAP – Defense Technology Area Plan
DTIRP - Defense Technical Inspection Readiness Program
DTLOM – Doctrine, Training, Leader-Development, Organization, and Material Requirements
DTO - Defense Technology Objective
DT/OT – developmental/operational testing
DTRA - Defense Threat Reduction Agency
DTRA(CB) - Defense Threat Reduction Agency's Chemical and Biological Defense Directorate

–E–

E. coli - *Escherichia coli*
ECV – Expanded Capacity Vehicle
ED – ethyl dichlorarsine
EEE - Eastern Equine Encephalomyelitis
EEG – electroencephalographic
ELISA - Enzyme-Linked Immunosorbent Assay
EMD – Engineering and Manufacturing Development
ENCOMPASS – Enhanced Consequence Management Planning and Support System
EOD - Explosive Ordnance Disposal
ERDEC - Edgewood Research, Development, and Engineering Center (U.S. Army)
EUCOM – European Command

–F–

F1 - Fraction 1
F1-V - Fraction 1 - "V" Antigen
Fab - Fragment Antigen Binding
FAR – Federal Acquisition Regulations
Fc - Fragment Crystallizable
FCBC – Field Management of Chemical and Biological Casualties Course
FDA - Food and Drug Administration
FDTE – Force Development Testing and Experimentation
FEST – Foreign Emergency Response Team
FLEETEX – Fleet Exercise
FM - Field Manual
FORCEM – Force Evaluation Model
FR – flame resistance
FUE - First Unit Equipped
FY - fiscal year
FY99 - Fiscal Year 1999
FYDP - Future Years Defense Plan

–G–

GA – tabun, a nerve agent
GAO – General Accounting Office
GB - sarin , a nerve agent
GD - soman, a nerve agent
GF – a nerve agent
GMP - Good Manufacturing Practice
GPFU - Gas Particulate Filter Unit

–H–

HAZWARN – NBC Hazardous Warning System
HAZWOPR – Hazardous Waste Operations and Emergency Response
hBuChE - Human Butrylcholinesterase
hCaE - Human Carboxylesterase
HD - sulfur mustard, a blister agent
HEPA – high efficiency particulate
HHA – Hand Held Immunochromatographic Assays
HMMWV - High Mobility Multipurpose Wheeled Vehicle
HN – Host Nation
HSC/YA – Human Systems Program Office
HTA – high threat area

–I–

IBAD - Interim Biological Agent Detector
IBMC - Industrial Base Maintenance Contract
ICAD – Individual Chemical Agent Detector
ICAM - Improved Chemical Agent Detector
ICDS - Improved Chemical Detection System
IDLH - Immediate Danger to Life and Health
IEG – Information Exchange Group
IL CBDWS - In-Line Chemical Biological Defense Water System
IM - intramuscular
IND - Investigational New Drug
IP – intraperitoneal
IPDS - Improved (chemical) Point Detection System
IPE - Individual Protective Equipment
IPT – Integrated Product Team
IR&D – Independent Research & Development
IR-LIDAR – Infrared Light Detection and Ranging
IS – Instrumentation System
ISD - Individual Soldier Detector
ITAP - Improved Toxicological Agent Protective Ensemble
ITS – Individual Training Standard
IVD - Individual Vapor Detector

–J–

JBPDS - Joint Biological Point Detection System
JBREWS - Joint Biological Remote Early Warning System
JBSDS – Joint Biological Standoff Detection System
JBUD - Joint Biological Universal Detector

JCAD – Joint Chemical Agent Detector
JCBAWM – Joint Chemical Biological Agent Water Monitor
JCBUD – Joint Chemical and Biological Universal Detector
JCHEMRATES - Joint Chemical Defense Equipment Consumption Rates
JCPE – Joint Collective Protection Equipment
JCS - Joint Chiefs of Staff
JFIRE - Joint CB Protective Firefighter Suit
JFOC - Joint Future Operational Capabilities
JFT – Joint Field Trail
JLAS – Joint Land, Aerospace, and Sea Simulation
JMAR – Joint Medical Asset Repository
JMNS - Joint Mission Need Statement
JMRR – Joint Monthly Readiness Review
JNBCDB - Joint NBC Defense Board
JORD - Joint Operational Requirements Document
JPACE - Joint Protective Aircrew Ensemble
JPO-BD - Joint Program Office for Biological Defense
JRTC – Joint Readiness Training Center
JSA - Joint Service Agreement
JSAM - Joint Service Aviation Mask
JSCBIS - Joint Service Chemical Biological Information System
JSGPM - Joint Service General Purpose Mask
JSIG - Joint Service Integration Group
JSIMS – Joint Simulation System
JSLIST - Joint Service Lightweight Integrated Technology (individual protection)
JSLNBCRS – Joint Service Light NBC Reconnaissance System
JSLSCAD – Joint Service Lightweight Stand-off Chemical Agent Detector
JSMG - Joint Service Materiel Group
JSNBCRS – Joint Service NBC Reconnaissance System
JSTPCBD - Joint Science and Technology Panel for Chemical/Biological Defense
JSWILD - Joint Service Warning and Identification LIDAR Detector
JTASC – Joint Training and Analysis Center
JTC - Joint Training Council
JTCG - Joint Technology Coordinating Group
JTCOPS – Joint Transportable CP System
JTF – Joint Task Force
JTPCBD – Joint Technology Panel for Chemical and Biological Defense
JVAP – Joint Vaccine Acquisition Program
JWARN - Joint Warning and Reporting Network
JWFC – Joint Warfighting Center
JWSTP – Joint Warfighting S & T Plan

–L–

L - lewisite, a vesicant agent
LAM - Louisiana Maneuvers
LCBPG - Lightweight CB Protective Garment
LD_{50} - Median Lethal Dose
LDS - Lightweight Decontamination System
LHA – general purpose amphibious assault ship
LHD – general purpose amphibious assault ship (with internal dock)
LIDAR - LIght Detection And Ranging
LLC – limited liability corporation
LMS – Lightweight Multipurpose Shelter
LNBCRS – Light NBC Reconnaissance System
LRBSDS - Long-Range Biological Stand-off Detection System
LSCAD - Lightweight Stand-off Chemical Agent Detector
LSCD - Laser Stand-off Chemical Detector
LSD – landing ship, dock
LSP - Logistics Support Plan
LWRS - Lightweight Reconnaissance System

–M–

M&S - Modeling and Simulation

M&S CA – Modeling and Simulation Commodity Area

M&S R&D – Modeling and Simulation Research and Development
MAGTF – Marine Air Ground Task Force
MAJCOM - Major Command
MANAA - Medical Aerosolized Nerve Agent Antidote
MANSCEN – Maneuver Support Center
MBDRP - Medical Biological Defense Research Program
MBPI - Michigan Biologic Products Institute
MCBAT – National Medical Chem-Bio Advisory Team
MCBC – Management of Chemical and Biological Casualties Course
MCBDRP - Medical Chemical and Biological Defense Research Program
MCDRP - Medical Chemical Defense Research Program
MCPE – Modular Collective Protection System
MCU-2A/P - a chemical protective mask
MCWP – Marine Corps Warfighting Publication
MD – methyl dichlorarsine
MDS - Modular Decontamination System
MED – Medical
MEIR – Medical Effects of Ionizing Radiation
METL - Mission Essential Task List

metL, thrA – methionine biosynthesis
MEU – Marine Expeditionary Unit
MFR - Multi-Function Radiac Set
MICAD - Multipurpose Integrated Chemical Agent Detector
MIL STD – Military Standard
MLRS – Multiple Launch Rocket System
MNDRP - Medical Nuclear Defense Research Program
MNS - Mission Needs Statement
MOP - Memorandum of Policy
MOPP - Mission Oriented Protective Posture
MOS - Military Occupational Specialist
MPH – miles per hour
MPS – Mission Performance Standard (also, Multipurpose Protective Sock)
MPSP - Medical Program Sub-Panel
MRMC – Medical Research and Materiel Command
MTW – Major Theater War
MULO - Multi-purpose Overboot
murE – murein biosynthesis

–N–

NAADS – Nerve Agent Antidote Delivery System
NAAG – NATO Army Armaments Group
NAAK – Nerve Agent Antidote Kit
NAAS - Nerve Agent Antidote System
NAPP - Nerve Agent Pyridostigmine Pretreatment
NATO - North Atlantic Treaty Organization
NBC - Nuclear, Biological, and Chemical
NBCDT – NBC Defense Training
NBC-E – nuclear, biological, and chemical-environment
NBCRS - NBC Reconnaissance System (Fox Vehicle)
NBCWP – NBC Defense Interservice Working Party
NCO - Non-Commissioned Officer
NDA - New Drug Application
NDI - Non-Developmental Item
NEPMU – Navy Environmental and Preventative Medicine Unit
NFPA – National Fire Protection Agency
NICP - National Inventory Control Points
NIEX - No-Notice Interoperability Exercise
NIH – National Institute of Health
NO – nitric oxide
NSN - National Stock Number
NTC – National Training Center

–O–

OAC – Officer Advance Course
OBC – Officer Basic Course
OG - Overgarment
O&M – Operations & Maintenance
OPCW - Organization for the Prohibition of Chemical Weapons (in The Hague)
OPR - Office of Primary Responsibility
ORD - Operational Requirements Document
OSD - Office of the Secretary of Defense

–P–

P3I - Pre-Planned Program Improvement
PACAF – Pacific Command
PACOM – Pacific Command
PAM – Preventative and Aerospace Medicine
PATS - Protective Assessment Test System
PB - President's Budget
PCPS – Portable Collective Protection System
PCR - polymerase chain reaction
PD – phenyl dichlorarsine
PDDA - Power Driven Decontamination Apparatus
PDM – Program Decision Memorandum
PDRR - Program Definition and Risk Reduction
PE – Program Element
PF - Positive Force Exercise
PfP – Partnership for Peace
PICS - Personal Ice Cooling System
PL 130-160 - Public Law 103-160, The National Defense Authorization Act of FY94
PMCD – Program Manager for Chemical Demilitarization
POL – petroleum, oil, and lubricant
POM - Program Objectives Memorandum
PQS – Personnel Qualification
PR - Positive Response Exercise
PRG – Program Review Group
PROFIS – Medical NBC Professional Filler Course
PSA – Pressure Swing Adsorption

–Q–

QDR - Quadrennial Review
QNFT – quantitative fit testing
QRR - Qualitative Research Requirements
OSM3 – oximeter instrument
QSTAG - Quadripartite Standardization Agreement
QWG – Quadripartite Working Group

–R–

RBC-AchE – red blood cell acetylcholinesterase
R&D – Research and Development
RDA - Research, Development, and Acquisition
RDTE (Also, RDT&E) - Research, Development, Test and Evaluation
RMC - Regional Medical Commands

RSCAAL - Remote Sensing Chemical Agent Alarm
RTP – Readiness Training Plan
rTSP - Reactive Topical Skin Protectant
RW – radiological/nuclear warfare

–S–

SACPS - Selected Area Collective Protection System
SAG – Study Advisory Group
SALAD - Shipboard Automatic Liquid Agent Detector
Saratoga - a CB protective overgarment
SAT – Systems Approach to Training
SAW - Surface Acoustic Wave
SBCCOM- Solider, Biological and Chemical Command (U.S. Army)
SCALP - Suit Contamination Avoidance Liquid Protection
SCAMP - Shipboard Chemical Agent Monitor Portable
SCPE – Simplified Collective Protective Equipment
SCUD – surface – to –surface missile system
SD - Stand-off Detector
SD/ASM - Stand-off Detector for Armor System Modernization
SDK – Skin Decontamination Kit
SE – staphylococcal enterotoxins
SEA - Staphylococcal Enterotoxin A
SEB - Staphylococcal Enterotoxin B
SMART-CB – Special Medical Augmentation Response Team-Chemical./Biological
SMART-PM – Special Medical Augmentation Response Team-Preventative Medicine
SNCO – Staff-Noncommissioned Officer
SOF - Special Operations Forces
SOFCAS - Special Operation Forces Chemical Agent Detector
SOI – School of Infantry
SO/LIC – Special Operations and Low Intensity Conflict
SORTS - Joint Status of Resources and Training System
SPOD – Seaport of Debarkation
SRT - Specialty Response Team
S&T – Science & Technology
STANAG – standard agreement
STB - Supertropical Bleach
STEPO - Self-Contained Toxic Environment Protective Outfit
STEPO-I - Interim Self-Contained Toxic Environment Protective Outfit
STO – Science Technology Objective
STRAC – Standards in Training Commission
STS – Specialty Training Standard

–T–

TAA – Total Army Analysis
TACWAR – Tactical Warfare
TAP – Toxicological Agent Protective boots and gloves
TAV - Total Asset Visibility
TB - Technical Bulletin
TBM – Transportation of Biomedical Materials
TDA – table of distribution and allowances
TED – Troop Equivalent Doses
TEU – Technical Escort Unit
TIM – toxic industrial material
TSG – The Surgeon General
TSP - Topical Skin Protectant

–U–

UAV – Unmanned Aerial Vehicle

UDP – Unit Deployment Program
UN – United Nations
UNSCOM – United Nations Special Commission
USA – United States Army
USACHPPM – United States Army Medical Research and Materiel Command
USACMLS – US Army Chemical School
USAF – United States Air Force
USAMEDDC&S – U.S. Army Medical Department Center and School
USAMMA – U.S. Army Medical Materiel Agency
USAMMDA – U.S. Army Medical Materiel Development Activity
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
USANCA - United States Army Nuclear and Chemical Agency
USAR – US Army Reserve
USC – United States code
USD(A&T) - Undersecretary of Defense (Acquisition and Technology)
USG – United States Government
USMC - United States Marines Corps
USN – United States Navy
USUHS - Uniformed Services University of the Health Sciences
UTC – Unit Type Code

–V–

VCA - Voice Communication Adapter
VEE - Venezuelan equine encephalomyelitis
VIC – Vector – In –Command
VLSTRACK – Vapor, Liquid, and Solid Tracking Model
VPU - Vapor Protective Undergarment
VTC – Video Teleconference
V&V – verification and validation
VVS – Vehicles, Vans and Shelters
VX - a nerve agent

–W–

WCF - Working Capital Fund
WEE - Western Equine Encephalomyelitis
WG – Working Group
WMD - weapons of mass destruction
WRAIR - Walter Reed Army Institute of Research
WRM – war reserve materiel
WRSI - War Reserves Secondary Items