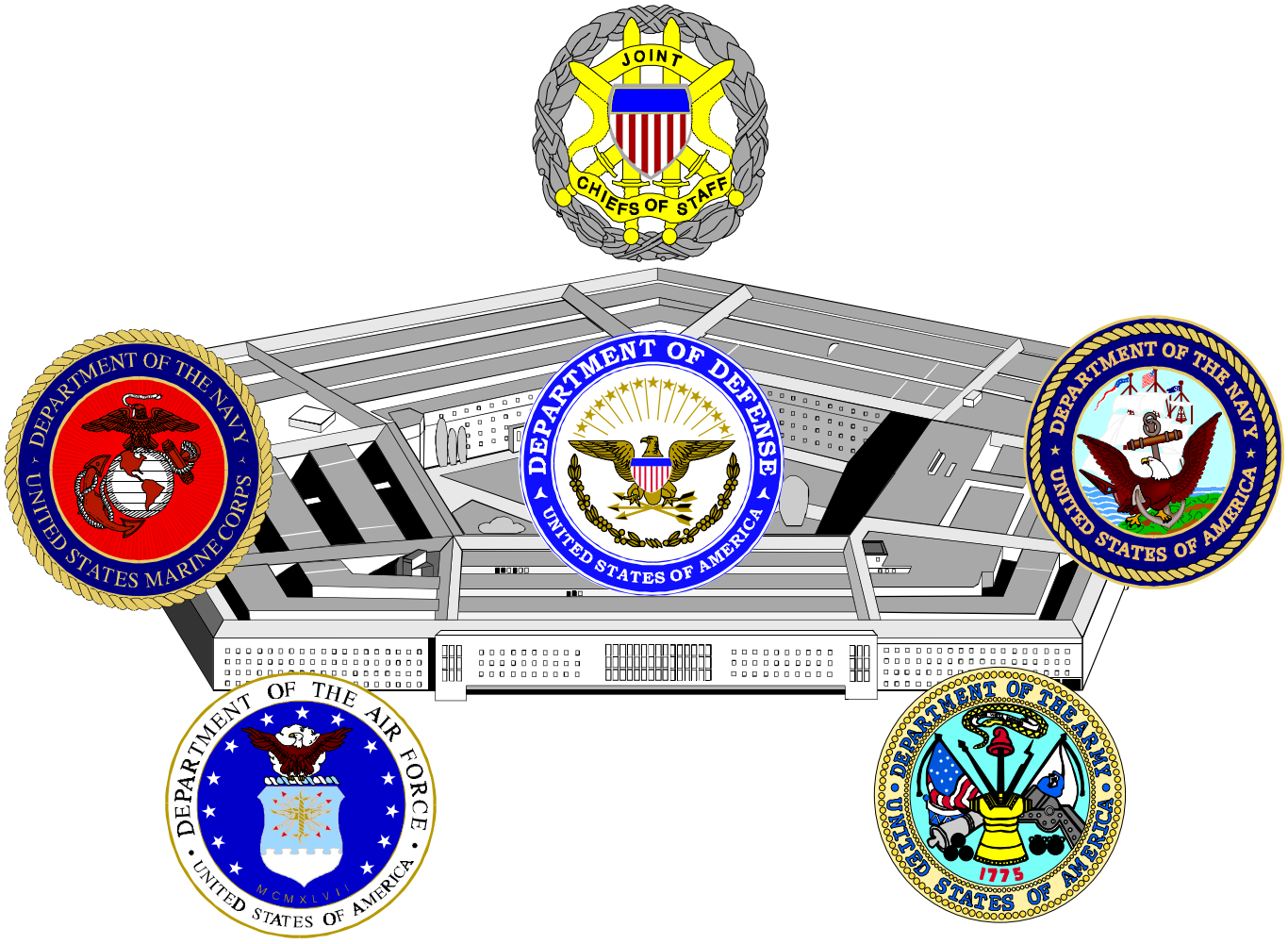
DEPARTMENT OF DEFENSE NUCLEAR/BIOLOGICAL/CHEMICAL (NBC) WARFARE DEFENSE



ANNUAL REPORT TO CONGRESS
APRIL 1995

EXECUTIVE SUMMARY

NUCLEAR, BIOLOGICAL, AND CHEMICAL DEFENSE

FY95 ANNUAL REPORT TO CONGRESS

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EXECUTIVE SUMMARY

The National Defense Authorization Act for Fiscal Year 1994, Public Law No. 103-160, section 1703, directs the Secretary of Defense to submit this assessment and a description of plans to improve readiness. The Department of Defense (DoD) Nuclear Biological and Chemical (NBC) defense program objective is to enable our forces to survive, fight, and win in NBC warfare environments. Numerous rapidly changing factors continually influence the program and its management. These factors include declining DoD resources (both monetary and force structure reductions), planning for war fighting support to numerous regional threat contingencies, the aftermath of the breakup of the Soviet Union, the signing and future ratification of the Chemical Weapons Convention (CWC), and continuing proliferation of weapons of mass destruction (WMD). To minimize the impact of use of WMD on our forces, we will need the capability not only to deter their use, but to prevent it. This will require improved WMD defensive capabilities. The DoD NBC defense program continues to work towards increasing the defensive capabilities of Joint Forces to survive and continue the mission during conflicts which involve the use of WMD.

For our forces to survive and fight under contaminated battlefield conditions, an integrated, balanced program is essential. Our forces must have aggressive, realistic training, and defensive equipment that allows them to avoid contamination, if possible, and to protect, decontaminate, and sustain operations on the non-linear battlefield. We must also have the capability to provide medical casualty management.

Programs are in place which if fully funded would adequately equip and train our forces to accomplish their missions in an NBC environment. U.S. equipment compares favorably to equipment fielded by our allies and adversaries. Modernization plan summaries contained within this report highlight the Department's approach to improve current equipment and resolve current shortcomings.

NBC WARFARE THREAT

The WMD threat has increased in potential diversity and frequency. Several Third World nations now possess the technologies and capabilities to produce and deliver a wide range of chemical and biological (CB) agents. The potential for facing NBC conditions in all regions, including those with temperature extremes, has dramatically increased. The Former Soviet Union's large chemical weapons stockpile and its biological weapons program formed the basis for US defense planning for many years. However, with recent changes within Eastern Europe, the Middle East and Southwest Asia, the number of countries that have a CB weapons capability has increased significantly and may continue to increase and pose serious threats to United States interests. In meeting this changing and evolving threat, a strong NBC defense program is an essential part of DoD strategy for counterproliferation of weapons of mass destruction.

NBC WARFARE INTELLIGENCE REQUIREMENTS

Proliferation of weapons technology, precision navigation technology, and chemical and biological technology to developing nations presents the United States with a complicated national security challenge. Intelligence efforts must emphasize collection and analysis of nations' "dual-use" chemical and biological industrial capability and developing 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.

NBC DEFENSE PROGRAM MANAGEMENT

Improved Management Structure

In response to Congressional direction, the Department of Defense has implemented an improved management structure for the DoD NBC defense program. In February 1994, the Secretary of Defense designated the Assistant to the Secretary of Defense for Atomic Energy (ATSD(AE)) as the single focal point for chemical and biological defense within the Office of the Secretary of Defense. In addition, the Secretary appointed the Army as the Executive Agent for DoD to coordinate and integrate research, development, test, evaluation, acquisition, and military construction requirements of the military departments for the CBD program.

Subsequently, the Army chaired a Joint Task Force to develop a management plan to coordinate and integrate the Services' CBD efforts. The Task Force's recommendations became the basis for the Joint Service Agreement (JSA) for Joint Nuclear, Biological and Chemical Defense Management. DoD implemented the JSA on 2 August 1994.

The Deputy Assistant to the Secretary of Defense (Atomic Energy) (Chemical/ Biological Matters), (DATSD(AE)(C/BM)) is responsible for the day-to-day coordination and integration of all CBD research, development, and acquisition (RDA) efforts. DATSD(AE) (C/BM) provides overall guidance for planning, programming, budgeting, and executing the CBD program. In the case of medical CBD research programs, ATSD(AE) provides this input by participating, as a member, in the Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee. ATSD(AE) is then responsible for ensuring coordination between the medical programs and the non-medical efforts.

The Secretary of the Army is the Executive Agent responsible for ensuring coordination, integration and administrative support for Service CBD requirements and programs. For non-medical CBD, the Secretary of the Army accomplishes this through the Joint NBC Defense Board, as defined in the JSA for Joint NBC Defense, and through the Assistant Secretary of the Army, Research, Development and Acquisition, ASA(RDA). To accomplish the required planning and programming functions, two subordinate joint groups support the Joint NBC Board. The Joint Service Integration Group (JSIG) is responsible for joint CBD requirements, priorities, training, and doctrine. The Joint Service Materiel Group (JSMG) is responsible for

coordinating and integrating all CBD research, development and acquisition efforts. These two groups perform the planning and programming functions for CBD.

For medical CBD research programs, the Secretary of the Army accomplishes this through participation in the oversight activities of the ASBREM Committee. The ASBREM Committee in concert with the ASA(RDA) is responsible for ensuring coordination and integration of Services medical CBD programs.

NBC DEFENSE PROGRAM MANAGEMENT ASSESSMENT

*** Integration and coordination of the DoD NBC defense program has improved. The department must continue to ensure that an effective program management system drives the development of joint NBC defense doctrine, training, and equipment. The Services must avoid duplication and develop NBC defense equipment that all the Services can use.**

ONGOING SOLUTIONS:

DoD continues to transition to a consolidated management approach. FY1994 accomplishments include:

- Establishment of a single office at OSD level, OATSD(AE), responsible for the overall coordination and integration of the NBC defense program. This includes the medical and non-medical aspects of the program.

- Establishment of OSD level oversight of research, development and acquisition of NBC defense equipment through the Defense Acquisition Board review process.

- Coordination, integration and development of an integrated, consolidated NBC defense Program Objective Memorandum (POM) and Budget Estimate Submission (BES). The FY96 President's Budget consolidates all chemical and biological defense RDT&E funding as a Defense program with oversight at the OSD level.

- Development of a management approach with improved emphasis on joint research, development and acquisition; training; doctrine; and logistics requirements. This management approach is defined in the Joint Service Agreement for Joint NBC Defense and described in the September 1, 1994 report to Congress on improvements in management of chemical and biological defense.

In addition, we also have a number of initiatives underway in FY95 to further improve the CB defense program. These include:

- An initiative to reduce the number of chemical detector technology programs to leverage available funds on the most promising technologies.

- Establishment of Joint Requirements Documents focusing on common needs between the Services.

- Emphasis on Joint RDT&E programs with the goal of minimizing Service-unique programs.

- Solidifying plans to revise the medical CB defense RDT&E program management structure.

- Conducting the first Defense Acquisition Board review of Chemical and Biological Defense RDT&E management.

NBC DEFENSE REQUIREMENTS

Continued proliferation of weapons of mass destruction (WMD) drives efforts to ensure that U.S. forces can fight and win in an NBC warfare environment. The three principles of NBC defense; contamination avoidance, force protection and decontamination provide the framework for formulating NBC defense requirements. When doctrinal, training, or organizational solutions (non-materiel solutions) cannot satisfy warfighting needs, we seek new equipment through the materiel acquisition cycle, leveraging new technology developments to provide the best solutions.

The key to successful implementation of RDA strategy is the concept of continuous incremental investment. Our RDA goal is to equip our forces with world class equipment in sufficient quantities, in the shortest possible time, to win decisively, quickly, and with minimum casualties. As authorized under the new Joint Service Agreement for non-medical programs and ASBREM for medical programs, the Army, as executive agent, coordinates, integrates, and reviews the DoD NBC defense program. The results of these reviews, conducted with all Services participating, are documented in the Joint Service Modernization and Joint Service RDA Plans. These documents form the basis for the consolidated NBC defense Program Objective Memorandum.

Non-Medical NBC Defense Mission Area Requirements and RDA Summary

Chapter 2 provides requirements and RDA program summaries for each of the principles of NBC defense. Contamination avoidance consists of three essential elements: reconnaissance, detection and warning. Early warning enables US forces to avoid NBC contamination. Detector development is the cornerstone for this area. The program is pursuing technological advances in remote detection, miniaturization, lower detection limits, and logistics supportability. Biological detection capability has the highest priority. When early warning is not possible or units are forced to occupy or traverse contaminated areas, protection provides survivability and continued operational capability in the NBC environment. Individual protection equipment includes protective masks and clothing. Technological advances are being pursued to produce mask

systems with fully compatible vision capabilities, ensembles for laser/ballistic protection, and reductions in logistics burden. Protective clothing under development will weigh less and impose less heat stress burden than present equipment. Collective protection equipment includes shelters for command posts, rest and relief, vehicular collective protection, and safe zones aboard ship. Technological improvements will reduce weight and size to improve deployability. Technological improvements that reduce logistic and manpower requirements; *e.g.*, filter change frequency and shelter assembly and disassembly time are also being pursued. When contamination avoidance fails, the forces must decontaminate personnel and equipment to reduce or eliminate hazards after NBC weapons employment. While effective against a wide variety of threat agents, existing systems are slow and labor intensive and pose logistical, environmental, and safety burdens. To improve capabilities in this functional area, the program places emphasis upon new decontaminating technologies which reduce existing manpower and logistics requirements.

NON-MEDICAL R&D REQUIREMENTS ASSESSMENT

*** The Services have worked closely over the past year to identify materiel solutions which have multi-service application. This integration needs to continue to receive strong emphasis. In addition, the program needs to place more emphasis on the Warfighting CINCs' requirements as input for research and development priorities.**

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

- Focusing and prioritization of chemical and biological detector programs to ensure that resources are leveraging the most promising technologies and are not diluted by excessive Service unique requirements.

- Identification of Joint and Service unique requirements for collective protection programs.

- Determining adequacy of funding for advanced decontamination systems, and review of requirements for large scale decontamination systems.

Medical NBC Defense Requirements

The medical NBC defense research programs have three broad goals:

- protect US forces war fighting capabilities during an NBC attack;
- treat casualties to prevent lethality and maximize return to duty;
- maintain state-of-the-art research and development efforts to provide timely medical countermeasures.

To meet these three goals, the Army executes three programs. The Medical Chemical Defense Research Program (MCRDP) provides new pretreatments, antidotes, and topical skin

protectants for chemical warfare agents, and develops novel therapies for chemical agent casualties. The Medical Biological Defense Research Program (MBDRP) provides medical countermeasures to deter, constrain, and defeat the use of biological threat agents, as well as advanced diagnostic defenses. Improved casualty care practices doctrine will increase the return to duty rate for troops exposed to chemical and biological agents, thus adding to force sustainment.

To effectively protect individuals against biological warfare (BW) agents, the US must immunize combat forces. Our priorities are to develop new or improved vaccines against known BW agents and increase the vaccine stockpile. Improved nerve agent antidotes and topical skin protectant increase force survivability against chemical threats. Fielding of a radiation antiemetic will allow service members to continue mission operations despite exposure to moderate levels of radiation in nuclear warfare environments.

MEDICAL R&D REQUIREMENTS ASSESSMENT

*** DoD lacks adequate vaccines to protect US military forces.**

***SOLUTION*:** Procure and stockpile sufficient stocks to inoculate US forces in accordance with recently issued DoD Directive. In FY1995, the program office will complete a review of contract approaches for acquisition of vaccines. In addition, DoD will complete an assessment of vaccine requirements critical to defining the cost of the program.

NBC LOGISTICAL READINESS

Since Operation Desert Shield/Storm, the logistical readiness of NBC defense equipment has improved. Services have increased stockage of most NBC defense equipment items especially individual protection items. However, shortfalls in the accountability and management of chemical and biological defense items continue. In addition, industrial base strategy for CB defense items remains a concern. Through joint efforts, the Services are actively pursuing solutions to these shortfalls.

NBC Defense Equipment Availability

The logistics community has recognized several shortfalls in the accountability and management of NBC defense item inventories. First, the Services continue to have very limited asset visibility of most chemical and biological items below the wholesale level. Second, Services procure NBC items through multiple separate and distinct funding authorizations. For example, the Services procure most individual protection items using Operations and Maintenance (O&M) accounts managed by the subordinate unit commander. The Army also procures individual protection items from war reserve funding authorizations to place stocks in war reserve inventories. The Services will work through the Joint NBC Defense Board to establish uniform policies and implement changes to correct these shortfalls.

Industrial Base

Since Operation DESERT SHIELD/STORM, DoD has completed four industrial base assessments. These studies confirm that the NBC industrial base sector primarily consists of small to medium size companies. These companies depend heavily on military requirements and sales for their survival. Recent changes in the NBC threat, as well as reductions in overall DoD NBC defense requirements have had a severe impact on this sector making it extremely fragile. DoD's "War Stopper" program aids in sustaining this base for some selected systems (battledress overgarment, chemical gloves, and nerve agent auto injectors). The Services must continue to integrate the vulnerability of the industrial base into acquisition/procurement decisions.

LOGISTICS SUPPORT ASSESSMENT

*** DoD lacks a joint, integrated system to maintain asset visibility of Chemical/Biological Defense Equipment (CDE) below wholesale level and also lacks a standardized war reserve program for CDE.**

***SOLUTION*:** DoD review existing systems and procedures, both for peacetime and war time reporting, and the war reserve process. Services need to address NBC defense asset visibility deficiency under the auspices of the Total Asset Visibility initiative.

During 1994, the CB defense community made some significant strides in addressing these problems. Under the leadership of the Joint Panel on Chemical and Biological (CB) Defense, a joint working group sought to consolidate CB defense databases. The joint working group agreed to reduce the number of databases to three, a reduction of fifty percent. Merging these databases should decrease redundancy and provide common information to everyone.

An assessment is underway by DoD to determine the most effective means to procure CB defense equipment after the initial procurement. This assessment will focus on how the Services have procured equipment and review the procedures for transferring program responsibility as it transitions from the Defense-wide consolidated RDT&E program to deployment and sustainment by the individual Services.

NBC DEFENSE TRAINING AND READINESS

NBC defense training and readiness continues to be a critical element of deterrence. The Services continued to improve the exercising of their NBC defense responsibilities under Title X of the FY94 Defense Authorization Act. The vision for the future is to build on the Service successes to develop a viable joint orientation to NBC defense capabilities. This capability must include joint doctrine and tactics, techniques, and procedures; joint modeling, simulation and wargaming; and joint professional training.

Within joint NBC defense doctrine, Joint Pub 3-11, *Joint Doctrine for Nuclear, Biological, and Chemical (NBC) Defense,* is the cornerstone Joint doctrinal manual. This document provides an overview of NBC defense operations at the strategic level. To fully implement this doctrine, the Services must develop solid operational joint NBC defense doctrine and tactics, techniques, and procedures that integrate Service operations in the battlespace.

Each of the Services has established adequate training standards and programs to sustain unit NBC training and readiness. They conduct NBC defense training at schools and in units. In compliance with Public Law 103-160, Section 1703, the Services co-located their NBC defense professional training at the US Army Chemical School, Ft McClellan, Alabama. Currently, Services conduct their own training with their own instructors, but all use the Chemical Defense Training Facility at the Army's Fort McClellan, Alabama, to train NBC defense experts and leaders in a lethal agent environment.

NBC DEFENSE TRAINING AND READINESS ASSESSMENT

*** DoD lacks integrated joint NBC defense doctrine.**

SOLUTION: Initiate the development of joint NBC defense doctrine beginning in FY95. The Joint Service Integration Group (JSIG) will oversee the development of this joint doctrine under the sponsorship of the Joint Staff.

*** The NBC defense program President's Budget does not reflect funding for Joint NBC defense doctrine, simulation and training development.**

***SOLUTION*:** OSD has identified funding for these initiatives in the FY96 budget. During the next DoD program/budget cycle, the CB program will establish long term support.

*** Limited WMD features in wargaming and planning models.**

***SOLUTION*:** The FY96 budget includes funding to address this shortfall. Efforts are underway in the current DoD programming cycle to establish long term support. In addition, an Army led joint Process Action Team (PAT) is assessing various methods to consolidate and improve integration of WMD features into wargames and planning models.

CHEMICAL WEAPONS CONVENTION ISSUES

DoD has set up a functional Implementation Working Group (IWG) to plan for the implementation of the Chemical Weapons Convention (CWC) and related chemical weapons agreements. Through regularly recurring meetings, representatives of the Office of the Secretary of Defense (OSD), the Joint Staff, the Military Services, and DoD agencies and activities plan

and coordinate to ensure successful implementation of the CWC and related bilateral CW agreements.

OSD, the Joint Staff, the Military Services, On-Site Inspection Agency (OSIA) and the Defense Nuclear Agency (DNA) provide technical experts to support activity at the CWC Preparatory Commission (PrepCom) in The Hague, The Netherlands on a recurring basis. The PrepCom is charged with developing procedures and establishing the international forum, the Organization for the Prohibition of Chemical Weapons (OPCW), which will oversee international compliance with the CWC. These activities focus on all requirements of the CWC, including those outlined in Article X of the CWC, "Assistance and Protection Against Chemical Weapons."

The Military Services and the OSIA have developed individual, detailed implementation plans to provide guidance for their commands and activities under the CWC and the related agreements. As outlined in their individual plans, the Services and OSIA have conducted assistance visits and formal exercises to ensure that all elements are prepared to comply with the agreements.

In accordance with the DoD Master Program Plan for Research, Development, Test and Evaluation for Arms Control, DNA directs the DoD research and development effort to ensure the arms control verification proceeds using the most effective technology available.

CONCLUSION

The DoD NBC defense program has made significant progress in improving the coordination and integration of Service CB defense research, development, and acquisition (RDA). The community is now better prepared to address shortcomings which still exist in our NBC defensive posture. The established RDA program will resolve many shortcomings by executing current procurement plans and adapting available technologies. Funding constraints will delay modernization and could effect training realism. For programs which demand state of the art solutions, the Services must demonstrate a continued commitment of time and resources. Together with coherent and improved management initiatives, proactive programs, and stable and balanced funding, U.S. capabilities will continue to improve into the future.

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TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

CHAPTERS **Page**

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

ANNEXES **Page**

LIST OF TABLES AND FIGURES

TABLES

FIGURES

INTRODUCTION

NUCLEAR, BIOLOGICAL, AND CHEMICAL DEFENSE

FY95 ANNUAL REPORT TO CONGRESS

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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. Section 1703 of the National Defense Authorization Act for Fiscal Year 1994, Chemical and Biological Weapons Defense, directs the Secretary of Defense to submit this assessment and a description of plans to improve readiness. This is the second report submitted since Section 1703 was passed.

The Department of Defense (DoD) NBC defense program objective is to enable our forces to survive, fight and win in NBC contaminated environments. Numerous rapidly changing factors are continually influencing the program and its management. These factors include a new defense strategy, an era of declining DoD resources to include force structure reductions, the aftermath of the breakup of the Soviet Union, the signing and future ratification of the Chemical Weapons Convention (CWC), and continued proliferation of weapons of mass destruction (WMD).

The President's July 1994 Report, *A National Security Strategy of Engagement and Enlargement,* outlines the "three central components" of the administration's strategic approach as "maintaining a strong defense capability and promoting cooperative security measures; our work to open foreign markets and spur global economic growth; and our promotion of democracy abroad." U.S. military capabilities are critical to the success of this strategy. United States forces must be capable of deploying rapidly and being able to respond to a variety of tasks. One of these tasks is to counter WMD—nuclear, biological and chemical weapons—along with their delivery systems, which pose a major threat to our nation's security. Thus, a key part of the Department of Defense's strategy is to seek to stem the proliferation of such weapons and to develop an effective capability to deal with these threats. To minimize the impact of use of WMD on our forces, we will need the capability not only to deter their use, but also, where necessary and feasible, to prevent it. This will require improved WMD defensive capabilities. The DoD NBC defense program continues to work towards increasing the capabilities of Joint Forces to survive and continue the mission during conflicts which involve the use of WMD.

The DoD NBC defense program continues to invest in future technology to provide improved capabilities with minimal adverse impact on our war fighting potential. Our goal is to improve our Forces' capability to detect NBC agents which facilitates the possibility to avoid them. We seek smaller, lighter protection and decontamination systems with reduced logistical burden. An integrated, balanced system of force protection and medical casualty care and management are necessary to sustain operational tempo on a nonlinear battlefield. Sound doctrine and realistic training remain fundamental to our defense against WMD.

II. THREAT ASSESSMENT

Nuclear Weapons Threat: The threat posed to the United States and its allies by the proliferation of nuclear weapons is real and growing. While there is no current, direct Inter-Continental Ballistic Missile (ICBM) threat against the United States by nations other than

Russia and China, the threat from theater ballistic missiles is of growing concern. More than two dozen countries have operational ballistic missiles, and more have programs in place to develop them. North Korea has sold Syria and Iran extended-range Scud Cs and has apparently agreed to sell missiles to Libya. Egypt, Israel, and Pakistan are developing and producing missiles, and several Persian Gulf states have purchased whole systems as well as production technology from China and North Korea. Some have equipped these missiles with WMD, and others are striving to do so.

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

Some of the causes of proliferation and some of the most dangerous proliferation threats, spelled out by then Director of Central Intelligence, R. James Woolsey, before the House Foreign Affairs Committee July 1993, hold true today:

> *"Nations continue to seek these weapons for a wide variety of reasons. Most nations perceive real benefits from the destructive power these weapons represent to their national security. Others value them for the prestige that leaders believe they convey, while some seek them to dominate their neighbors. A few countries, such as Iraq, develop these weapons not just for symbolic reasons, but to actually use -- against their enemies in war or, tragically, on their own people. Others think that the only way to offset a hostile neighbor's threatening weapons is to develop similar capabilities. We can see this particularly in South Asia, where mutual Indian and Pakistani suspicions have fueled a nuclear arms race, increased the risk of conflict, and gravely increased the cost of war if it occurs. Still others view these weapons as a way to buy security on the cheap, a shortcut to achieving a military capability that they believe will serve as a compelling psychological deterrent."*

One of the trouble spots in the world that could erupt into warfare with the actual use of nuclear weapons is the one involving India and Pakistan. Both nations have nuclear weapon development programs. Other areas such as the Mid-East and Far-East have the potential for similar action. The nuclear threat posed by North Korea is of major concern not only to South Korea and Japan but also to China. Nuclear weapons in the hands of North Koreans leaders can destabilize the entire region. However, things can change and change rapidly. As long as nations perceive nuclear weapons as enhancing their security, and others are willing to sell the technology, required production equipment, or finished weapons, the threat from nuclear proliferation will grow.

Chemical and Biological Weapons Threat: With the disintegration of the Soviet Union, and collapse of the Warsaw Pact, the chemical and biological weapons (CBW) threat from these

sources has diminished. However the capabilities which have been attributed to developing nations pose a most serious threat. The Iran-Iraq War revealed both the extent and impact chemical weapons proliferation has had on Third World regions in which the United States maintains vital interests. The FY 1991 Joint Military Net Assessment by the Joint Chiefs of Staff states:

> *"Approximately 20 countries have confirmed or suspected offensive chemical warfare programs and a slightly smaller number have confirmed or suspected offensive biological warfare programs. These numbers are expected to increase over the next decade."*

Most of the major countries in the Middle East, such as Egypt, Iraq, Iran, Libya, and Syria either have, or are suspected of having chemical and biological weapons programs. In Asia, these countries include China and North Korea. There are several reasons for this proliferation:

Third World perceptions of the political-military utility of CBW has stimulated their proliferation. For example, one of the most significant potential values of CBW is as a regional strategic deterrent. A Third World nation wishing to insure itself against coercion by a neighbor with stronger conventional forces might see considerable value in a capability to make long-range strikes with CBW against the neighbor's cities.

Other potential values of CBW for Third World nations are the ability to retaliate in kind against first use by a CBW capable neighbor or as a deterrent to invasion by superpower expeditionary forces. Considerable difficulty would be encountered in making an amphibious assault if the defending nation could strike amphibious ships with CBW or hit beachheads with such munitions. In addition, CBW agents could be employed against large troop concentrations and movements once an assault has begun. Moreover, the knowledge that a Third World country could launch a CBW attack against US coastal cities from aerial platforms or apparently benign merchant ships might deter the US from challenging the Third World country in the first place. Depending on the aggressor, such scenarios are either already possible or nearing reality, and must be factored into the calculus of dealing with Third World belligerents.

Compounding the problem is the ease with which proliferating nations can start CBW programs.

> *"...First and perhaps foremost, the technologies used in these weapons are more available and more easily absorbed by Third World countries than ever before...Second, most of these technologies are so-called dual use technologies...they have legitimate civilian applications...Chemicals used to make nerve agents are also used to make plastics and foodstuffs. Moreover, a modern pharmaceutical industry could produce biological warfare agents as easily as vaccines and antibiotics...We are closely watching the brain drain from the Soviet republics...The most worrisome problem is probably those individuals*

whose skills have no civilian counterpart, such as...engineers specializing in weaponizing CW and BW agents"

Robert Gates
Director, Central Intelligence Agency
15 January 1992 Testimony to US Senate,
Government Affairs Committee

Though the 1972 Biological and Toxin Weapons Convention banned the development of offensive capabilities, and the 1925 Geneva Protocol banned the first use of chemical weapons, there have been sufficient violations of existing treaties to justify maintaining a strong NBC defense posture. The CWC, which bans the possession, manufacture or use of chemical warfare (CW) agents and provides for control of selected precursor chemicals, has been signed by over 159 nation states. However, many Third World countries possessing CB weapons may refuse to become signatories, or may sign and cheat. Therefore, a strong training program coupled with a balanced Research, Development and Acquisition (RDA) program remains a high priority to serve both as a deterrent and to reduce the military impact should violations occur.

NBC WARFARE INTELLIGENCE REQUIREMENTS

Nations with CBW capabilities are increasing. Proliferation of weapons technology, precision navigation technology, and chemical and biological technology to developing nations presents the United States with a complicated national security challenge. Intelligence efforts must emphasize collection and analysis of nations' "dual-use" chemical and biological industrial capability and developing 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. The Intelligence Community should conduct a national review of chemical and biological warfare intelligence requirements and assess the adequacy of current assets to execute the required intelligence program.

III. OVERVIEW OF CONTENTS

- *Chapter 1* describes measures taken to improve the overall joint management and coordination of the NBC defense program.

- *Chapter 2* provides non-medical NBC defense requirements and research and development programs information. Both requirements (equipment capabilities, development and readiness) and the status of research and development assessments are described within the framework of the functional areas of NBC defense.

- *Chapter 3* provides medical NBC defense requirements and research and development information. Medical technologies preserve combat effectiveness by timely provision of medical countermeasures in response to Joint Service NBC defense requirements. Both requirements and the status of research and development are examined in detail.

- *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.

- *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.

- *Chapter 6* provides information on the planning and preparations for implementation of the CWC.

- Annexes provide detailed information on all Joint and Service unique NBC defense equipment. In addition, Annex H and I provide information on two previously Congressionally required reports for the CB defense program.

- Annex H provides the FY94 Annual Report to Congress on Research, Development, Test and Evaluation conducted by the Department of Army for the Purpose of Medical Biological Defense. This report is a Section 2370, U.S. Code 10 requirement.

- Annex I provides the Department of Defense, Annual Report to Congress on the Research, Development, Test and Evaluation of the Chemical/Biological Defense Program, 1 October 1993 through 30 September 1994. This report is a Section 1511, U.S. Code 50 requirement.

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CHAPTER 1

NBC DEFENSE MANAGEMENT

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1.1 MANAGEMENT IMPLEMENTATION EFFORTS

In February 1994, The Secretary of Defense assigned the Office of the Assistant to the Secretary of Defense (Atomic Energy), ATSD(AE), as the single office responsible for management and oversight of the Department of Defense (DoD) Chemical and Biological Defense (CBD) program. To perform these responsibilities the ATSD(AE) is tasked to:

- Ensure close and continuous coordination between the non-medical and medical chemical and biological defense programs.

- Provide an annual report to Congress on chemical and biological defense readiness, training and material.

- Direct the consolidation, coordination, and integration of the chemical and biological defense budget for the military departments.

1.1.1 Management Reviews

To exercise oversight of the program, DoD has initiated Defense Acquisition Board (DAB) reviews of CBD efforts. The DAB held its second review of the Biological Defense Program on 3 February 1994. ATSD(AE) has initiated actions to schedule the third Biological Defense Program review for April 1995 and the first Chemical/Biological Defense Program review for the summer of 1995.

ATSD(AE) will schedule DAB program reviews as required but at least annually. On the basis of these reviews, the USD(A&T) will provide direction for chemical/biological defense acquisition programs.

In addition, the ATSD(AE) will also chair an executive-level steering committee for medical and non-medical CBD matters. This committee will provide a forum for Service, Joint Staff, and Office of the Secretary of Defense (OSD) representatives to make decisions to complement the DAB process.

1.1.2 Technology Base Review

ATSD(AE), in coordination with the Director, Defense Research & Engineering (DDR&E), will provide technical oversight for all Service technology base programs and will perform reviews of these programs at least annually. The first of these reviews took place at the Edgewood Research Development and Engineering Center (ERDEC) on 9–11 August 1994.

1.1.3 Coordination and Integration of the Program

In February 1994, the Secretary of Defense designated the Army as the Executive Agent for DoD to coordinate and integrate research, development, test, evaluation, and acquisition

activities, and the military construction requirements of the military departments for the CBD program.

Subsequently, the Army chaired a Joint Task Force to develop a management plan for the coordination and integration of the Services' CBD efforts that incorporated the direction from Congress contained within PL 103-160, the FY94 National Defense Authorization Act. The Task Forces' recommendations became the basis for the Joint Service Agreement (JSA) for Joint Nuclear, Biological and Chemical Defense Management. DoD implemented the JSA on 2 August 1994.

1.2 ORGANIZATIONAL RELATIONSHIPS

Figure 1-1. DoD CB Defense Program Management Structure

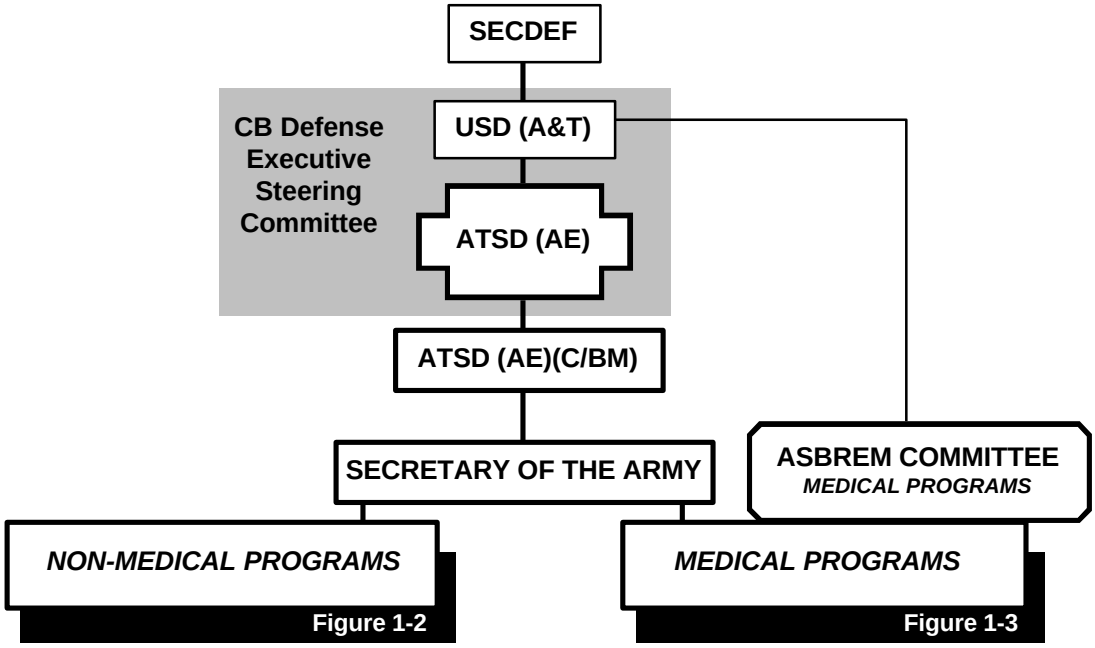


Figure 1-1 portrays the organizational relationships for the overall CBD program. The Assistant to the Secretary of Defense (Atomic Energy)(Chemical/Biological Matters), ATSD(AE)(C/BM) is the principal deputy to ATSD(AE) and is responsible for the overall coordination and integration of all CBD research, development, and acquisition (RDA) efforts. ATSD(AE)(C/BM) provides the overall guidance for planning, programming, budgeting, and executing the CBD program. He also retains approval authority for all planning, programming, and budgeting documents. In the case of medical CBD programs, ATSD(AE)(C/BM) provides this approval by representing ATSD(AE) on the Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee. He is then responsible for ensuring coordination between the medical programs and the non-medical CBD efforts. He directly approves all non-medical planning and programming documents which are provided by the Joint Nuclear Biological and Chemical (NBC) Defense Board.

The Secretary of the Army is the Executive Agent responsible for coordination, integration, execution and administrative support for Service CBD requirements and programs.

- For non-medical CBD, the Secretary of the Army accomplishes this through the Joint NBC Defense Board, as defined in the Joint Service Agreement for NBC Defense and through the Assistant Secretary of the Army, Research, Development and Acquisition, ASA(RDA).

- For medical CBD Programs, he accomplishes this through participation in the oversight activities of the ASBREM Committee. The ASBREM Committee in concert with the ASA(RDA) is responsible for ensuring coordination and integration of Services medical CBD programs. This medical oversight process is detailed in section 1.2.2 of this chapter.

The military departments' acquisition organizations will manage the individual CB defense programs according to service and DoD directives.

1.2.1 Non-Medical Programs – Management Structure

Figure 1-2. DoD Non-Medical CB Defense Management Structure

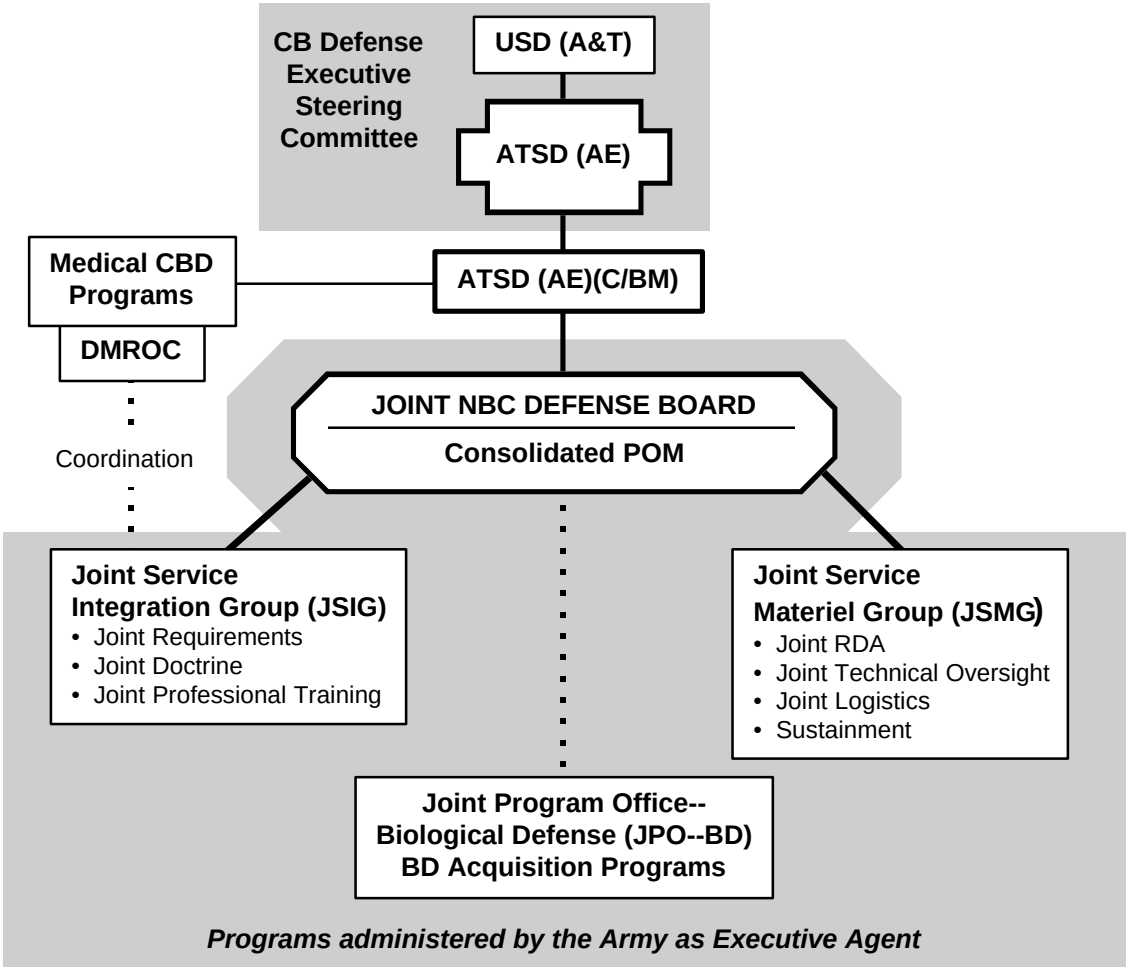


Figure 1-2 describes the organizational structures outlined in the JSA and used by the Joint NBC Defense Board to perform planning and programming functions. Two subordinate joint groups support the Joint NBC Defense Board. The Joint Service Integration Group (JSIG) is responsible for joint CBD requirements, priorities, training, and doctrine. The Joint Service Materiel Group (JSMG) is responsible for coordinating and integrating all CBD research, development, acquisition, and logistics support efforts. These two groups perform the planning and programming functions for CBD.

The JSIG plays the lead role in the planning process. During the planning process, it validates NBCD requirements and provides an integrated list of requirements. Based on those requirements, the JSIG prepares the Joint NBC Modernization Plan which describes the efforts needed to meet current and future requirements. On the basis of the requirements submitted, the JSMG prepares the Joint Research, Development, and Acquisition (RDA) Plan which describes and integrates all Service RDA efforts, from technology base efforts to procurement programs.

The group submits these plans to the Joint NBC Defense Board for final review. ATSD(AE)(C/BM) provides the final approval of all planning documents.

In concert, the JSIG and the JSMG prepare the CBD Program Objective Memorandum (POM) under the guidance of the Joint NBC Board Secretariat. The JSIG defines the requirements and sets priorities for the overall program. The JSMG coordinates the efforts of the Service acquisition organizations in determining the cost and schedule for the programs needed to meet these requirements. The Joint NBC Defense Board Secretariat prepares the POM for Board approval and forwarding to ATSD(AE)(C/BM).

During budgeting and execution processes, the Secretary of the Army is responsible for preparing the consolidated budget. Acting upon direction from the ATSD(AE)(C/BM), ASA(RDA), in coordination with the Army Comptroller will issue instructions to the Joint NBC Defense Board. The executing agencies within the Services will provide the budget documentation through their Service staffs. SARDA consolidates the budget and identifies budget issues. The Joint NBC Defense Board will attempt to resolve all inter-Service issues. Unresolved issues will be resolved at ATSD(AE) through the Executive Steering Committee.

1.2.2 Medical Programs – Management Structure

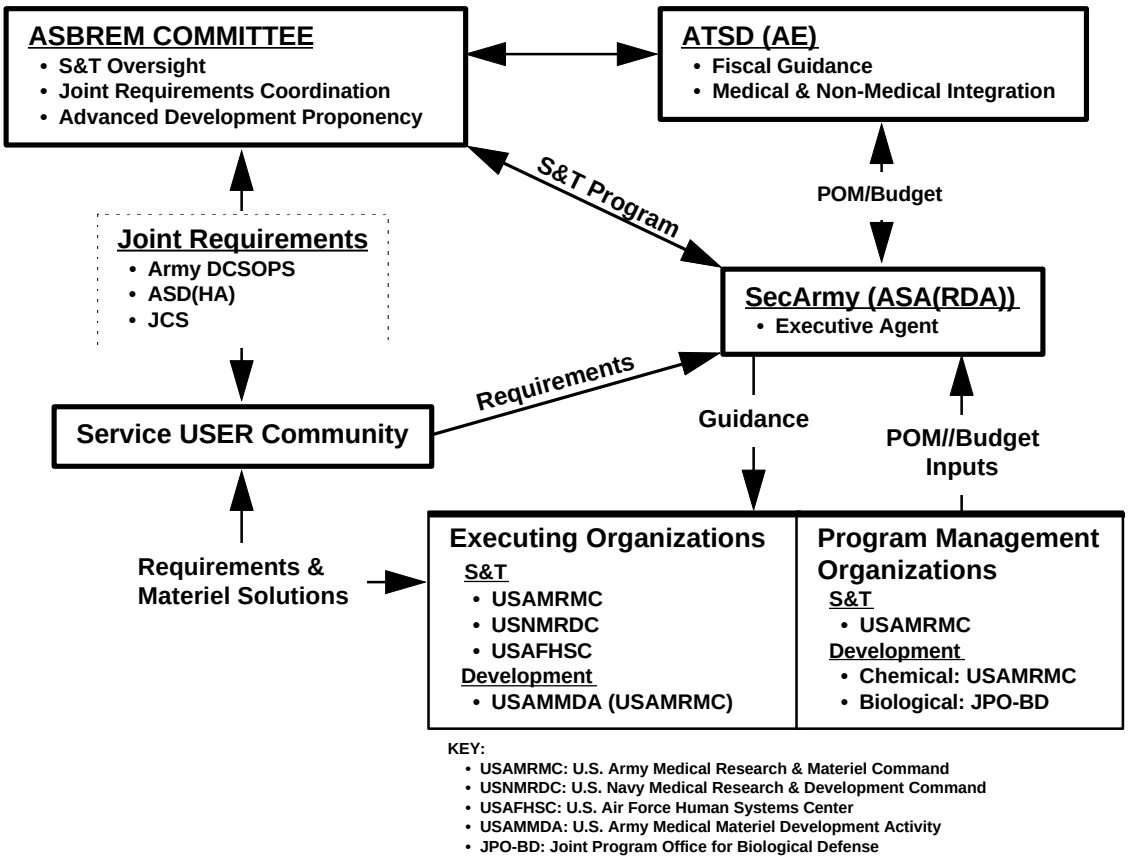
For medical NBC defense programs the Army is the executive agent. The US Army Medical Research and Materiel Command (USAMRMC) is responsible for planning, programming, and budgeting for medical research requirements for all the military departments.

The Congressionally mandated ASBREM Committee was chartered in 1981. This committee is co-chaired by the Director, Defense Research and Engineering (DDR&E) and the Assistant Secretary of Defense (Health Affairs), ASD(HA). In recognition of the continuing need to facilitate management coordination, improve information exchange, and accomplish medical research, development, testing, and evaluation activities pertinent to the missions of the Army, Navy, and Air Force, the Commanders of the USAMRMC, the Naval Medical Command for Fleet Readiness and Support, and the Air Force Human Systems Center meet periodically in joint sessions. Key objectives of this committee are to increase cost effectiveness of resource utilization, address organizational roles, conduct management studies, resolve Service organizational/functional alignment issues, ensure program relevance, avoid duplication among DoD's and other agency programs, and to define Service issues which require resolution/coordination with other Federal agencies.

Figure 1-3 portrays the organizational relationships for medical CBD program management. Currently the medical CBD RDA program is managed through the ASBREM Committee for science and technology programs, the Army's Deputy for Medical Systems (ASA(RDA)) on behalf of the Surgeon General sponsor for each Service's medical chemical defense advanced development efforts, and through the Joint Biological Defense Program Office for advanced development and procurement of biological defense capabilities. The Army serves as the Executive Agent for administration, and the U.S. Army Medical Materiel Development Activity (a subordinate element of USAMRMC) serves as the medical systems advanced

development execution organization. There is currently a DoD effort underway to consolidate medical RDT&E in a coordinated and integrated manner under the ASBREM Committee. Until this effort is complete, the planning and programming for the consolidated effort will be performed under the administration of the U.S. Army. The user communities identify and validate requirements for medical CBD capabilities. The ASBREM Committee coordinates with the JSIG to achieve requirements integration. The RDT&E execution organizations in coordination with the ASA(RDA), as the executive agent, then develop the Joint Medical RDA Plan and Medical Materiel Modernization Plan in coordination with the ASBREM Committee and the executing activities.

Figure 1-3. DoD Medical CB Defense Management Structure



ASA(RDA) will direct and coordinate POM and budget preparation activities and is responsible for ensuring appropriate coordination with the ASBREM Committee. Within the ASBREM Committee, ASD(HA) is the proponent for all medical advanced development programs and products. ATSD(AE)(C/BM) will provide fiscal guidance and introduce any issues regarding coordination between the medical and non-medical programs. ASA(RDA) will be responsible for coordination with the ASBREM. ATSD(AE)(C/BM) will receive the ASA(RDA)-approved POM for medical CBD Programs and will integrate it with the non-medical POM. Any unresolved coordination issues will be addressed by the CBD Executive

Steering Committee. ASA(RDA) will integrate the medical and non-medical budget estimate submissions and present budget issues to ATSD(AE)(C/BM).

The US Army is the DoD EA for the Medical Chemical Defense Research Program (MCDRP) and Medical Biological Defense Research Program (MBDRP) as prescribed in DoD Directive 5160.5. As such, the Army is the lead requirements coordinator. The Joint Technology Coordinating Group (JTCG) 3 (MCDRP) and JTCG 4 (MBDRP) of the ASBREM Committee are responsible for the research program's consolidation, coordination, and integration. The ASBREM Committee maximizes efficiency by coordinated planning, and minimizing unnecessary program overlaps and costly materiel retrofits. The Joint Service Research, Development, and Acquisition Plan, the Army Technology Base Master Plan and the Medical Science and Technology Master Plan are the program drivers for MCDRP and MBDRP. The science base is managed through the development and execution of Science and Technology Objectives (STO). The advanced development program (6.4 – 6.5) is directed by the US Army Medical Materiel Development Activity. Both programs are integrated between DoD in-house and contract efforts.

The Armed Forces Radiobiology Research Institute (AFRRI) is DoD's sole laboratory for conducting biomedical research to address military medical operational requirements for dealing with the prompt and delayed effects of radiation exposure. AFRRI, formerly a subordinate activity to the Defense Nuclear Agency, is currently assigned to the Uniformed Services University of the Health Sciences. An annual review of the AFRRI research program is conducted by the AFRRI Board of Governors (consisting of the Surgeons General of the Services, the Deputy Chiefs of Staff for Operations of the Services, the Under Secretary of Defense for Acquisition, the Assistant Secretary of Defense for Health Affairs, and the Assistant to the Secretary of Defense for Atomic Energy, and chaired by the Director of the Defense Nuclear Agency). Funding for AFRRI is provided through the Director, Defense Research and Engineering. Like the Biological and Chemical Defense Research Programs, the Medical Nuclear Defense Research Program is coordinated and integrated by the ASBREM.

The Medical Chemical and Biological Defense Research Programs depend upon comprehensive STOs and a mature and effective advanced development program. The maintenance of a strong technical base capability addresses current and future threats. It allows the DoD to exploit advances in the biotechnology and neuroscience field leading to novel advances in medical countermeasures. Next generation products and future systems development flow from the maintenance of a strong science and technology base. Therefore, it is imperative to adequately fund the medical chemical defense and medical biological defense science and technology base in conjunction with advanced development during the budget formulation process. Current management challenges include balancing resource allocation as DoD downsizes, coping with the loss of in-house resources and the rising costs for research, personnel and facilities. These challenges are being met by weighing the benefits of project success against the associated costs and risk, adopting realistic but aggressive schedules and milestones, applying success-failure criteria for project evaluation/continuation, and coordinating basic research, directed research, and development.

1.3 FUNDS MANAGEMENT

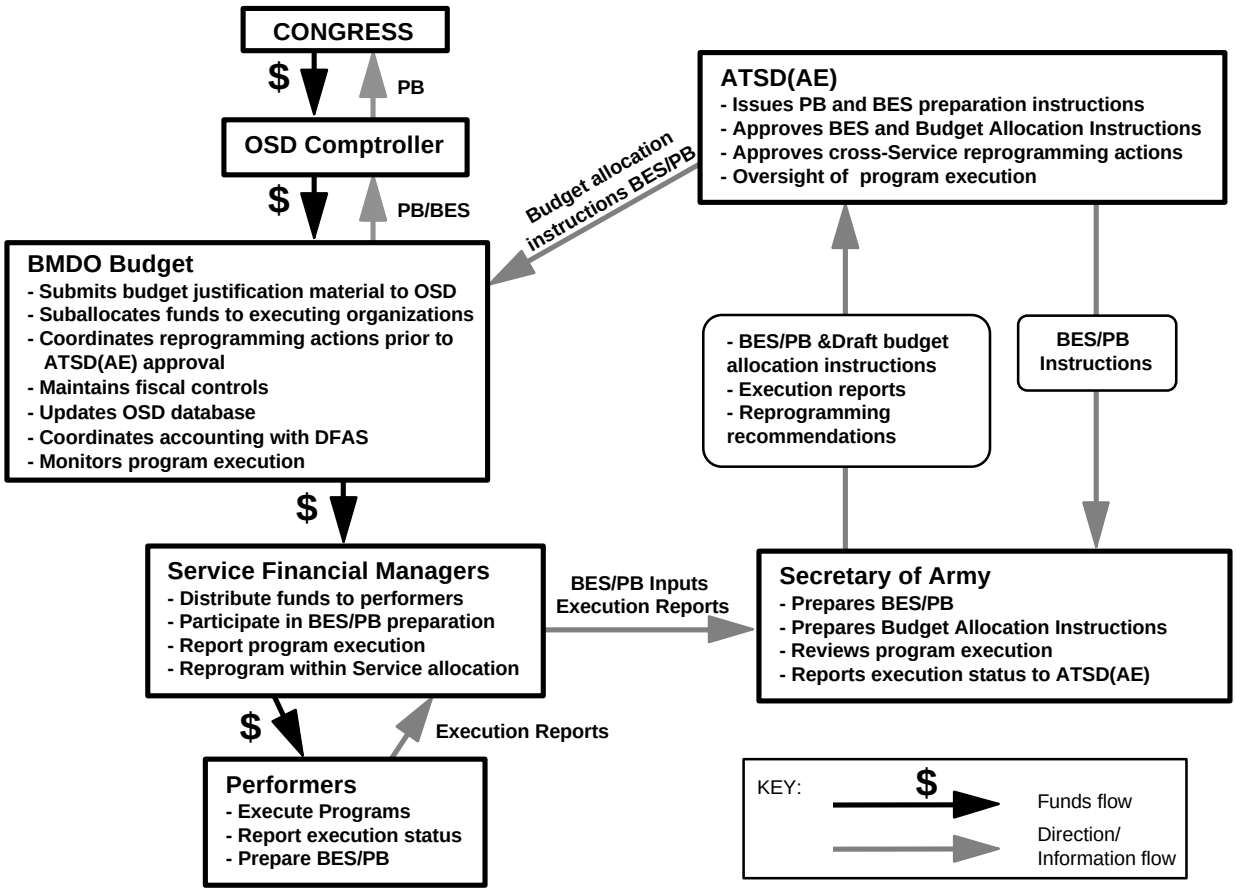
Figure 1-4 describes the funds flow for the CBD program and the coordination between funding and executing organizations. The key organizations in this process are: ATSD(AE)(C/BM) as OSD focal point, ASA(RDA) as executive agent, and the Ballistic Missile Defense Office (BMDO) as the funds manager. Participating organizations are the Service Headquarters staffs and the executing organizations. ATSD(AE)(C/BM) will issue instructions to the Army Acquisition staff as to how funds should be distributed. The ASA(RDA) will prepare funds suballocation instructions and submit them to ATSD(AE)(C/BM). ATSD(AE)(C/BM) will instruct BMDO to distribute the funds to the Services based on the approved President's Budget with appropriate revisions.

The Services' financial managers will have authority to shift funds between projects within their CBD programs but may not reprogram funds between program elements. Any reprogramming between program elements and inter-Service reprogramming must be approved by the ATSD(AE)(C/BM). The Army on behalf of ATSD(AE)(C/BM) will issue execution and program status reporting instructions. The Services' financial managers will report execution status to the Army on a regular basis. The Army will report execution status to ATSD(AE) on a periodic basis. In addition, it is the Executive Agent's responsibility to notify ATSD(AE) when programs deviate from execution plans and when programs are in danger of not meeting OSD obligation and execution goals.

During the execution year for non-medical programs, the Joint NBC Defense Board's Secretariat will staff all actions resulting from the requirement to reallocate funds between the Services. The Secretariat will establish and coordinate the specific procedures it will use prior to September 1995. During the execution year for medical programs, the Headquarters, U.S. Army Medical Research and Materiel Command (USAMRMC) will staff all actions resulting from the requirement to reallocate funds between the Services. USAMRMC will establish and coordinate the specific procedures it will use prior to September 1995.

BMDO will serve as the comptroller for the CBD program with administrative support from ASA(RDA). BMDO will update the OSD comptroller databases as necessary after the POM, BES, and President's Budget. ASA(RDA), through ATSD(AE)(C/BM), is responsible for providing BMDO the necessary data to accomplish these updates in a timely manner. BMDO will ensure that ATSD(AE)(C/BM) and ASA(RDA) are kept informed of all OSD comptroller guidance, directives, and schedules. In addition, BMDO will issue the funding documents, per ATSD(AE)(C/BM) direction and perform all required accounting functions, with the assistance of the Army staff.

Figure 1-4. Chemical and Biological Defense Funds Flow



1.4 NBC DEFENSE PROGRAM MANAGEMENT ASSESSMENT

*** Oversight and management of the DoD NBC defense program are improving. With recent Congressional direction and diminishing research, development and acquisition funding, it is imperative that an effective program management system drives the identification of joint NBC defense requirements to avoid duplication and the development of NBC defense equipment that can be used by all forces.**

ONGOING SOLUTIONS:

DoD continues to transition to a consolidated management approach as directed by Section 1702, Public Law 103-160. Initiatives already accomplished include:

- The establishment of a single office at OSD level, OATSD(AE), responsible for the overall coordination and integration of the NBC defense program. This includes the medical and non medical aspects of the program.

- Establishment of OSD level oversight of research, development and acquisition of NBC defense equipment utilizing the DAB process. Chemical and Biological DABs were held during the past year.

- Coordination and development of a consolidated NBC defense Program Objective Memorandum (POM) and Budget Estimate Submission that provide the basis for the FY96 President's Budget request to Congress, with overall funding consolidated as a Defense-wide program at the OSD level.

- Development of a management approach with improved joint emphasis on research, development and acquisition; training; doctrine; and logistics requirements. This management approach is defined in the 2 August 1994 Joint Service Agreement for Joint NBC Defense.

- Finalization of Implementation Plans for the Joint Service Integration Group and the Joint Service Material Group.

In addition, we also have a number of initiatives underway in FY95 to further improve the chemical and biological defense program. These include:

- An initiative to reduce the number of chemical detector technology programs to leverage available funds on the most promising technologies.

- Establishment of Joint Requirements Documents focusing on common needs between the Services.

- Emphasis on Joint RDT&E programs with the goal of minimizing Service-unique programs.

- Solidifying plans to revise the medical CBD RDT&E program management structure.

- Conducting the first DAB CBD review.

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CHAPTER 2

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

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2.1 INTRODUCTION

This chapter provides a consolidation of Joint and Service unique non-medical NBC defense requirements and an assessment of these programs to meet the needs of the Force. The discussion of both requirements and the status of research and development assessments are conducted within the framework of the three principles of NBC defense doctrine for the mission area, shown in Table 2-1.

Table 2-1. Principles of Chemical and Biological Defense Doctrine

- **Contamination Avoidance**
- **Force Protection**
- **Decontamination**

As defined in Joint Pub 3-11, *Joint Doctrine for Nuclear, Biological, and Chemical Defense*, contamination avoidance includes avoiding detection and bypassing contaminated areas. Passive measures include training, camouflage and concealment, hardened positions, and dispersion. Active avoidance measures include contamination detection, marking, alarms, warning, reporting, and control measures. Force protection consists of five groups of activities: hardening of positions; protecting personnel; assuming Mission Oriented Protective Posture (MOPP); using physical defense measures; and reacting to attack. Decontamination stops the erosion of combat power and reduces casualties that may result from inadvertent exposure or failure of protection.

Continued proliferation of weapons of mass destruction creates continuous need to ensure that U.S. forces can fight and win in an NBC threat environment. The ever increasing danger from these weapons also demands that we look for every opportunity to avoid technological surprise. When doctrinal, training, or organizational solutions (non-materiel solutions) cannot be found, we seek new equipment through the materiel acquisition cycle. The evolving requirements of operations demand joint forces progressively capture and leverage technological advances to provide the best NBC defense equipment for the forces. We must continue to build on the fundamentals of NBC defense doctrine.

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

Through the process of requirements identification and analyses, Services in coordination with the CINCs, decide if a materiel solution will solve the requirement. If a valid requirement exists, then our research and development modernization process will identify improved technology approaches which may provide a new system, or upgrade an existing system. Continuous modernization is the way we sustain our forces, their capabilities, and our entire acquisition system—its people, industrial base, infrastructure, and programs.

Given our national strategy of achieving and applying technological superiority, there are several underlying concepts that form the foundation of acquisition modernization. The first of these is the need for reducing cycle time in the acquisition of new systems or the integration of emerging technologies into older systems. The use of Advanced Concept Technology Demonstrations (ACTDs), open systems and architectures, and the new emphasis of commercial standards and practices should allow us to shorten the time necessary to field new equipment. Our programs must reduce the cost of ownership by the use of concepts such as design-to-cost and concurrent engineering to ensure that equipment is easy to maintain and repair even with the complexity seen in most new systems.

2.2 NBC DEFENSE MISSION AREA REQUIREMENTS AND RDA SUMMARY

The Services have been working closely over the past year to increase the jointness in ongoing programs. This report highlights those improvements and discusses cooperative efforts for further Joint development of requirements. This section is a summary of the requirements in each of the mission area tenets. Tables 2-2 through 2-10 provide a consolidation of Joint and Service unique requirements and acquisition strategies. Since the focus of this chapter is on RDT&E efforts, fielded items are not included in these tables. Descriptions of fielded equipment can be found in the annexes at the end of this report and appendix 1 of Chapter 4.

2.3 CONTAMINATION AVOIDANCE (Detection, Identification and Warning)

NBC reconnaissance, detection, and warning are the essential elements of contamination avoidance. Early warning is the key to avoiding NBC contamination. Sensors for the individual joint task force member and systems capable of detecting multiple agents and characterizing new agents are being developed. Technological advances are being pursued in remote detection, miniaturization, lower detection limits, logistics supportability and biological detection capability. The following sections detail contamination avoidance science and technology efforts, modernization strategy, and joint and service unique programs.

2.3.1 Contamination Avoidance Science and Technology Efforts

2.3.1.1 Goals and Timeframes. The goal of the detection subarea is to provide a real-time capability to detect, identify, locate, quantify, and warn against all CB warfare agent threats below threshold effects levels. See Table 2-2. Science and technology efforts currently emphasize multi-agent sensors for biological agent detection and standoff CB detection. To meet near-term needs, a number of individual sensors are being developed while detection technology matures. Far term objective technologies will allow integration of chemical and

biological point and standoff detection into a single system. The technology focus is on detection sensitivity and specificity across the evolving spectrum of CB agents; system size/weight, range, signature and false alarm rate; and integration of CB detectors into various platforms, individual clothing, and C^3I networks.

Table 2-2. Contamination Avoidance Science and Technology Strategy

By 1995	By 2000	By 2005
• Field limited NDI systems for Bio Agent point and standoff detection • Demo standoff detection from mobile platforms with range to 3 km • Aircraft interior vapor detection • Personal Chemical Monitor • Demo sensor deployment application framework tool prototype • Demo micro-EM bio-agent detector prototype • Demo miniaturized CB surveillance detector	• Demonstrate integrated point/ standoff biodetection capability (ATD) • Complete R&D of tunable, eyesafe laser for standoff detection • Demo individual Soldier Chemical Detector weighing <8 oz and measuring 2″x1″x1″ • Equipment contamination scanner, handheld • In-line water CM monitor • Biological Air Particle counter • Biological Identifier	• Demonstrate integration of chemical and biological agent detection in one system • Wide Area CB Scanner with 5–10 km hemispherical radius and agent discrimination

2.3.1.2 Potential Payoffs and Transition Opportunities. The future CB detection system will provide the capability to detect, identify, map and track all CB contamination in the 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. Small, lightweight CB detectors can be incorporated into clothing ensembles to provide an individual CB detection capability. CB detection technologies have dual use potential in monitoring air pollution, noxious fumes inside enclosed areas and municipal water supplies.

2.3.1.3 Major Technical Challenges. The major technical challenges are in the areas of biological detection and identification, including remote sensing, improved agent discrimination and quantification, sampling efficiency, interferent rejection and antibody/probe development. Size reduction of CB detectors, development of integrated biological and chemical detection systems, and the fusion of sensor data with mapping, imagery and other data for real-time display of events are also challenges. Finally, detector technologies based on olfactory-like chemical sensing and molecular approaches to optical sensors offer long term opportunities.

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 to reduce the chance of force degradation caused by contamination. These capabilities, which also encompass NBC reconnaissance, identification and reporting, have the strongest urgency for force readiness and will continue to be emphasized by the DoD community in the near and distant future. Table 2-3 shows the roadmap of DoD requirements for contamination avoidance.

Early detection and warning is key to avoiding NBC contamination. As a result, DoD is concentrating CBD RDA efforts on providing its warfighters real-time capabilities to detect, identify, locate quantify, and warn against all CB warfare threats below threshold effects levels. Current emphasis is on multi-agent sensors for biological agent detection and or stand-off detection of chemical and biological agents. To meet the needs of the next three to five years, several stand-alone detectors and sensors are being developed. As detection technology matures, development efforts will focus on system miniaturization and improved sensitivity, range, false alarm rate and signature. This focus will facilitate the integration of CB detection into personal warfighter gear and onto various air, sea, and ground platforms, and will allow for CB warnings and messages to be transmitted to commanders throughout the theater. Table 2-4 provides an overview of joint and service unique RDA efforts and service involvement.

The detection and warning program area faces numerous technical and management challenges. The major technical challenge is in the area of biological detection and identification. It encompasses the development of technologies for remote sensing, improved agent discrimination and quantification, sampling efficiency, and interferent rejection.

The management challenge involves the coordination and consolidation of dozens of detection and warning RDA efforts across the Services. In the past, the Services planned their detection and warning requirements around limited and very specific missions. This strategy resulted in the initiation of a number of RDA efforts which shared common technical goals, but were constrained to service unique requirements. However, recent management organizations and initiatives, such as the Joint Program Office for Biological Defense (JPO-BD) and the Joint Panel for Chemical and Biological Defense (JPCBD) are building Joint Service coordination across the mission area.

Over the past two years, JPO-BD has coordinated the development of two key projects—Biological Stand-off System and Biological Point Detection System—to satisfy Services' biological defense needs. The requirements for these JPO-BD managed projects were developed by a joint service working group, and responsibilities for project execution have been clearly defined by the four services to maximize their RDTE effectiveness and to avoid duplication of effort. Similarly, the JPCBD has begun to transform and consolidate approximately 30 detection and warning requirements into eight fully coordinated joint projects. Requirements, nomenclature, and program plans for six chemical projects (*i.e.*, automatic detectors; miniature monitors and detectors; water monitors and detectors; reconnaissance systems; lightweight stand-off detectors; and warning and identification LIDAR) have already been developed. Over the next year, the services will begin to develop coordinated requirements for two additional projects (*i.e.*, warning and reporting; and agent water).

2.3.3 Joint Service Contamination Avoidance Programs

Consolidation of Joint Service contamination avoidance programs has been a primary goal for the past year. Building upon the success of the Joint Bio-detection initiative of the prior year, chemical detection programs have been restructured to meet multi-service needs. Bolded

entries in Table 2-3 highlight Joint orientation of these programs. Detailed descriptions of Joint contamination avoidance programs are at Annex A.

Table 2-3. Contamination Avoidance Modernization Strategy (Joint & Service Unique)

	NEAR (FY95-98)	MID (FY 99-03)	FAR (FY 04-09)
Chemical point	**Joint -Programmable agent detection capability; surface sampling capability (CAM/ICAM)** Air Force -*Programmable automatic point detection for all agent vapors (AVAD)* Navy -*Improved automatic point detection of nerve/mustard (IPDS)* Marine Corps -*Rapid agent warning and transmission (HAZWARN)*	**Joint -Capable of automatic, digital point detection of nerve and blister agents aerosols and vapor (ACADA)** Army -*Automatically alarm transmit warnings; activate collective protection systems (MICAD)* Navy -*Automatically detect liquid agent (SALAD)*	**Joint -Improved, all-agent programmable automatic point detection; portable monitors, miniature detectors for aircraft interiors; ship holds; individual soldiers (JSCMAD)** **Joint -In-line detection of CB contamination in water supply systems (Agent Water)**
Biological point	**Joint -Capability to detect and identify biological agents; operate while ship is underway (IBAD)** Army -*Limited manual point detection of biological agents (NDI-BIDS)*	**Joint -Capable of Automatic remote, point and portable bio-detection (BADS)** **Joint - Automatically detects and identifies bio-agents; programmable, automatic point CB agent detection; personal monitoring (BIDS P^{3}I)**	**Joint -Automated detection of all known biological and chemical agents**
NBC Recon-naissance and CB Stand-off Detection	**Joint -Stationary stand-off chemical vapor detection (M21)** **Joint -Mobile automatic integration of sensors and data; 5 km stand-off on-the move; modeled CB hazards (JSNBCRS)** **Joint - CB impact model; modeled CB hazard, micro met and terrain**	**Joint -Long-ranged biological detection and identification capabilities (Bio Stand-off)** **Joint -Lightweight ground-mounted short-ranged stand-off detection for chemical agent vapors (JSLSCAD)** **Joint -Integration of biological detection and identification capabilities (JSNBCRS)** **Joint -Light reconnaissance vehicle (JSNBCRS)**	**Joint -Mobile stand-off detection, ranging, and mapping of chemical vapors and liquid (JSCWILD)** **Joint -Sensors for strategic recon; UAV mounted and long-range stand-off detection and identification of chemical liquid agents (JSLSCAD)** **Joint -Short-range (5 km) biological detection, ranging capabilities; air and ground platforms (Bio Stand-off)**
Warning	Army -*Automatic wide area transmission of events (MICAD; ANBACIS)* Marine Corps -*Chemical Hazard & warning capability (HAZWARN)*	**Joint -Integrated and automatic NBC warning and reporting**	
Radiac	**Joint -Improved multi-function digital radiacs (MFR Set)** **Joint -Portable dose-rate gamma/ beta radiation meter (AN/VDR-2)** Army -*Improved accuracy; digital radiation monitoring (AN/PDR-75; AN/PDR-77)*	Army -*Compact, digital whole body radiation measurement (AN/UDR-13)*	Army -*Stand-off radiation detection and measurement* Army -*Airborne radiation detection and measurement*

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

Table 2-4. Contamination Avoidance RDA Efforts (Joint & Service Unique)

Category	Nomenclature	Status	USA	USAF	USMC	USN
Automatic Detectors and Monitors	- M90 Automatic Vapor Agent Detector (AVAD)	Prod/Fielded		Rqmt		
	- XM22 Automatic Chem Agent Detector (ACADA)	RDTE	Rqmt	Interest	Rqmt	Interest
	- Shipboard Liquid Agent Detector (SALAD)	RDTE				Rqmt
	- Improved Point Detection System (IPDS)	RDTE				Rqmt
	- Chemical Agent Monitor(CAM)/ Improved CAM (ICAM)	Production	Rqmt	Rqmt	Rqmt	Interest
	- Agent Water:	RDTE				
	-- In-Line CB Detector (IL CBDWS)/Chemical Agent Water Monitor (CAWM)/CB Agent Water Monitor (CBAWM)	*	*Rqmt*	*Rqmt*	*Rqmt*	*Rqmt*
	- Joint Service Chemical Miniature Agent Detector (JSCMAD)	RDTE				
	-- Individual Soldier Detector (ISD)/SOF Chemical Agent Detector (SOFCAS)/Individual Vapor Detector (IVD)/ Aircraft Interior Detector (AIDET)/Shipboard Chemical Agent Monitoring Portable (SCAMP)/CW Interior Compartment System (CWICS)/Improved Chemical Detection System (ICDS)	*	*Rqmt*	*Rqmt*	*Rqmt*	*Rqmt*
	- Biological Point Detection	RDTE				
	-- Interim Biological Agent Detection System (IBADS)	*		*Rqmt*	*Rqmt*	*Rqmt*
	-- Biological Agent Detection System (BADS)					
	-- Biological Integrated Detection System (BIDS)	*	*Rqmt*			
	--- Bio-Detector (BD)/Bio-Detector and Warning (BDWS)/ CB Agent Sample Kit (CBASK)/CB Mass Spectrometer	**	*Rqmt*	*Rqmt*	*Rqmt*	*Rqmt*
Stand-off	- M21 Remote Sensing Chemical Agent Alarm (RSCAAL)	Production	Rqmt		Fielded	
	- Joint Service Lightweight Stand-off Chemical Agent Detector (JSLSCAD)	RDTE				
	-- Lightweight Stand-off Chemical Agent Detector (LSCD) /M21 Moving Background/Chemical Agent Remote Detection System (CARDS)/Stand-off Detector for Armor System Modernization (SD/ASM)	*	*Rqmt*	*Rqmt*	*Rqmt*	*Rqmt*
	- Joint Service Chemical Warning and Identification LIDAR Detector (JSCWILD)	RDTE				
	-- Laser Stand-off Chemical Detector (LSCD)/Area Detection System (ADS)/Stand-off Detector (SD)/CB Stand-off Detector (CBSD)	*	*Rqmt*	*Rqmt*		
	- Biological Stand-off	RDTE				
	-- Long-Range Bio Stand-off Detection System (LRBSDS)/ Short-Range Bio Stand-off Detection System (SRBSDS)/ Strategic Biological Detector System (SBDS)	*	*Rqmt*	*Interest*		*Rqmt*
NBC Recon	- Joint Service NBC Reconnaissance System (JSNBCRS)	RDTE				
	-- XM93E1 NBCRS/CB Mass Spectrometer (See BIDS)	*	*Rqmt*		*Rqmt*	
	-- Light NBCRS/Lightweight Recon System (LWRS)	*	*Rqmt*		*Rqmt*	
Warning	- NBC Hazardous Warning System (HAZWARN)	RDTE	Interest		Rqmt	
	- Multipurpose Integrated Chemical Agent Detector (MICAD)	RDTE	Rqmt	Interest	Interest	
	- ANBACIS	RDTE	Rqmt	Interest	Interest	Interest
Radiacs	- Multi-Function Radiac Set (MFR)	RDTE		Rqmt		
	- Point Radiation Detector System	RDTE				Rqmt
	- AN/UDR-13 Pocket Radiac	RDTE	Rqmt	Interest	Rqmt	
	- Stand-off Radiac	RDTE	Rqmt			
	- AN/VDR-2 Radiac Set	Production	Rqmt		Rqmt	
	- AN/PDR-75 Radiac Set	Production	Rqmt			

Rqmt = Service requirement
Int-NIR = Service interest, no imminent requirement
Rqmt, Interest = Sub-product requirement or interest
Project XYZ = Consolidated Joint Service project
_ = Imminent Joint Service Effort
* = Sub-product(s) of a Joint Service project

Chemical Warfare Agent Contamination Avoidance

In the near-term, the Army is developing an Automatic Chemical Agent Detector (ACADA) for *in situ* detection of low level chemical agent vapors. Because this system is relatively small and light, ACADA is suitable for many vehicle mounted and man portable applications. In the mid-term, the Army and Marine Corps have also agreed to focus upon development of a Joint Service NBC Reconnaissance System (NBCRS). The proposed system will consist of a suite of detectors required for a specific mission which could be easily integrated into the platform of choice. Currently two configurations are proposed: a light and a medium version, to fulfill either expeditionary or armored mission profiles, respectively. The FOX NBCRS would fulfill heavy requirements.

In the mid- to far-term, the Army, Navy, and Marine Corps have agreed to develop the Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD). The system will be designed for standoff, on-the-move detection (5 km) of chemical agent vapors. The "core" system will weigh approximately 13 pounds and occupies approximately 1.3 cubic feet. The system may be modified to accommodate a variety of requirements. To date, a 360° x 60° scanner was developed for Armored Systems Modernization applications (tracked and wheeled vehicles), and the system was integrated into a gimbal for Marine Corps helicopters and UAV contamination avoidance roles. This system is also being considered by the Navy for shipboard use. The Army, Navy, and Air Force have also agreed to a Joint Service Chemical Warning and Identification LIDAR Detector (JSCWILD). The JSCWILD is a laser-based standoff detection system being developed to meet the requirements for the detection of liquid surface contamination, aerosols, and vapors. Although this system is much heavier than its passive counterpart (JSLSCAD), it does provide the ability to detect chemical agents in all forms (liquids, vapors, aerosols) as well as mapping and ranging information. The Navy will be conducting a test for shipboard use. The Air Force's primary use for this system will be air base defense.

In the far-term, the four services are focusing their chemical point detection requirements on the Joint Service Chemical Miniature Agent Detector (JSCMAD). The JSCMAD will represent a family of chemical point detection systems which will eventually replace the ACADA. This system will be considerably smaller and lighter than the ACADA and be configured for a variety of applications such as individual soldier detectors, shipboard chemical agent monitoring, and aircraft interior detection. A requirement for an agent water monitor has been identified by the Army, Air Force, and Marine Corps. Joint program plans will be developed pending the completion of an Air Force study in FY95.

Biological Warfare Agent Contamination Avoidance

In the near-term, the Bio Point Detection System will be developed to meet each of the four Services' needs for a lightweight biological point detector. This system will be capable of being adapted to a variety of platforms as well as man portable. Currently, there are three efforts being conducted under the Joint Program Office for Biological Defense: (a) the Interim Biological Agent Detection System (IBADS); (b) the Biological Agent Detection System

(BADS), a follow-on program to the IBADS; and (c) the Biological Integrated Detection System (BIDS). The BADS and IBADS are a sensor suite developed for shipboard use, while the BIDS is a ground vehicle-based system.

In the mid-term, the Services are jointly developing a Biological Standoff Detection System to gain advanced warning of biological warfare attacks. Currently two system variants are being developed: a short-range and a long-range detector. The short-range system will feature a 5 km range and offer high sensitivity. The long-range system will be capable of detecting biological agents at distances of up to 100 km but will be less sensitive than the short-range system.

2.3.4 Service Unique Contamination Avoidance Programs

Various detection and warning requirements have unique mission profiles and technical specifications. While in some instances, the RDTE effort may leverage off the technical achievements of a closely related detection and warning project, the application beyond its intended mission is limited and accordingly has been designated as a service-unique effort.

Navy

In the near-term, the Navy is developing the Improved (Chemical Agent) Point Detection System (IPDS). The detection system offers continuous operation and advanced detection sensitivities which do not respond to shipboard interferents or interfere with naval electronics. The Navy is also developing the Shipboard Automatic Liquid Agent Detector (SALAD). This shipboard system will be used to detect chemical agent “rain”, a requirement unique to the shipboard environment. As with the IPDS, it will offer continuous operation, and advanced detection sensitivities which do not respond to shipboard interferents or interfere with Naval electronics.

Marine Corps

In the near term, the Marine Corps is currently developing an NBC Hazardous Warning System (HAZWARN). The HAZWARN is an interim system designed to meet an immediate need to semi-automatically compile and transmit to field units NBC warnings collected from field detectors. Similarly, the Army is developing an Automated NBC Information System (ANBACIS) to automatically format and transmit to adjacent units, NBC warnings and reports. The services are currently reviewing requirements for ANBACIS and HAZWARN, along with command and control efforts for potential joint service coordination. Tentatively, they have agreed to merge the follow-on HAZWARN effort with the ANBACIS effort for CB warning and reporting system. The program will respectively address the software and hardware aspects of CB warning and command and control. Program plans will solidify in FY95 as requirements are developed.

2.4 FORCE PROTECTION

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

- ***Individual protection*** equipment includes protective masks and protective clothing. Protective masks that improve compatibility with weapon sighting systems and reduce weight and cost are being developed. Technological advances are being pursued to produce mask systems that provide fully compatible vision capabilities, laser/ballistic protection, and further reduction in logistics burden. Protective clothing is being developed which will present less weight and heat stress burden than present equipment.

- ***Collective protection*** equipment includes shelters for command posts, rest and relief, vehicular collective protection, and safe zones aboard ship. Lightweight shelters with integrated environmental control and power generation capabilities are being developed. Technological improvements are being pursued to reduce weight and size to improve deployability. Technological improvements that reduce logistic and manpower requirements; *e.g.*, filter change frequency and shelter assembly and disassembly time are also being pursued.

The following sections detail CB protection science and technology efforts, modernization strategy, and joint and service unique programs.

2.4.1 Force Protection Science and Technology Efforts

2.4.1.1 Goals and Timeframes. The goals of the protection subarea are to maintain a high level of protection against CB warfare agents while reducing the physiological burden associated with wearing protective equipment; to integrate CB protection with protection from environmental, ballistic and other threats; and to provide a protective environment for personnel operating in aircraft, armored vehicles, ships, shelters and other large-area enclosures. See Table 2-5. To achieve these goals, physiological performance requirements key to the design and evaluation of clothing and respirators are being established. New barrier and filtration materials, and permeable fabrics to accommodate these performance requirements, are being developed and evaluated. Regenerative filtration materials and techniques that would virtually eliminate the need to replace collective filters are being explored.

Table 2-5. Force Protection Science and Technology Strategy

By 1995	By 2000	By 2005
• Demo mask with 50% reduction in breathing resistance and 50% improvement in field of vision • Demo Joint Service Battle Dress Overgarment	• Demonstrate regenerative filter prototype • New chemical protective clothing, handwear and footwear materials transition to 21 CLW • Personal air conditioner backpack weighing less than 10 pounds	• Continuous Operations filter technology • Personal Dosimeter

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

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

2.4.2 Force Protection Modernization Strategy

It is not reasonable to assume that forces can always avoid NBC hazards, therefore individual warfighters and warfighting units must be provided materiel to protect them from the effects of these lethal agents. The protection provided must be effective against all known threats and not measurably degrade the performance of people, weapons, or equipment. Total NBC protective measures, which consist of individual and collective protection, allow our forces to maintain combat superiority in a contaminated environment. A summary of protection modernization requirements is provided in Table 2-6.

The goal for the protection RDA area is to provide equipment which allows US forces to operate in a contaminated NBC environment with no or minimal degradation of the warfighters' performance. The near-, mid-, and far-term project efforts are aimed at maintaining current protection levels while reducing physiological and logistical burdens. Table 2-7 provides an overview of Joint Service and Service unique individual and collective protection RDA efforts and Service involvement.

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

Protective masks, the first line of defense against CB warfare agents, will be improved to provide greater user comfort and to reduce the breathing resistance currently encountered. Mask systems will require increased NBC survivability and compatibility with combat or personal equipment. Future respiratory systems, such as the A/P23P-14(V)N and the XM45, will require

enhanced compatibility with both life support and tactical systems on fixed and rotary wing aircraft. In the future, the focus will be on integrated respiratory protective ensembles which offer optimal compatibility with personal, tactical and crew support systems.

Table 2-6. Force Protection Modernization Strategy (Joint & Service Unique)

	NEAR (FY95-98)	MID (FY99-03)	FAR (FY04-09)
Individual Eye/ Respira-tory	**Joint -Voice amplification; laser/ballistic eye protection; improved decontam-inability, better comfort (M40A1/M42A1)** **Joint -Lightweight, expendable protection system (DERP) compatible with aircrew life support systems** Army -*Aircrew mask compatible with sighting systems and night vision goggles (M48/49)*	**Joint -Reduced physiological burden, improved comfort, enhanced optical and communications cooling** Navy -*Improved complete protection for all aircrews (A/P 23P-14(V)N)* Marine Corps -*Light forces protective mask* Army -*Improved compatibility with aviation sighting/night vision systems; protection against future threat agents (ACPM)(XM45)*	**Joint -Advanced Integrated Individual Soldier Protection System (Future Soldier System)** **Joint -Improved multiple agent protection** Army -*Integrated eye/respiratory protection with soldiers system (RESPO 21)*
Individual Clothing	**Joint -Advanced protective suit technology; lighter, improved agent/flame protection; reduced heat stress integrated with all respiratory and micro-climatic cooling systems (JSLIST)** **Joint -Improved foot protection (MULO)** **Joint -Improved hand protection (Improved CB Glove)** Army -*Improved protection with self contained breathing capability for special purposes (STEPO-I)*	**Joint -Improved protection/ less burdensome protective suits; improved foot and hand protection/less burdensome (JSLIST II)**	**Joint -Integrated multiple threat modular protection (chemical, biological, environmental, ballistic directed energy and flame)** **Joint -Improved protection/ less burdensome protective suits; improved foot and hand protection/less burdensome (JSLIST III)**
Collective Systems	**Joint -Higher entry/exit rates, airlock for litter patients (M28)** **Joint -NBC protection for supplies (NBC Covers)** **Joint -CB Protection for tactical hospitals (DEPMED)** Air Force -*CB hardening for air transportable medical hospitals (CHATH)* Navy -*Backfit ships with contamination free protected zones (SACPS)* Navy -*Improved filters to reduce maintainability & logistic burden* Marine Corps -*Protection for all combat vehicles and unit shelters*	**Joint -Regenerable protective filtration (fixed & mobile platforms); reduces logistics burden, size, weight, power needs; protects against future threat agents** Army -*Modular, reduced size, weight and power for vehicle/shelter collective protection (AICPS)* Army -*NBC protection for Integrated Command Post* Army -*NBC protection forward tactical Medical units (CBPS)*	**Joint -Advanced protective filtration systems for Low Observable vehicles; light forces** Army -*Integrated regenerable filtration for vans, vehicles and shelters*

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

Table 2-7. Force Protection RDA Efforts (Joint & Service Unique)

Category	Nomenclature	Status	USA	USAF	USMC	USN
	INDIVIDUAL PROTECTION:					
Integrated	- 21st Century Warrior Land Warrior	RDTE	Rqmt	Interest	Interest	Interest
Eye/ Respiratory	- MBU-19/P Aircrew Eye/Respiratory Protection (AERP)	Production	Interest	Fielded	Interest	Rqmt
	- Disposable Eye Respiratory Protection (DERP)	RDTE	Interest	Rqmt	Interest	Interest
	- M48/49 Aircraft Mask	RDTE	Rqmt			
	- A/P 23P-14(V)N	RDTE			Rqmt	Rqmt
	- XM45 Aircrew Protective Mask (ACPM)	RDTE	Rqmt	Interest	Interest	Interest
	- Respo 21	RDTE	Rqmt	Interest	Interest	Interest
	- M40A1/M42A1	Production	Rqmt		Rqmt	
Ancillary Equipment	- Protection Assessment Test System (PATS)	Production	Rqmt	Interest	Fielded	Interest
	- Voice Communication Adapter	Production		Rqmt	Fielded	Rqmt
Battlefield Protective Suits	- CB Protective Overgarment Saratoga	Production	Interest		Fielded	Interest
	- Chemical Protective Undergarment (CPU)	Production	Rqmt		Int-NIR	
	- Aircrew Uniform Integrated Battlefield (AUIB)	Production	Rqmt		Int-NIR	
	- Joint Service Lightweight Integrated Suit Technology (JSLIST)	RDTE				
	-- Enhanced AUIB	*	Rqmt			Interest
	-- Lightweight CB Protective Garment	*	Rqmt	Interest	Interest	Interest
	-- Vapor Protective Flame Resistant Undergarment (VPFRU)	*	Rqmt			
	-- Advanced Battledress Overgarment (ABDO)	*	Rqmt		Interest	Interest
	-- Advanced Chemical Protective Garment (ACPG)	*				Rqmt
	-- Groundcrew Ensemble (GCE)			Rqmt		
Specialty Suits	- Suit Contamination Avoidance Liquid Protection (SCALP)	Production	Rqmt		Interest	
	- Interim-Self Contained Toxic Environment Protective Outfit (STEPO -I)	Production	Rqmt			
	- Improved Toxicological Agent Protective (ITAP)	RDTE	Rqmt	Rqmt	Interest	Interest
	- CB Protective Firefighter Ensemble (FFEN)	RDTE		Rqmt		
	- Firefighter Suit-Combat (FIS-C)	RDTE	Rqmt			
Protective Accessories	- Multipurpose Overboot (MULO)	RDTE	Rqmt	Rqmt	Rqmt	Interest
	- Improved CB Protective Gloves	RDTE	Rqmt	Interest	Interest	Interest
	COLLECTIVE PROTECTION					
Collective Protection Equipment	- CB Protected Deployable Medical Systems (DEPMEDS)	Production	Rqmt	Rqmt	Interest	Int-NIR
	- Chemically Hardened Air Transportable Hospital (CHATH)	RDTE	Int-NIR	Rqmt		
	- M20A1/M28 Simplified CPE	Production	Rqmt			Int-NIR
	- Standardized Integrated Command Post System and Tent (SICPS) and SICPS P^3I	RDTE	Rqmt			
	- CB Protected Shelter (CBPS)	RDTE	Rqmt		Interest	
	- Advanced Integrated Collective Protective System (AICPS) for Vehicle, Vans, and Shelters	RDTE	Rqmt		Interest	Interest
	- Advance Deployable Collective Protection Equipment (ADCPE)	RDTE	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

Future protective clothing ensembles will be required for land, sea, air, and marine forces to achieve reductions in bulk and weight without any loss of protection or durability. To satisfy these needs, the four Services have consolidated their mission specific requirements into a first truly joint evaluation program for the next generation chemical garments—the Joint Service Lightweight Integrated Suit Technology (JSLIST) program. New accessories, such as gloves and footwear, are also required to execute missions and tasks which require greater tactility and traction. Similarly, clothing systems for firefighters and Explosive Ordnance Disposal (EOD) personnel are required to enhance existing cooling and chemical protection systems without undue physiological burdens.

Collective protection equipment (CPE) development efforts are focused on NBC protection systems at the crew, unit, ship, and aircraft level which are smaller, lighter, less costly and more easily supported logistically. New systems are required to make "clean" environments more available for critical operations (*i.e.*, where IPE otherwise places an unacceptable burden upon the service member in performing duties) and for essential rest and relief. Modernization concentrates on: (1) improved air filtration methodologies, (2) advanced technologies integrated into power and ventilation for Army systems, that offer a significant improvement in logistics, and (3) applications on essential Army vehicles, vans and shelters. Efforts are in place to support major weapons system developments such as the V-22 Osprey, the Comanche, and Armored Systems Modernization.

2.4.3 Joint Service Force Protection Programs

Joint programs are shown in Table 2-6 as bolded entries. A detailed description of Joint IPE and CPE programs is at Annex C.

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, and better compatibility with weapon sights, and a second skin which is compatible with both Service's protective ensembles. The second skin design also is being reviewed by the Navy and Air Force for potential adoption. The Army and Marines are also fielding the Protection Assessment Test System (PATS) to provide users of the M40 and M42 mask with a rapid and simple means for validating the fit and function of the mask to ensure readiness. The Air Force is conducting a limited test on PATS to determine how well it works with the MCU-2/P series mask.

The Navy, in coordination with the Marine Corps, is leading an effort to equip all forward deployed fixed and rotary wing aircrew with improved chemical, biological, and radiological (CBR) protection. The CBR ensembles will feature off-the-shelf items, such as the A/P23P-14(V)N respirator assembly. The Army, in cooperation with the Marine Corps, has just completed a product improvement program for the M40 series mask. The Air Force is introducing the Aircrew Eye-Respiratory Protection (AERP) systems to protect aircrews from

CB hazards. This system compliments the recently fielded lighter weight aircrew ensemble. Fielding of the M40 series masks for the Army and Marine Corps is currently underway.

Mid- and far-term, research is focused on improved charcoals and filtering technologies, as well as improved masks for light and special operations forces (SOF). Far-term plans include the RESPO 21, 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.

Clothing. In the area of full body protection, the JSLIST is underway to coordinate the selection of advanced technology chemical protective materials and prototype ensembles. The program originated as a US Marine Corps 6.2 and 6.3 demonstration of chemical protective materials and garment designs. In August 1992, the Service Project Managers for chemical protective clothing agreed to combine their programs, using the initial Marine Corps data base and other R&D efforts. Requirements for chemical protection, durability, heat stress reduction, launderability, concept of use and flame protection vary by Service and mission.

The clothing systems will utilize new material technologies from both domestic and foreign sources and material components used in the designs can be varied to support Service unique requirements. There will be one overgarment design, one design for a primary garment, and an undergarment design. The scheme will minimize the number of suits and maximize inter-Service compatibility.

Merging development efforts will eliminate unnecessary duplications and allow each Service to leverage those technologies which offer the best merit and performance. Materials which meet Services' requirements will be placed on a qualified materials list to encourage multi-source competition and to provide surge capability. Variations in suit design will be minimized to gain economies of scale in production and a vital industrial base.

The Army, in coordination with the other Services, is conducting a development project for a Multipurpose Overboot to replace the current black vinyl overboot with a boot that has greater durability, better traction on all surfaces and improved protection. A similar effort is underway for an Improved CB Protective Glove which will have better tactility and protection. Both project schedules are being executed in parallel with the JSLIST program.

In the mid-term, the Army, in coordination with the other three Services, is developing an Improved Toxicological Agent Protective (ITAP) ensemble for EOD and depot operations in Immediate Danger to Life and Health (IDLH) contamination concentrations. The ITAP will incorporate improvements in material and design and includes a one-hour supplied air bottle system which can be switched to a filtered air respirator when operators exit the area of high contamination. A Personal Ice Cooling System (PICS) is being developed for use with the ITAP. The ITAP and PICS will be joint Service programs. In addition, the Army is working with the Air Force on a chemical protective fire fighter's suit. Detailed system requirements and program plans are currently being coordinated among the Services.

In the far-term, efforts will focus on integrated protection for "The 21st Century Land Warrior System." This next generation technology will be directed toward integrating CB protection into a system which will also provide environmental, ballistic, directed energy and flame protection, as well as reduced physiological burden. A strong emphasis on supporting technologies must continue. Materials that detoxify a broad range of chemical and biological agents on contact, and can be incorporated into fibers, fabrics and semi-permeable membranes are being developed using biotechnology as well as the more conventional approaches.

Collective Protection

The Services are fielding the NBC Protective Shelter for Tactical Medical Unit (DEPMEDS) to significantly improve our medical readiness (Chapter 3) and developing the Chemical/Biological Protective Shelter (CBPS) to provide clean areas for selected combat and combat support personnel.

Near-term collective protection efforts, such as the Advanced Integrated Collective Protection System (AICPS) will provide protection against future CB threats and offer size, weight, and energy reductions. They will also provide transportability and maintainability enhancements and decrease system set-up times.

2.4.4 Service Unique Force Protection Programs

Service unique programs are shown in Table 2-6 as italicized entries. A detailed description of the Service Unique IPE and CPE projects is presented in Annex D.

Individual Protection—Army

Eye Respiratory. The Army is developing the M48/49 protective masks to replace the M24 aviator mask and as a product improvement to the M43 mask. 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 system. The Air Force is also developing the Disposable Eye/Respiratory Protective (DERP) Mask for short term and emergency uses.

In the mid-term, the Army will replace the M43 mask for the general aviator with the Aircrew Protective Mask, XM45. The XM45 will be lighter and less expensive than the M43 and feature CB protection without the aid of force ventilated air.

Clothing. The Aircrew Uniform Integrated Battlefield (AUIB) and the Chemical Protective Undergarment (CPU) are type classified. The AUIB is a flame resistant CB protective uniform which is lighter and less bulky than previous ensemble configurations. The CPU, which has been adopted by armor crews, is worn under the Nomex coveralls.

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

Collective Protection

The ***Air Force*** has recently introduced the Chemically Hardened Air Transportable Hospital to enhance medical readiness. The ***Army*** has introduced the M20A1/M28 Simplified CPE to provide CB protection and environmental control to existing structures. The new Simplified CPE provides liquid agent resistance and allows for expansion of the protected area.

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 Protection System (SACPS) is currently being installed on selected LHA-1 class ships. CPS utilizes special filters to remove NBC contaminants from the atmosphere. 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.

2.5 DECONTAMINATION

When contamination avoidance fails, personnel and equipment must be decontaminated to reduce or eliminate hazards after NBC weapons employment. Decontamination systems provide a force regeneration capability for units that become contaminated. Modular decontamination systems are being developed to provide decontamination units with the capability to tailor their equipment to specific missions. Technological 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 and service unique programs.

2.5.1 Decontamination Science and Technology Efforts

2.5.1.1 Goals and Timeframes. The goal of decontamination is to develop technologies that will eliminate toxic materials without performance degradation to the contaminated object and with being environmentally safe. See Table 2-8. This area includes decontamination of personnel, individual equipment, tactical combat vehicles, and military bases. The current decontamination technologies being pursued include enzymes, catalysts that improve reactivity, decontaminants that are effective in both fresh and brackish water, reactive coatings, and improved reactive sorbents. 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 1995	By 2000	By 2005
• Demo improved sorbents • Aircraft Interior Decon procedures (non-system)	• Aircraft Interior Decon system • Improved decon material to replace DS 2	• Demonstrate sensitive equipment and environment safe decon materials • Demonstrate enzymatic decon • New self-decontaminating materials

2.5.1.2 Potential Payoffs and Transition Opportunities. The payoff from enhanced decontamination materials and systems will be new non-corrosive, non-toxic, non-flammable, and environmental 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. Reactive coatings may, in the future, 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. The technical difficulties associated with this effort have been in increasing the activity of the decontaminants and developing systems that effectively clean all surfaces and materials, and are environmentally safe. Reduction of the manpower and logistics burdens of decontamination also remains a significant challenge.

2.5.2 Decontamination Modernization Strategy

Decontamination systems provide a force regeneration capability for units that become contaminated. Existing capabilities rely upon the physical application and rinse down of decontaminants on contaminated surfaces. Existing systems are effective against a wide variety of threat agent, yet are slow and labor intensive, and present logistical, environmental, and safety burdens. To improve capabilities in this functional area, the Joint Services place emphasis upon new decontaminating technologies which reduce existing manpower and logistics requirements. They are safer on the environment, the warfighter, and equipment. Table 2-9 shows the roadmap of DoD requirements for skin and equipment decontamination systems.

The goal for the NBC decontamination program area is to secure technology which removes and detoxifies contaminated materiel without inflicting injury to the combat equipment, the personnel, or the environment. Research and development of non-corrosive, all-agent multipurpose decontaminants and decontaminating systems for combat equipment, aircraft, personal gear, and skin remains a priority. Alternative technologies, such as sensitive equipment decontamination methods and large scale automated decontamination systems, and catalytic coatings and sorbents, attract strong interest across the four Services. Table 2-10 provides an overview of Joint Service and Service Unique RDA efforts and Service involvement.

Table 2-9. Decontamination Modernization Strategy (Joint & Service Unique)

	NEAR (FY95-98)	MID (FY99-03)	FAR (FY04-09)
Skin and Equipment Decontam-inants	**Joint - Less Caustic and Damaging to Equipment M291/M295)**	**Joint - Non-caustic, non corrosive decontaminate for personnel and equipment** Army - *Higher efficiency decon methods (Sorbent Decon)* Navy - *Less caustic capability*	
Bulk Decontam-inants	**Joint - Non-caustic, non corrosive easy to store multipurpose decontaminants**	**Joint - Auto-releasing coatings; reduces skin contact hazard & labor requirements** Army - *Environmentally acceptable replacement for DS-2* Navy - *Enzymes for chemical agent decontamination*	**Joint - Self-decontaminating auto releasing coatings; reduces manpower and logistic requirements, eliminates skin contact hazard** Navy - *Contamination resistant shipboard materials*
Expedient Delivery Systems		Air Force - *Self decontamination without degrading aerospace materials (Aircraft Interior Decontamination System)*	Army - *Advanced non-aqueous self strip coating to reduce water and labor requirements*
Deliberate Delivery Systems	**Joint - High pressure water wash; mechanical scrubber; improved decontaminate dispenser (increased vehicle throughput)**	**Joint - Non-aqueous capability for electronics, avionics and other sensitive equipment** Army - *High pressure hot water washing and decontaminate scrubber capability; reduced water, labor, and logistic burden (Modular Decon System)*	**Joint - Rapid large scale automated decon capability; reduced manpower and logistic burden** **Joint - Vehicle interior decon capability** Army - *Waterless decon capability for electronics and avionics*

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

Table 2-10. Decontamination RDA Efforts (Joint & Service Unique)

Category	Nomenclature	Status	USA	USAF	USMC	USN
Personnel	- M295 Individual Equipment Decontaminating Kit	Production	Fielded	Interest	Interest	Interest
Combat Equipment, Vehicles, and Aircraft	- M17A2/A3 Lightweight Decontamination System	Production	Fielded	Interest	Fielded	Interest
	- XM21/XM22 Modular Decontamination System (MDS)	RDTE	Rqmt	Int-NIR	Int-NIR	Int-NIR
	- Aircraft Interior Decontamination System (AIDECONS)	RDTE	Int-NIR	Rqmt	Int-NIR	Int-NIR
	- M17 Diesel Lightweight Decontamination System	RDTE		Int-NIR	Rqmt	Interest
	- XM19 Non-Aqueous Equipment Decontamination System (NAEDS)†	RDTE	Rqmt	Interest	Interest	
Decontaminant Solutions and Coatings	- Sorbent Decontamination System	RDTE	Rqmt	Interest	Interest	Interest
	- Decontaminating Enzymes	RDTE	Rqmt	Interest	Interest	Interest
	- Catalytic Coatings	RDTE	Rqmt	Interest	Interest	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
† = Development on hold awaiting a replacement for Freon.

2.5.3 Joint Service Decontamination Programs

The lead Service for DoD's decontamination program, the Army, developed the M291 skin decontamination kit as a replacement to the M258A1 decontamination kit for all Services,

and is currently introducing the M295 for improved personal equipment decontamination. The M295 provides the warfighter a fast and non-caustic decontaminate system for personal gear. The Army and Marine Corps will be the first Services to field the M295.

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 and enzymatic foams are being explored and may offer operational, logistics, cost, safety, and environmental advantages over current decontaminants. It should be noted that present shipboard chloride 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 self-stripping coatings which can reduce or eliminate the necessity of manual decontamination. A detailed description of the Joint Service decontamination projects is presented in Annex E.

2.5.4 Service Unique Decontamination Programs

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

In the mid-and far-term, the Air Force is working on approaches to decontaminate aircraft interiors. The system will reduce contamination on and absorbed into surfaces to a safe level and will not require additional rinse cycles after decontamination. A detailed description of the Service Unique decontamination project efforts is presented in Annex F.

2.6 NON-MEDICAL CB DEFENSE REQUIREMENTS ASSESSMENT

*** Over the past year, the Services have worked together closely to improve the Joint orientation of NBC defense requirements. The work being accomplished will positively impact 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.**

CHAPTER 3

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

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3.1 REQUIREMENTS

DoD has maintained a robust medical research and development program for NBC defense for many years. This research 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 the past two years.

Specific initiatives programmed to improve NBC medical readiness include:

- **Continued emphasis on NBC medical countermeasures research**
- **A biological defense immunization policy**
- **Medical collective protection**
- **Enhanced medical diagnosis of exposure to agents**

Chemical warfare agents include vesicants, nerve, blood and respiratory agents, while biological agents include bacteria, viruses, rickettsia, toxins, and physiologically active compounds. The nuclear threat includes the use of a single or small number of crude nuclear weapons as well as conventional explosive devices mated with intensely radioactive sources.

Technology Barriers: It is not always possible to evaluate the efficacy of countermeasures for CB agents in personnel. Future threats may involve genetically engineered biological weapons that may be easily produced, highly lethal, difficult to detect, and resistant to conventional therapies.

Challenges in the Medical NBC Warfare Defense Programs

Medical prophylaxis, pretreatment, and therapies are necessary to protect personnel from the toxic or lethal effects of NBC threat agents. DoD has fielded a number of medical countermeasures, which greatly improve individual medical protection and treatment, and diagnosis.

DoD complies with all Food, Drug and Cosmetic Act requirements. The Food and Drug Administration (FDA) has traditionally required large-scale field trials in man to demonstrate efficacy of drugs and biologicals prior to licensure. There are, however, legal and ethical constraints that preclude such efficacy studies for CW and BW countermeasures. Field studies of efficacy cannot be performed, since exposure to CBW agents does not occur naturally. The high lethality and/or toxicity of CB agents also makes it unethical to perform the controlled human efficacy studies usually required by the FDA for product licensure (*e.g.*, tests of effectiveness of the product against the threat in humans). For these reasons, many CB countermeasures are likely to remain in Investigational New Drug (IND) status. IND products must be administered under provisions of an approved protocol and with written informed consent. In contingency situations, the DoD can request a waiver from the FDA from the requirement for written informed consent. DoD continues to work with the FDA to ensure that all DoD products are safe, efficacious, and available to the soldier when needed.

The medical NBC defense research programs discussed in this section are divided into chemical, biological, and nuclear areas of research. Table 3-2, at the end of this chapter, provides a summary of the medical NBC defense programs and planned modernization program over the next fifteen years.

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 CW defense requirements. Detailed descriptions of the MCDRP are in Annex G (Section G.1).

3.2.1 Goals

- **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 prophylaxis, pretreatment, antidotes, and therapeutic countermeasures
  - Develop skin protectants and decontaminants
  - Identify factors that influence safety and efficacy properties of candidate countermeasures
  - Develop and maintain preformulation, formulation, and radiolabeling capabilities

- **Provide medical management of chemical casualties to enhance survival and expedite and maximize return to duty:**

  - Develop concepts, and recommend therapeutic regimens and procedures for the management of chemical casualties
  - Develop diagnostic and prognostic indicators for chemical casualties
  - Develop life-support equipment for definitive care

3.2.2 Objectives

The objectives of the program differ with the varying threats:

- For **vesicant agents** the objective is to develop a pathophysiological data base on vesicant chemical agents and develop a working hypothesis on how damage occurs at the cellular level. Used with associated technologies, this approach will enable the formulation of definitive pretreatment and treatment strategies, and is expected to produce a realistic concept for medical prophylaxis, immediate post exposure therapy and topical protection.

- For **nerve agents** the objective is to field a safe and effective advanced anticonvulsant nerve agent antidote, and develop and field a more effective enzyme reactivator for use with the Mark I kit.

- For **blood agents** the objective is to develop and field a safe and effective cyanide pretreatment.

- For the **respiratory agents** the objective is to develop approaches to prophylaxis and therapy by understanding pathophysiological changes after agent exposure.

3.2.3 Threats, Countermeasures, Technical Barriers, Status, and Accomplishments

The classical threat categories include: blister/vesicant agents (*e.g.*, sulfur mustard [HD] and lewisite), nerve agents (*e.g.*, soman [GD], VX), blood agents (*e.g.*, cyanide), and respiratory agents (*e.g.*, phosgene). The threats, however, are not restricted to commonly accepted classical agents. Novel agents may be developed by potential adversaries. Additionally, current threats include the possibility of the use of combinations of chemical agents with other chemical agents, biological agents or nuclear weapons. The ability to provide timely and effective medical countermeasures to new threats depends upon maintaining a high level of technological capability.

The countermeasures include pharmaceuticals, medical equipment, specialized materiel or medical procedures, and concepts for training, doctrine, and organization. Medical countermeasures are designed not only to prevent lethality, but to preserve and sustain combat effectiveness in the face of combined threats from chemical and conventional munitions on the integrated battlefield by:

- Prevention of the effects of chemical agents (*e.g.*, pretreatments, prophylaxis, topical protectants);
- Far-forward treatment upon exposure to chemical warfare threats (*e.g.* antidotes),
- Chemical casualty care (*e.g.*, diagnosis, therapy and management).

3.3 MEDICAL BIOLOGICAL DEFENSE RESEARCH PROGRAM

The mission of the Medical Biological Defense Research Program (MBDRP) is to develop medical countermeasures to deter, constrain, and defeat the use of biological agents against US Forces (DoD Directive 5160.5, May 1985). Annex G (Section G.2) and Annex H contain detailed descriptions of the MBDRP.

3.3.1 Goals

- Protecting U.S. forces' war fighting capability during a biological attack.
- Reducing vulnerability to validated and novel threats by maintaining a strong technology base. The program is directed against agents of biological origin that are validated military threats, but can adapt to newly identified threats.
- Providing medical management of biological warfare casualties.

3.3.2 Objectives

In accomplishing the goals of the MBDRP, efforts are focused on three objectives (see also Table 3-1 for descriptive summaries of medical biological defense countermeasures):

- Prevent casualties with medical countermeasures (through the use of vaccines, toxoids, drugs, and other medical treatments);
- Diagnose disease (through the use of forward deployable diagnostic kits and confirmation assays); and
- Treat casualties to prevent lethality and maximize return to duty (through the use of antitoxins drugs, and other medical treatments).

In addition to requirements derived from Army sources, the MBDRP must respond to requirements of other Services as specified in the Joint Service Agreement.

3.3.3 Threats, Countermeasures, and Technical Barriers

A biological threat agent is defined as a living micro-organism or toxin that can cause disease or death in humans and be intentionally disseminated. Principal threats include protein toxins, bacterial agents, viral agents, and neuroactive compounds. The ease and low cost of producing a biological agent; the difficulty in detecting its presence and protecting (and treating) it intended victims; and the potential to selectively target humans, animals, or plants conspire to make defense against this class of weapon particularly difficult. Biological agents can produce casualties over an area of thousands of square kilometers. Biological agents can also be used with devastating effect in combination with nuclear, chemical, or conventional weapons.

Table 3-1. Medical Biological Defense Countermeasures

VACCINES

- *Live, attenuated vaccine*. A vaccine produced by altering the genetic information controlling infectivity or replication of the threat organism. The altered organism can be safely inoculated into humans when formulated into a vaccine.
- *Vectored vaccine*. A portion of the genetic information of a biological threat agent is introduced into an organism (the vector) that does not cause disease in man. A vector organism may provide protection against both the vector and the biological threat agent.
- *Synthetic vaccine*. A bioengineered protein or naked gene from a threat organism that is not toxic nor capable of replication. The bioengineered product will provide protective immunity similar to the natural agent.
- *Microencapsulated vaccines*. Vaccines incorporated into a chemically defined matrix that allows for vaccine time release and vaccine delivery to target organs within the body.

TREATMENT

- *Human monoclonal antibodies*. Use molecular genetics to produce large quantities of human monoclonal antibodies (the body's natural defense against disease) against biological threat agents. The human monoclonal antibodies will be used to treat battlefield casualties.
- *Cytokine strategies*. Cytokines are biologically active soluble factors which modulate the behavior of other cells in the body. The ability to control the cytokine response will allow medical personnel to treat some biological threat agents.

DIAGNOSTIC TECHNOLOGIES

- *Immunological technologies*. These tests are easy to use, compact, rapid (minutes) and require no logistic support. These tests are currently used in out-patient clinics and doctor's offices.
- *Nucleic acid technologies*. Nucleic acid tests, specifically the polymerase chain reaction (PCR), are extremely sensitive and specific. Nucleic acid tests identify the disease causing organism by its genetic signature.

Critical elements of Medical Biological Defense include the ability to rapidly identify an agent and the ability to provide prophylactic and/or therapeutic protection from the agent. Often, the most effective countermeasure is pre-deployment active immunization.

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

- Characterize biochemistry, physiology and morphology of biological threat agents;
- Define the molecular biology of the threat agent;
- Investigate the pathogenesis and immunology of the disease;
- Determine the mechanism of action of the threat agent in a model system;
- Define the sites and mechanisms of action of candidate solutions;
- Establish safety and efficacy data for candidate solutions;
- Demonstrate the validity of candidate solutions.

Technical deficiencies in the private sector include the lack of highly regulated containment facilities to support biological defense research and scientific expertise in biological defense. These factors restrict the depth of expertise, facilities and support available. This has become a critical issue in light of personnel and programmatic downsizing initiatives, and the additional emphasis that is being placed on out-sourcing MBDRP work. The technological and scientific basis for biological defense can be quickly eroded.

3.4 MEDICAL NUCLEAR DEFENSE RESEARCH PROGRAM

The mission of the Medical Nuclear Defense Research Program (MNDRP) is to conduct research in the field of radiobiology and related matters essential to the support of the Department of Defense and the Military Services. The detailed descriptions of the MNDRP are at Annex G (Section G.3).

3.4.1 Goals

- Sustain combat capability, increase survival, and minimize short- and long-term health problems associated with ionizing radiation alone and in combination with other weapons of mass destruction.
- Address operational requirements that require expertise in either radiation biophysics or biology.
- Maintain core of expertise to meet current research requirements and to counter future threats.

3.4.2 Objectives

The objectives of this program are to maintain a coherent radiobiology research program that addresses every aspect of military medical operational requirements for dealing with radiation injuries. This includes programs in casualty management, prevention of radiation injury, maintenance of performance, and radiation hazards assessment.

3.4.3 Threats, Countermeasures, and Technical Barriers

The most likely nuclear scenarios are those involving the deployment of relatively low-yield nuclear devices targeted at either a military installation or a sensitive political target (*e.g.*, the seat of government or large population center). In such scenarios, personnel can be expected to be exposed to the prompt radiation of the initial event as well as to chronic exposures resulting from the residual radioactive contamination. Because the nuclear weapons inventories of our adversaries are expected to be small, it is possible that the number of nuclear weapons deployed will be small and that they will be augmented by the use of larger stockpiles of biological or chemical agents.

A fundamental limitation to an effective medical response on a nuclear battlefield has historically been the incompatibility between the requirements of sophisticated medical response strategies and the huge scale of the casualties expected in massive exchange. However, 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.

The ability to provide a credible medical response to a nuclear event depends on the availability of appropriate therapeutic strategies, trained medical personnel, and advanced treatment facilities; all of which are currently available. The ability to sustain and improve these capabilities within DoD depends on maintaining a core of scientific radiobiology talent that continues to address these issues.

The primary technical barriers are:

- extending advanced treatment strategies from blood-forming organs to the gut;
- examining dose rate effects, with an emphasis on chronic exposures associated with operations in heavily contaminated areas;
- addressing combined effects scenarios such as the toxicological and radiological effects of depleted uranium munitions wounds.

Table 3-2. Medical NBC Defense Programs and Modernization Strategy

	NEAR (FY95-98)	MID (FY99-03)	FAR (FY04-09)
Medical - Biological Defense	Polyclonal antibody therapy Genetically engineered vaccines	Mouse-Human monoclonal antibody therapy Drug therapy for toxins Proteosome delivery	Nucleic acid therapy Multi-agent vaccines
Medical - Chemical Defense	Multi-chambered Autoinjector Topical Skin Protection Establish feasibility of Catalytic Pretreatments for Nerve Agents	Advanced Anticonvulsant Nerve Agent Antidote System (NAAS; HI-6) Cyanide pretreatment	Catalytic Scavengers for Broad Range of CW Agents Reactive Topical Skin Protectant
Medical - Nuclear Defense	Identification of cytokine for platelets Improved anti-emetic strategies Pharmacological approach to synapse deficits	Combination immunomodulator therapies New generation immunomodulators for multi-organ injuries Cognitive performance enhancing pharmaceuticals	Molecular strategies to reduce radiation-induced cancer/ mutation

3.5 MEDICAL R&D REQUIREMENTS ASSESSMENT

*** DoD lacks adequate vaccines to protect US military forces.**

***SOLUTION*:** Procure and stockpile sufficient stocks to inoculate US forces in accordance with recently issued DoD Directive. In FY1995, the program office will complete a review contract approaches for acquisition of vaccines. In addition, DoD will complete an assessment of vaccine requirements critical to defining the cost of the program.

CHAPTER 4

NUCLEAR, BIOLOGICAL AND CHEMICAL WARFARE DEFENSE LOGISTICAL STATUS

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4.1 INTRODUCTION

Logistical support in the area of CB defense is of considerable importance to the Services. As a result of Desert Shield/Storm, the Joint Services Coordination Committee (JSCC) for Chemical and Biological Defense Equipment (CBDE) was formed to address CB defense logistics problems of the Services and key industrial base issues. In June 1994, the members of the JSCC were canvassed to determine whether the JSCC charter should be renewed. Based on the recommendations of the members, the Director of Logistics, Joint Staff renewed the charter of the JSCC through 2 August 1995.

As discussed in Chapter 1, to implement the procedures prescribed in Public Law 103-160, Title XVII – Chemical and Biological Weapons Defense, the Services enacted the Joint Service Agreement (JSA). The objective of this agreement is to develop and execute a fully integrated and coordinated CB defense program within the Department of Defense that meets the intent of Congress and provide the best CB defense for our service members and our nation. Of particular note, in the area of logistics, is that, under the JSA, the Services will establish a Joint Service Materiel Group (JSMG). The JSMG will have the mission to coordinate and integrate the Services' CB science and technology; CB research, development and acquisition; CB sustainment for the Services; conduct CB logistics requirements planning for all Services; and review arms control, chemical demilitarization and non-stockpile RDA and science and technology programs for possible CB defense application.

During the collection of data for this report, several problems were highlighted regarding the accountability and management of CB defense item inventories. First, the Services have very limited asset visibility of most chemical and biological items below the wholesale level. Second, Services procure CB items through multiple separate and distinct funding authorizations. For example, most individual protection items are procured by the subordinate unit commander using Operations and Maintenance (O&M) account monies. The Army also procures individual protection items from war reserve funding authorizations to place stocks in war reserve inventories. The Services are aware of these problems and are working jointly to resolve them. Third, in the Air Force and the Army, the responsibility for chemical and biological defense equipment is divided between two offices. For example, in the Air Force, requirements are a responsibility of the Office of the Civil Engineer, while inventory status is a responsibility of the Deputy Chief of Staff for Logistics. This division of responsibility hindered the collection of data for the 1994 report and has continued as a problem in the collection of data this year. However, the formation of the JSMG should alleviate this problem since both requirements and sustainment will be under the purview of this group.

4.2 NBC DEFENSE LOGISTICS MANAGEMENT

Defense Logistics Agency (DLA) and Army Materiel Command (AMC) are the inventory managers or National Inventory Control Points (NICP) for most CB defense items. They are responsible for industrial base development, acquisition and storage of wholesale peacetime and sustainment wartime stocks. They are also responsible for maintaining dedicated

Service wholesale war reserve sustainment stockpiles. Stocks in wholesale accounts would back-up unit-held Service stocks.

Service inventories of CB defense items are maintained at unit level using unit-level manual records or using a subordinate headquarters- or installation-level automated system. Stocks held at wholesale level are maintained using a separate automated system. Currently, there is little connectivity between the two systems.

For example, the Air Force uses an automated system called Standard Base Supply System (SBSS) to track and monitor supply transactions and stockage at installation level. This system does not provide for inter-installation connectivity to link logistics databases. When items are issued to gaining units at an installation, they are generally transferred from SBSS records to non-automated unit records. Additionally, accountability of only selected CB defense items (*i.e.*, protective masks) is entered and routinely tracked on SBSS. Other CB defense items, because of reduced logistics coding requirement, are maintained only on non-automated unit records. To correct this deficiency, the Air Force is establishing Mobility Automated Inventory Tracking System (MAITS) to provide a semi-automated tracking system for Chemical Defense Equipment (CDE) items. MAITS has provided for increased Air Force Staff asset visibility for installation CDE stocks; but it does not provide information flow directly into the wholesale data bases. This system will, however, provide an interim Air Force CDE logistics tracking net until current Air Force automated databases are linked under the DoD Total Asset Visibility (TAV) program. While other Services sub-automated databases have different names, their problems are similar. As a result, there is limited Service-level asset visibility for CB defense items. However, the Services are addressing this deficiency under the auspices of TAV, a long-term initiative, which will link existing DoD logistics automated systems.

Three DoD studies conducted during the last three years confirm that the CB industrial base sector is composed of primarily small to medium size companies. These companies are heavily dependent on military requirements and sales for their survival. Recent changes in the CB threat as well as reductions in overall DoD CBD requirements have had a severe impact on this sector. Hence, this sector is extremely fragile. One measure the DoD is using to sustain this base is the “War Stopper” program. Selected CBD items have been included in the “War Stopper” program for which Congress provides specialized funding to sustain designated industrial base capabilities. Currently, the three CBD items in the “War Stopper” program are assessed in this report. DoD is reviewing its industrial base strategy for all items in this sector.

4.3 QUANTITIES, CHARACTERISTICS, AND CAPABILITIES

The results of the data collection efforts are compiled at the end of this chapter in Table 4-1, Logistic Readiness NBC Report Data. The items listed under *Nomenclature* are the currently fielded NBC defense items in one or more of the Services. The characteristics and capabilities of these items are detailed in appendix 1 at the end of this chapter. There are different versions of some similar items listed in Table 4-1.

Under the provisions of Title X of the FY94 Defense Authorization Act, Service Secretaries are responsible for, and have the authority to conduct, all affairs of their respective Departments. Some of the Service Secretaries' functions are supplying, equipping (including research and development), training, and maintaining. Hence, the Services develop quantitative and qualitative requirements for CB defense items independently.

The *Wartime Requirement* quantities reflected in Table 4-1 are those computed by the Services based on DoD's strategy for responding to two nearly simultaneous major regional conflicts. The *Wartime On-hand* quantities are wartime stocks being held by the Services. Table 4-2 presents the quantities of stocks held by AMC and DLA at the wholesale level for peacetime and wartime use. Quantities *On Contract* are those quantities for which a Service or agency has submitted a requisition or purchase order but has not received the requisitioned items. Finally, the quantities depicted as *Estimated Procurements* are quantities the Services have forecasted for procurement, if sufficient funds are available. These procurements at first appear to exceed the requirements. In fact, the quantities represent estimated requirements needed to replace wartime *and* peacetime consumptions of CB assets, to include training use and shelf-life expiration. It must be emphasized that these are based on major command estimates of requirements. Actual procurements will be based on funding available during the appropriate time frame.

4.4 LOGISTICS STATUS

During data collection for the 1994 report, the inventory status was compiled for over one hundred items of fielded CB defense equipment. From this data, 67 items of CB defense equipment were reviewed. CB items such as batteries, mask hoods and filters, were considered as a subset of the primary item for risk assessments. The quantity required for wartime needs was then compared to the quantity currently on-hand. The wartime requirement was based on the strategy for responding to two nearly simultaneous major regional conflicts.

During data collection for the 1995 report, information on the inventory status of the same list of fielded CB defense equipment was compiled. Similarly, from this data, 78 items this year were reviewed. The following items have been added to the 1995 review:

- Mask, M43, Apache
- Mask, MCU-2/AP
- Hood, MCU-2/AP
- M256A1 Trainer
- Tube Phosgene
- Battery, BA 3517/U
- Power Supply, M10
- Power Supply, M10A1
- Maintenance Kit, M273
- M58A1 Trainer
- Sodium Hypochlorite
- A/E 32U-8 Decontamination System

Only one item—Gloves, 7 mil—was included in the 1994 assessment but is not included in 1995. The omission is due to a change in Service requirements.

The items included in the 1995 review are assessed as low, moderate, or high risk based on Service data as of September 15, 1994. Table 4-3 contains exhibits which provide the

complete results of the assessment. “Risk” is defined as the probability that a 15% shortage or more in the wartime requirement would exist which would severely impact a Service's capability to respond to a contingency.

Low risk is assessed if less than a 15% shortage existed or at least 85% of the wartime requirement was currently on-hand in service inventories. Moderate risk is assessed if a 15–30% shortage in the wartime requirement existed or the percentage of the wartime requirement is between 70–84%. An item is assessed as high risk if the quantity on-hand is less than 70% of the wartime requirement.

In comparison to 1994 data, the percentage of the original 67 items in the low risk category decreased from 70% to 60%. The percentage of items in moderate risk increased from 6% to 9%, while the percentage of items in the high risk category increased from 24% to 30%. One item (1%) assessed in 1994 was not assessed in 1995.

In assessing the additional twelve items for which information was compiled this year, eleven of the items are in the low risk category and one is in the high risk category. However, due to changes in requirements or inventory, some of the original sixty-seven changed risk category in this year’s assessment. Including the additional items and omitting the one item not assessed, there were seventy-eight items in the 1995 assessment. Fifty-one items (65%) are in the low risk category; six items (8%) are in the moderate risk category; and twenty-one items (27%) are in the high risk category. A comparison is shown in Figure 4-1.

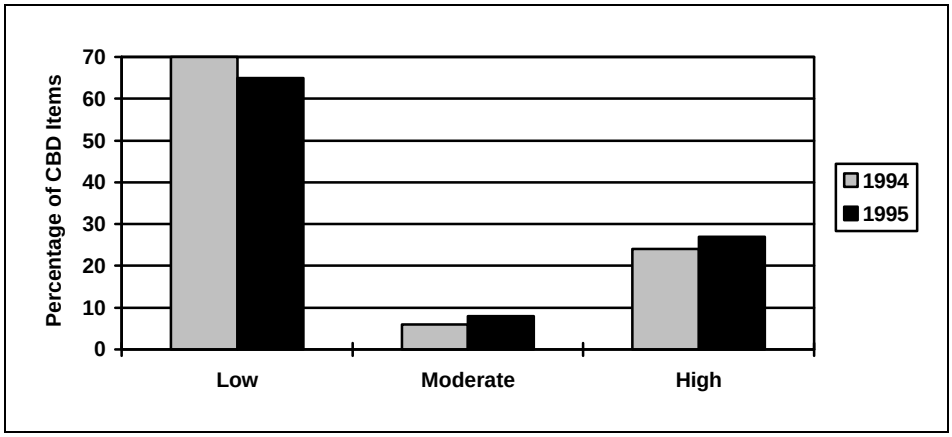

Figure 4-1 Fielded Chemical and Biological Defense Items Data Assessment

CB 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 four functional areas.

- Contamination Avoidance
- Protection (Individual and Collective)
- Decontamination
- Medical

4.4.1 Contamination Avoidance

Table 4-3, at the end of this chapter, is the compilation of assessments of items used in contamination avoidance. The M256A1 Detection Kit, Chemical Warfare Directional Detector, and the Chemical Agent Protective Detection System continue to be assessed as low risk.

The M8A1 Chemical Agent Alarm and the Individual Chemical Agent Detector remain in the moderate risk category. The Chemical Agent Monitor, NBC Reconnaissance System (FOX), M274 NBC Marking Kit, M272 Water Test Kit, and XM21 RSCAAL continue to be assess in the high risk category. With the exception of the CAM and XM21 RSCAAL, there was minimal change in either requirements or on-hand inventory. For the CAM and the XM21 RSCAAL, the high risk category assessment resulted from a significant increase in Service wartime requirements. Of the six new items assessed under contamination avoidance, five were assessed as low risk; one was assessed as high risk.

The Marine Corps and Army are exploring the development of a new Light Nuclear, Biological, and Chemical Reconnaissance System (LNBCRS). The LNBCRS will allow the commander to maneuver his forces and avoid contaminated areas. The LNBCRS will be used to provide units with accurate and rapid NBC combat hazard information. LNBCRS will locate, mark, and verify the existence of radiological, biological, and chemical hazards in support of land operations. There are two separate vehicle platforms that will be required; Light Armored Vehicle and High Mobility Multipurpose Wheeled Vehicle. Each platform is composed of two sub-systems; the Base Vehicle and the Equipment Suite.

4.4.2 Protection

Individual Protection

Currently fielded CBD equipment items were primarily designed for use in the European environment against a Soviet threat. Equipment in this functional area provides protection against all known CB threat agents. Service unique requirements have led to Service-specific procurements and duplication in capability in this functional area. As a consequence, this has resulted in procurements of six different chemical protective suits and six different masks. Table 4-2 compiles the items used in the individual protection of U.S. forces.

There are 33 items included in the individual protection assessment area. All of the overgarments, with the exception of the Saratoga suit, continue to be assessed as low risk. Although the Saratoga continues to be assessed as high risk, there was an increase in Service on-hand inventory.

The Services are 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.*, aircrew, tank crew, *etc.*). Newer versions of masks are being procured to replace the existing masks. For example, the M40 and M42 masks are replacing the M17 and M25 masks. The newer M40, M42 and MCU-2/P masks provide increased protection

and improved fit and comfort. The M40 and M42 masks provide compatibility with most Army and Marine Corps weapons systems' optics and sights. The MCU-2/P is designed to meet the needs of the Air Force ground crews and Navy shipboard and shore-based support missions. The M40 and M42 masks are assessed as high risk, but will improve to low risk upon receipt of quantities on contract.

The 1995 assessment of all masks included in the 1994 assessment, except the MCU-2/P Mask, remains unchanged. The MCU-2/P Mask changed from low to high risk because of an increase in requirements and decrease in inventory. The M40 and M42 Masks continue to be assessed as high risk, but the Service inventories of both improved. The black/green vinyl overboot assessment changed from low risk to high risk due to increase in Service wartime requirements and decrease in on-hand inventories. The M7 Hood assessment improved from moderate to low risk because on-hand inventory substantially increased. As mentioned previously, the Gloves, 7 mil, were not assessed in this report.

The Universal Second Skin is a Joint program. The basic protective mask (M40/M42) was developed to fulfill a Joint service operational requirement. The mask was designed to provide protection against field concentrations of all chemical and biological agents in vapor and aerosol form and against radioactive fallout particles. The second skin is one of the components of a pre-planned product improvement. The Universal Second Skin program, a Joint US Army/US Marine Corps, was initiated to identify a second skin which would meet both the Marine Corps and Army requirements for use with the M40/M42 series masks. Both developed prototype designs and, after field user and human engineer testing, the Marine Corps design was selected as the best design.

The Services have joined efforts to develop, test and field the next generation of chemical suits. The JSLIST program is described in Chapter 2.

Collective Protection

The primary collective protection item is the M51 shelter, which is assessed as high risk (see Table 4-3). Although the quantities of M51 shelters on-hand would normally result in a low risk assessment, the maintenance posture of the M51 renders this as a high risk item. Very few (only 40) are mission capable because most are too old and, therefore, cannot be used for chemical collective protection. The M51 is being replaced by the new chemical and biological protective shelter (CBPS). However, the M20A1 shelter will be used as an interim replacement item until the new protective shelter is fielded. The M20 shelter is also assessed as high risk, but this is a new system that is being procured from production. Collective protection equipment is also being introduced to provide CB protection through the use of filtered air under positive pressure to a variety of vans, vehicles, shelters, and ships.

The 1995 assessment of the M51 shelter and M20 shelter continue to be high risk; the portable collective protective system and the Survivable Collective Protective System-2 continue to be low risk. In 1995 the M51 assessment is based on maintenance posture as well as a decrease in the on-hand inventory.

4.4.3 Decontamination

Current decontaminants used with our decontamination systems are highly effective in decontaminating all CB agents (Table 4-3), but most present environmental hazards. The Services are attempting to find environmentally safe decontaminants.

The primary item used in personnel decontamination is the M258A1 Personal Decontamination Kit. The M291 is a new item which is being introduced to replace the M258A1. Both are effective against nerve and blister agents. Although the M291 is assessed as high risk because it is a new item, the M258A1 is assessed as low risk.

Chemical decontamination personnel use the Power-Driven Decontamination Apparatus (PDDA), M12A1 to mix and apply various decontamination solutions. The M12A1 is assessed as moderate risk. Although the M12A1 on-hand stocks would result in an assessment as low risk, the maintenance requirements due to the age of this item limit full utilization as a decontamination device. The Services are planning to replace this item with the Modular Decontamination System, XM21/XM22. The Lightweight Decontamination System (LDS), M17A2 is used to provide operational equipment decontamination. The M17A2 is assessed as moderate risk. Basic soldier skills for decontamination of vehicle and crew-served weapons are accomplished using the Portable Decontamination Apparatus, M11 and Decontamination Apparatus, Portable, M13. The M11 and M13 are assessed as low risk.

The 1995 assessment of the M258A1 and M291 Decontamination Kits, M13 Decontamination Apparatus, M17 Lightweight Decontamination System, and the Power-Driven Decontamination Apparatus remain unchanged. Again in 1995, as in 1994, the Power-Driven Decontamination Apparatus is assessed as moderate risk based on the maintenance posture of this item. The assessment of M11 Decontamination Apparatus changed from low to moderate risk due to an increase in Service wartime requirements.

4.4.4 Medical

Medical items are used to counteract the effects of exposure to a chemical or biological agent. The medical items listed in Table 4-3, remain at low risk, except for the 2-PAM Chloride, Autoinjector which changes from low risk to high risk. The increased risk for the Autoinjector results from an increase in requirements and a decrease in on-hand inventory. Medical research continues to develop medical countermeasures to deter, constrain, and defeat the use of biological agents against US Forces. The medical biological research program is directed against agents of biological origin that are validated medical threats.

4.5 PEACETIME REQUIREMENT

In peacetime, CB defense equipment is necessary to conduct training so that personnel are familiar with the use of the equipment and are confident that it will provide the necessary protection when used correctly.

As mentioned previously, individual protection items are maintained at the unit level. For the most part, items are used in peacetime for training and are drawn from contingency stocks. This requires many units to maintain both training and contingency stocks. For selected items such as chemical clothing, contingency utility is lost when the item is used for training. Because peacetime training requirements are met in this manner, major commands do not track training equipment separately from wartime stocks. The Services, however, have indicated that adequate CB defense equipment is on-hand to conduct training.

4.6 FUNDING

In accordance with the CB Defense management initiatives outlined in Chapter 1, funding of RDT&E and procurement has been centralized in a defense-wide account. However, operations and maintenance has not been consolidated at the DoD level. Therefore, for non-major end items (*i.e.*, most CB defense equipment), each Service will separately fund replenishment and sustainment of CB Defense equipment. War reserves, maintained by the Army, will require substantial funding from 1999 through 2005 as the existing items, principally chemical protective clothing, reach their maximum extended shelf lives.

In FY95, the Joint Service Materiel Group (JSMG) will conduct an assessment to determine the most effective means to consolidate the different funding approaches of the Services. This assessment will focus on how the Services have procured equipment with other than standard procurement funds (*e.g.*, with operations and maintenance funds), and will review the procedures for transferring program responsibility as it transitions from production to deployment and sustainment.

Under the current acquisition procedures and DoD guidance to minimize wholesale stockpiles, procurements are based on funded Service requisitions. Procurement is usually based on economic buy quantities (a consolidation of all Service requisitions) to provide the best value to the government. Some procurements of non-critical items, however, result in significant delays in delivery to the requisitioner because of the time required to produce economic buy quantities.

4.7 INDUSTRIAL BASE

Since Operation DESERT SHIELD/STORM, DoD has completed four industrial base assessments:

- Joint Service Industrial Base Assessment Implementation Plan for the Nuclear, Biological, and Chemical Defense Sector, 3 June 1994;
- Nuclear, Biological, and Chemical Sector Study: A Joint Service Industrial Base Assessment for NBC Defense Programs (FOUO), 2 February 1994;
- The 1993 National Defense Industrial Base Capability Assessment Report to Congress (Draft);
- The Department of Defense Report on War Stopper Items (1992).

These assessments indicate that the CB 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 CBD items (battledress overgarment, 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.

Recent changes in the CB threat and reduced DoD requirements are severely threatening the viability this sector. DoD is reviewing its industrial base strategies regarding this sector. DLA and AMC, in conjunction with the Services, are developing industrial base approaches which will ensure sustainment of key or critical manufacturing processes and capabilities. From the review of these cited documents, the industrial base can provide the CB defense items needed on the battlefield. Industry representatives have reviewed the Joint Service Sector Study and commented favorably upon the plan. As a result, a genuine partnership has developed. Industry has developed an extensive list of recommendations to secure that partnership; some which are achievable while others may be too optimistic. The following items are of particular concern.

4.7.1 Battledress Overgarment (BDO)

There is only one firm manufacturing the BDO. The annual peacetime requirement is projected to be 150,000 BDOs—a quantity sufficient to maintain only one supplier. DLA, via the "War Stopper" program, will maintain the supplier through April 1995 until new suit technologies have been developed. Fielding of the new chemical defensive suit is expected in late 1997. Related to the BDO, Duro, Inc. is the sole source for the inner layer of the charcoal slurry impregnated fabric (a key capability) used within the BDO suit. DLA has awarded an Industrial Base Maintenance Contract (IBMC) to Duro to maintain this capability. By maintaining Duro's critical process capability, DLA will be able to establish BDO production within six months. There are sufficient war reserve stocks to meet any near term requirements.

4.7.2 Chemical Protective (CP) Gloves

The CP Glove is made out of butyl rubber. Butyl rubber is the most cost effective material capable of withstanding all chemical agents with desirable mechanical properties over a wide range of environmental conditions. There are two current producers of the CP Gloves—Siebe North, Inc., Charleston, SC and Guardian Corp., Willard, Ohio. The current strategy provides for an IBMC at Siebe North and at Guardian. The Services have adequate stock on-hand for contingency use. Recent DoD surveillance tests have validated the protective qualities of the existing stocks. The health of the Services on-hand inventories has allowed DLA to pursue an IBMC with both current manufacturers to sustain the industrial base with "War Stopper" funding.

4.7.3 Medical Chemical and Biological Defense Material

The sole supplier to DoD for nerve agent antidote kits is Survival Technology, Inc. (STI) of St. Louis, Missouri. U.S. Army Medical Materiel Development Agency (USAMMDA) has also added STI to their New Drug Application (NDA) for producing the Convulsant Antidote, Nerve Agent (CANA) autoinjector. Food and Drug Administration (FDA) approval is expected in the summer of 1995. Defense Personnel Support Center (DPSC) has applied $401,000 of "Warstopper" funds to this program. Because of the Service's confirmed minimal peacetime requirements for nerve agent antidotes, STI's nerve agent antidote production line in being maintained with an Industrial Base Maintenance Contract (IBMC). USAMMDA's centralized management initiative for medical CDE should also help maintain the health of STI's line. The shelf-life extension of nerve agent antidote kits is part of USAMMDA's initiative, and will help keep STI active.

Although the sole source for nerve agent autoinjectors is a US company, STI, both atropine and pralidoxime chloride drugs used to fill the autoinjectors are obtained from German suppliers. Currently, there are no domestic sources for these drugs.

Additionally, pyridostigmine bromide tablets (PBT) a nerve agent pretreatment, and plague vaccine can be considered "War Stopper" items which must be available to support worldwide troop deployment. These items have a limited commercial application and require a dedicated production base.

4.7.4 Decontamination Kit, Skin, M291

The M291 kit is no longer in production. The sole supplier of the resin, Rohm & Hass, Co., sold its mixing and packaging equipment to manufacture the kit. Alternatives to produce a different kit that does not require the XE-555 resin are being studied.

4.8 NBC DEFENSE LOGISTICS SUPPORT ASSESSMENT

*** DoD lacks a Joint, integrated system to maintain asset visibility of chemical defense equipment (CDE) below wholesale level and also lacks a standardized war reserve program for CDE.**

***SOLUTION*:** DoD established the requirement for asset visibility and reviewed existing systems and procedures, both for peacetime reporting and war time reporting. Services need to address the CB defense asset visibility deficiency under the auspices of the Total Asset Visibility initiative. The war reserve process is under review. Congressional support may be required if a major automated system is determined to be needed.

During 1994, the CB defense community addressed this problem and has made some significant strides. Under the leadership of Joint Panel on CB Defense, a Joint working group was established to consolidate CB defense databases. The Joint working group agreed to reduce the number of databases by 50 percent and concurred on a list of three databases. Merging the databases should decrease redundancy and provide common information to everyone charged with management or execution of a CBD program.

An assessment is underway by the JSMG to determine the most effective means to consolidate the different funding lines of the Services into a single Defense account for CB defense programs. This assessment focuses on how the Services have procured equipment with other than standard procurement funds (for example, with operations and maintenance funds) and is reviewing the procedures for transferring program responsibility as it transitions from production to deployment and sustainment.

Table 4-1. Logistical Readiness NBC Report Data

					ESTIMATED PROCUREMENTS		
NOMENCLATURE	**NSN**	**WAR REQ**	**WAR O/H**	**ON CONTRACT**	**FY 95**	**FY 96**	**FY97**
OVERGARMENTS							
SUIT, CP CAMO (BDO)	8415-01-137-1700-07	2,331,278	3,238,524	144,961	272,802	212,512	192,409
SUIT, CP CAMO-DESERT		1,020,002	1,240,339	194	2,400	2,400	1,800
CP, UNDERCOVERALL	8415-01-040-3141	0	0	0	11,336	11,336	11,336
SUIT, BRIT, MK IV	NOT AVAIL	0	19,500	0	0	0	0
SUIT, CP, SARATOGA	8415-01-333-7573-76	654,000	104,350	332,000	0	0	20,000
SUIT, CP, OG (CPO)	8415-00-177-5008(M)	0	41,057	4	0	0	0
SUIT, CP, OG MK3	8415-01-214-8290(M)	342,978	356,781	0	0	0	0
JSLIST	NOT AVAIL	400,000	0	0	0	21,700	40,000
CHEMICAL OVERBOOTS							
BLACK/GREEN VINYL O/BOOTS	8430-01-317-3374-85	3,956,856	3,051,606	38,394	520,250	484,255	172,105
CP SOCKS	8415-01-040-3169	0	0	0	18,912	18,912	18,912
CP FOOTWEAR COVERS	8430-01-021-5978(L)	271,492	888,115	0	0	0	0
DISP FOOTWEAR COVER	8430-00-580-1205-03	0	0	0	0	0	0
CP GLOVES							
CP GLOVES 25 MIL	8415-01-033-3517-20	6,885,261	7,497,556	1,580	223,556	169,782	173,972
CP GLOVES INSERTS	8415-00-782-2809	0	0	0	125,320	125,320	125,320
CP GLOVES 14 MIL	8415-01-138-2497-00	0	1,269,524	16,453	81,100	81,100	81,100
CP GLOVES 7 MIL	8415-01-138-2501-04	0	124,674	1,579	22,640	22,640	22,640
CB MASK							
MASK, CB, M17A2	4240-01-143-2017-20	731,034	1,807,868	0	0	0	0
MASK, M24, AVIATOR	4240-00-776-4384(M)	18,295	40,750	36	0	0	0
MASK, M25A1, TANK	4240-00-994-8751-52	52,964	182,287	0	0	0	0
MASK, CB, M40	4240-01-258-0061-63	1,327,721	755,292	242,618	135,438	130,896	0
MASK, M42, TANK	4240-01-258-0064-66	145,423	112,330	77,447	11,666	0	0
MASK, M43, APACHE	4240-01-208-6966-69	3,557	3,889	0	0	0	17,000
MASK, MCU-2/P	4240-01-175-3443	243,924	257,671	42	0	0	0
MASK, COMM, ADAPTOR	NOT AVAIL	50,000	4,000	15,007	10,000	15,000	1,000
MASK, MCU-2/AP	4240-01-284-3615	2,603	61,412	1,286	0	0	0
MASK, MCU-2/AP(WR)	4240-01-327-3299	0	177,064	24,470	0	0	0
MASK, MARK V	4240-00-268-9732	0	0	0	0	0	0
MASK, AR-5, A/P22P-2	PT#1505217	9,237	9,237	0	0	0	0
MASK,SECOND SKIN	NOT AVAIL	277,333	0	44,000	0	0	0
MASK, AERP	NOT AVAIL	33,800	15,800	14,430	2,409	1,161	0
MISC PROTECTION							
CANTEEN W/M1 CAP	8465-01-115-0026	405,145	540,292	2,191	10,000	10,000	0
CANTEEN COVER	8465-00-860-0256	376,606	510,681	911	4,000	4,000	0
CP HELMET COVER	8415-01-111-9028	3,030,460	2,737,667	193,110	172,541	115,491	114,616
NBC HH CALCULATOR	NOT AVAIL	0	30	0	0	0	0
AIRCREWMAN CAPE	8415-01-040-9018	0	0	0	11,012	11,012	11,012

Table 4-1. Logistical Readiness NBC Report Data (Continued)

					ESTIMATED PROCUREMENTS		
NOMENCLATURE	**NSN**	**WAR REQ**	**WAR O/H**	**ON CONTRACT**	**FY 95**	**FY 96**	**FY97**
MISC PROTECTION							
HOOD, M6A2 (FOR M17)	4240-00-999-0420	833,123	1,325,567	14	281,368	254,192	272,648
HOOD, M7 (AIR)	4240-00-021-8699	110,040	136,637	0	23,357	23,394	20,977
HOOD, M5 (TANK)	4240-00-860-8987	163,681	63,227	0	43,839	42,337	52,066
HOOD, FOR MCU-2A/P	4240-01-189-9423	0	1,280,137	62,578	150,000	150,000	0
HOOD, M40	NOT AVAIL	1,917,298	302,261	1,193,706	272,941	255,388	260,923
FILTER SET, M13A2	4240-00-165-5026	798,029	1,426,175	385	386,712	329,776	146,880
FILTER CAN, M10A1	4240-00-127-7186	253,061	221,668	0	29,691	29,806	27,535
FILTER CAN, C2	4240-01-119-2315	2,603,699	3,292,144	54,225	515,582	511,313	409,178
FILTER CAN, C1	4240-00-218-0779	0	0	0	0	0	0
FILTER, GP	4240-01-161-3110	0	0	0	0	0	0
FILTER, GP, M18	4240-00-828-3952						
CARRIER, M15A1 (M17)	4240-00-933-2533	0	136,270	0	0	0	0
CARRIER, M13A1 (M25)	4240-00-910-3657	0	5,261	0	0	0	0
CARRIER, M17 (M24)	4240-00-476-2541	0	6,903	0	0	0	0
MICS (COOL SYSTEM)	4240-01-298-4140YR	0	0	0	0	0	0
MICS VEST	8415-01-217-5634	0	0	0	0	0	0
CARRIER, M40/M42		269,000	158,602	0	0	0	0
CHEMICAL DETECTION							
DET KIT, M256A1	6665-01-133-4964	112,860	152,886	15,066	43,996	28,997	37,455
M256A1 TRAINER	6665-01-112-1644	1,230	395	7	10	10	0
DET PAPER, M9	6665-01-049-8982	43,620	192,525	21,225	70,000	60,000	0
DET PAPER, M9	6665-01-226-5589	44,669	185,068	0	0	0	0
DET PAPER, M8	6665-00-050-8529	105,721	579,488	15,236	40,000	40,000	
TUBE PHOSGENE	6665-01-010-7965	3	3	0	0	0	0
ALARM, CAA, M8A1	6665-01-105-5623	44,295	42,840	144	0	0	0
BATTERY, BA3517/U	6135-00-450-3528	0	420	41	15	0	0
POWER SUPPLY, M10	6130-00-859-2225	0	35	0	0	0	0
POWER SUPPLY, M10A1	6130-01-093-2739	0	95	8	10	0	0
MAINT KIT, M273	5180-01-108-1729	0	110	8	0	0	0
CWDD, AN/KAS-1	5855-01-147-4362	0	0	0	0	0	0
CHEM AGENT MONITOR	6665-01-199-4153	23,586	11,829	167	0	2,000	0
CAM BATTERY	6665-99-760-9742	88,000	80,172	113	0	0	0
CAPDS	6665-01-294-2556	0	0	0	0	0	0
NBC RECON SYSTEM	NOT AVAIL	215	113	0	0	0	0
NBC MARK SET, M274	9905-12-124-5955	2,412	758	5	0	0	0
WATER TEST KIT, M272	6665-01-134-0885	3,269	41	10	0	0	0
IND CHEM AGENT DET	NOT AVAIL	13,000	9,993	0	0	0	0
XM21 RSCAAL	NOT AVAIL	251	125	0	0	0	0

Table 4-1. Logistical Readiness NBC Report Data (Continued)

					ESTIMATED PROCUREMENTS		
NOMENCLATURE	**NSN**	**WAR REQ**	**WAR O/H**	**ON CONTRACT**	**FY 95**	**FY 96**	**FY97**
DECONTAMINATION EQUIPMENT							
DECON KIT, M258A1	4230-01-101-3984	1,107,382	1,532,700	16,757	204,008	192,557	263,517
M58A1 TRAINER	6910-01-101-1768	32,152	45,900	0	0	0	0
DECON KIT, M291	4230-01-276-1905	796,935	547,558	97,660	288,445	145,171	140,504
DECON APPAR, M11	4230-00-720-1618	109,891	86,636	0	38,467	36,347	47,647
DECON APPAR, M13	4230-01-133-4124	101,341	62,827	5,258	6,289	3,474	3,646
DS2, 1 1/3 QT	6850-00-753-4827	136,061	126,498	2	292	287	287
DS2, 5 GAL	6850-00-753-4870	206,386	152,880	0	66	54	54
DS2, M13CAN	NOT AVAIL	151,698	55,931	0	6	0	0
SUPER TROP BLEACH	6850-00-297-	4,249	4,249	0	0	0	0
SODIUM HYPOCHLORITE	6810-00-598-7316	0	1,274	364	0	0	0
CALCIUM HYPOCHLORITE	6810-00-255-0471	512	537	0	0	0	0
DRY SORBENT POWDER	4230-01-262-0484	0	20	0	0	0	0
L/WT DEC SYS, M17	4230-01-303-5225	3,883	2,900	532	515	0	0
A/E32U-8 DECON SYS	4230-01-153-8660	0	257	0	0	0	0
PDDA, M12A1	4230-00-926-9488	1,537	1,584	0	0	0	0
NITROGEN CYLINDERS	4200-00-775-7541	43,322	41,404	0	0	0	0
COLLECTIVE PROTECTION/ MEDICAL EQUIPMENT							
SHELTER, CO/P, M51	4240-00-854-4144	1,178	612	0	0	0	0
PORTABLE CO/P SYS	NOT AVAIL	200	200	0	0	0	0
SURVIVAL CO/P SYS-2	4230-01-184-7913	0	0	0	0	0	0
SURVIVAL CO/P SYS-2A	4230-01-315-7465	0	0	0	0	0	0
KMU-450 SHEL MOD KIT	4240-01-044-7659	0	0	0	0	0	0
SHELTER, CO/P, M20	4240-01-166-2254	2,478	1,296	190	0	0	0
NAAK, MKI	6705-01-174-9919	1,888,734	3,207,468	0	60,000	60,000	60,000
ATROPINE AUTOINJ	6505-00-926-9083	1,614,228	1,886,797	0	0	0	0
ATROPINE TRAINER	6910-01-194-0378	0	0	0	0	0	0
2-PAM CHLORIDE,AUT	6505-01-125-3248	488,462	224,929	0	0	0	0
2-PAM TRAINER	6910-01-194-2227	0	0	0	0	0	0
PYRIDOSTIGIMINE TAB	6505-01-178-7903	344,999	720,744	0	4,000	4,000	4,000
CANA	6505-00-137-5891	806,171	478,309	0	50,000	50,000	50,000

Table 4-2. Logistical Readiness NBC Report Data: Stocks Held by DLA and AMC

NOMENCLATURE	NSN	DLA Inventory O/H	On Contract	AMC Inventory O/H
OVERGARMENTS				
SUIT, CP CAMO (BDO)	8415-01-137-1700	111,000	78,000	131,450
SUIT, DESERT	8415-01-327-5346	32,000		33,158
SUIT, DESERT	8415-01-324-3084			
UNDERCOVERALL	8415-01-040-3136	49,000		
SUIT, CP, SARATOGA	8415-01-333-7573		326,000	
SUIT,CP,OG,(CPO)	8415--00-407-1060			
SUIT, CP, OG MK3	8415-01-214-8289	64,000		
CHEMICAL OVERBOOTS				
BLACK/GREEN VINYL	8430-01-317-3374	692,000	101,000	546,953
CP SOCKS	8415-01-040-3169	496,000		
CP FOOTWEAR COVERS	8430-01-021-5978	103,000		
DISP FOOTWEAR COVER	8430-00-580-1205	149,000		
CP GLOVES				
CP GLOVES 25 MIL	8415-01-033-3517	1,500,000		1,422,837
CP GLOVE INSERTS	8415-00-782-2809	1,000,000		
CP GLOVES 14 MIL	8415-01-138-2497	1,000,000		
CP GLOVES 7 MIL	8415-01-138-2501	264,000		
GLOVES LINER	8415-01-138-2494	330,000		
CP HELMET COVER	8415-01-111-9028	134,000		334,538
MISC PROTECTION				
AIRCREWMAN CAPE	8415-01-040-9018	10,000		
HOOD, M6A2 FOR M17	4242-00-999-0420			419,556
HOOD,M7 (AIR)	4240-00-021-8699			94,369
HOOD, M5 (TANK)	4240-00-860-8987			191,795
FILTER SET, M13A2	4240-00-165-5026			509,367
FILTER SET, M10A1	4240-00-127-7186			62,902
FILTER CAN, C2	4240-01-119-2315			1,044,601
CANTEEN W/M1 CAP	8465-01-115-0026	266,000	219,000	
CANTEEN COVER	8465-00-860-0256		967,000	
MICS VEST	8415-01021705634	14,000		

Table 4-2. Logistical Readiness NBC Report Data: Stocks Held by DLA and AMC (Continued)

NOMENCLATURE	NSN	DLA Inventory O/H	On Contract	AMC Inventory O/H
CHEMICAL DETECTION				
DET KIT, M256A1	6665-01-133-4964			42
DECONTAMINATION EQUIPMENT				
DECON KIT, M258A1	4230-01-101-3984			325,340
DECON , M291	4230-01-276-1905			6,984
DECON, M11	4230-00-720-1618			44,077
DECON, M13	4230-01-133-4124			101,938
COLLECTIVE PROTECTION/ MEDICAL EQUIPMENT				
SHELTER, CO/P, M20	4240-01-166-2254			
ATROPINE AUTOINJECTOR	6505-00-926-9083	56,522	291,800	
ATROPINE TRAINER	6910-01-194-0378	201	425	
2-PAM CHLORIDE, AUT	6505-01-125-3248	32,195	133,180	
2-PAM TRAINER	6910-01-194-2227	261		
PYRIDOSTIGIMINE TAB	6506-01-178-7903	17,615		
CANA	6505-00-137-5891	5,878		

Table 4-3. Logistic Assessments: Major NBC Defense Items

Risk Assessment:

Low – Services have at least 85 percent of wartime requirement on-hand to support two nearly simultaneous major regional contingencies

Moderate – Services have between 70 to 85 percent of wartime requirement on-hand to support two nearly simultaneous major regional contingencies

High – Services have less than 70 percent of wartime requirement on-hand to support two nearly simultaneous major regional contingencies

Chemical Contamination Avoidance/Detection

Items	Assessment	Remarks
Detection Kit, M256A1	Low	
Individual Chemical Agent Detector	Moderate	Modernization Item
Chemical Agent Alarm, M8A1	Moderate	
Chemical Agent Monitor	High	
Chemical Agent Protective Detection System (CAPDS)	Low	
Chemical Warfare Directional Detector (CWDD), AN/KAS-1	Low	
NBC Reconnaissance System "Fox", M93	High	Modernization Item/Procurement
Water Testing Kit, M272	High	Curtailed
NBC Marking Set	High	

Individual Protection

Items	Assessment	Remarks
Masks		
M17 Series, General Purpose	Low	Being replaced by M40 (Army/Marines); Replaced by MCU-2P Series (AF/Navy)
M25A1, Tank	Low	Being replaced by M42 (Army/Marines)
M24, Aviator	Low	
M40, General Purpose	High	Modernization Item
M42, Tank	High	Modernization Item
Mask, M43, Apache	Low	
Mask, MCU-2/AP	Low	
Mask, MCU-2P	High	
Mask, AR-5/AP22-P2	Low	
Suits		
Battledress Overgarment (BDO)	Low	
Chemical Protective Overgarment	Not Assessed	Phase-Out Item
Chemical Protective Undercoverall	Low	
British Mark III	Low	
British Mark IV	Not Assessed	
Saratoga	High	Modernization Item
Gloves		
Chemical Protective Gloves	Low	
Chemical Protective Glove Inserts	Low	
Overboots		
Green/Black Vinyl Overshoes (GVO/BVO)	High	
Chemical Protective Footwear Covers	Low	Being replaced by GVO/BVO
Disposable CP Footwear Covers	Low	

Table 4-3. Logistic Assessments: Major NBC Defense Items (Continued)

Collective Protection

Items	Assessment	Remarks
Shelter, Collective Protective, M51	High	Risk increased due to maintenance
Portable Collective Protective System	Low	
Survival Collective Protective System-2	Low	
Shelter, Collective Protective, M20	High	Modernization Item

Decontamination Equipment

Items	Assessment	Remarks
Decon Kit, M258A1	Low	Being replaced by M291
Decon Kit, M291	High	Modernization item
Decon Apparatus, M11	Moderate	
Decon Apparatus, M13	High	Modernization item
Lightweight Decon System, M17	Moderate	
A/E32U-8 Decon System	Low	
PDDA, M12A1	Low	Risk increased due to maintenance

Medical Defense

Items	Assessment	Remarks
Nerve Agent Antidote Kit (NAAK)	Low	
Atropine Autoinjector	Low	
2-PAM Chloride Autoinjector	High	
Pyridostigmine Tab	Low	
CANA	Low	
Biological Warfare Vaccines	High	Vaccine production facility is planned

APPENDIX 1
Currently Fielded NBC Defense Items: Characteristics and Capabilities

Chemical Defense Equipment (CDE) descriptions.

a. BATTLE DRESS OVERGARMENT (BDO) CHEMICAL PROTECTIVE (CP) SUIT

The BDO is a camouflage patterned (desert or woodland), two piece, air permeable overgarment that is typically worn over the duty uniform. The overgarment material consists of an outer layer of nylon cotton, and an inner layer of charcoal impregnated polyurethane foam. The BDO provides protection against chemical agent vapors and liquid droplets, biological agents (to include toxins), and radioactive alpha and beta particles. The BDO is issued in a sealed vapor-barrier bag that protects the garment from rain, moisture and sunlight. The BDO will retain its protective properties for at least 30 days after removal from the bag, and for at least 24 hours after exposure to a liquid chemical agent.

b. CP SUIT, OG MK3 (NAVY SUIT)

The Mark III chemical, biological, radiological (CBR) suit protects against chemical agent vapors, aerosols, droplets of liquid, and biological agents. The suit consists of separate smock and trousers in addition to gloves and overboots. The Mark V is the primary mask currently in use, which is scheduled to be replaced by the AF MCU-2/P mask.

c. CP SUIT, SARATOGA (USMC)

Like the BDO, the SARATOGA is an air permeable, camouflage patterned overgarment. But instead of carbon impregnated foam, SARATOGA uses spherical, activated carbon adsorbers immobilized in the liner fabric. This system allows for a lighter, cooler garment. The carbon spheres are also specially treated to minimize water adsorption. This means that the SARATOGA is practically insensitive to humidity and perspiration, and allows for repeated laundering of the garment.

d. GREEN/BLACK VINYL OVERBOOTS (GVO/BVO)

The GVO/BVO is a fitted vinyl overshoe that can be used by the wearer for protection against nuclear, biological, chemical (NBC) agents, or foul weather. The impermeable GVO/BVO provides protection against all known agents for a minimum of 14 days after the soldier starts to use it, provided it is not torn or worn through. The GVO/BVO provides a minimum of 24 hours protection after contamination. The GVO/BVO may be decontaminated to extend their usefulness.

e. CP GLOVES

The CP glove set consists of a butyl-rubber, chemical protective outer glove, and a cotton inner glove for perspiration absorption. CP 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 electronic repair personnel. The 14 mil glove is used by personnel such as aviators and mechanics where good tactility is necessary, and treatment is not too harsh. The 25 mil glove is used by personnel who perform close combat tasks and heavy labor, and require a durable glove. The 14 and 25 mil glove sets will provide protection for at least 24 hours, and can be decontaminated to extend their usefulness. The 7 mil glove set should be replaced within 6 hours after exposure to a chemical agent.

f. FIELD PROTECTIVE MASKS

(1) M17A2 PROTECTIVE MASK

The M17A2 Protective Mask consists of: a butyl rubber face piece; two activated charcoal filters that are 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).

(2) ABC-M24 AIRCRAFT PROTECTIVE MASK, AND M25A1 TANK PROTECTIVE MASK

These protective masks provide the wearer protection from NBC aerosols/vapors both in their vehicle/aircraft, and on the ground. These masks consist 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. There are two major differences between the M24 and M25A1 masks. The masks have different microphone connections to fit either armored vehicle or aircraft 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 M24 has a different adapter kit that allows coupling to the aircraft's oxygen supply system.

g. M256A1 CHEMICAL AGENT DETECTOR KIT

The M256A1 kit can detect and identify field concentrations of: nerve agents (sarin, tabun, soman and VX), blister agents (mustard, phosgene oxime, and lewisite), and blood agents (hydrogen cyanide and cyanogen chloride) in about 10 minutes. The kit consists of a carrying case containing 12 individually wrapped detector tickets, a book of M8 chemical agent detector paper, and a set of instructions. Each detector ticket has on it pretreated test spots, and glass ampoules containing chemical reagents. In use the glass ampoules are crushed to release the reagents, which run down preformed 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 efficacy.

h. ABC-M8 VGH, AND M9 CHEMICAL AGENT DETECTOR PAPER

M8 and M9 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 booklets that are 4" by 2 1/2" in size. Each booklet contains 25 sheets of detector paper that are capable of detecting G (sarin, tabun, soman) and 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 feet 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 and L (lewisite) blister agents. However, it cannot distinguish the identity of the agent; it turns red upon contact with any of the listed agents. M9 paper is typically placed on the BDO and vehicle exteriors to warn personnel of the presence liquid chemical agent.

i. M8A1 CHEMICAL AGENT ALARM (CAA)

The M8A1 is a system that continuously samples the air to detect dangerous concentrations of G and V type nerve agent vapors. The M8A1 may be employed in a number of configurations, but all configurations are built around the M43A1 detector, and the M42 alarm. The configurations differ primarily in their mountings and power supplies; for example, ground mounted and battery operated, or mounted on a vehicle and powered by the vehicle's electrical system. The M43A1 measures 6 1/2" X 5 1/2" X 11"; the battery used in ground mounted operations adds another 7 3/4" in height to the M43A1. The M43A1 uses a radio-isotope to ionize molecules in the air that is continuously pumped through the system, and detects electrical current changes that occur in the presence of nerve agents. The M43A1 will alarm within about 1-2 minutes from exposure to agent. The M42 is a remote visual and audible alarm that measures 7" X 4" X 2 1/3". The M42 may be placed up to 400 meters from the M43A1 detector to give users advance warning of an approaching agent cloud.

j. AN/KAS-1 CHEMICAL WARFARE DIRECTIONAL DETECTOR (CWDD)

The CWDD is a Navy system that allows stand-off detection of nerve agents during both day and night. The CWDD employs forward-looking, infra-red sensing technology to detect potential threats. The system consists of a sensor unit and a power conditioning unit. The total weight of the fully submersible CWDD is 46 pounds.

k. CHEMICAL AGENT MONITOR (CAM)

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 to detect and identify agents within 1 minute of agent exposure. A weak radioactive source ionizes air drawn into the system and the CAM then measures the speed of the ions' movement. Agent identification is based on characteristic ion mobilities, and relative concentrations based on the number of ions detected. The 3 pound, 15"

long CAM can either be powered 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 surveillance, monitoring of decontamination operations, and determining when it is safe to unmask.

l. 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 a DECON 1 WIPE containing an aqueous decon solution soaked gauze pad, and a DECON 2 WIPE containing a decon solution filled glass ampoule within a gauze pad. Personnel use the two wipes successively to remove/neutralize liquid chemical agents from their skin, clothing and personal equipment and weapons.

m. 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 DAP cannot be effectively stowed.

n. M13 DECONTAMINATING APPARATUS, PORTABLE (DAP)

The man portable M13 consists of: a vehicle mounting bracket, a pre-filled fluid container containing about 3 2/3 gallons 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.

o. 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.

p. SHELTER, CB M51

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.

q. NERVE AGENT ANTIDOTE KIT (NAAK), MARK I (INCLUDES ATROPINE AND 2-PAM CHLORIDE AUTOINJECTORS)

The NAAK consists of two auto-injectors held in a single plastic clip. The first auto-injector contains atropine, which counters the symptoms of nerve agent poisoning (i.e., uncontrolled muscle contractions). The second auto-injector contains the oxime 2-PAM Chloride, which directly counters the nerve agent itself. The auto-injectors contain spring loaded hypodermic syringes that inject their contents when pressure is applied to the tips of the auto-injectors (auto-injectors must be free of the plastic clip). Each person is issued 3 NAAKs whenever use of chemical weapons is likely. Medical units have additional supplies of the two auto-injectors in their chemical agent treatment kits.

r. NERVE AGENT PRETREATMENT PYRIDOSTIGMINE (NAPP) TABLET

NAPP is an adjunct to the NAAK, and enhances the effectiveness of the NAAK. Personnel are issued a packet containing 21 NAPP tablets, and will begin taking NAPP only when directed to. NAPP is taken when chemical agent exposure is likely within the next several hours or days. One NAPP tablet is taken every 8 hours on a continuous basis until either directed to stop, or all 21 tablets are consumed.

s. CONVULSANT ANTIDOTE, NERVE AGENT (CANA)

CANA is similar to the NAAK auto-injectors in operation, and contains 2 milliliters of the anti-convulsant drug diazepam. The CANA auto-injector is distinguished from the NAAK auto- injectors by the 2 flanges along the length of its barrel. Typically, only one CANA is issued per person. CANA is administered only as a part of buddy-aid; that is, when the nerve agent casualty has lost too much control to administer first aid to himself, his buddy will administer his CANA for him.

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CHAPTER 5

NUCLEAR, BIOLOGICAL, AND CHEMICAL (NBC) DEFENSE READINESS AND TRAINING

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5.1 INTRODUCTION

For weapons of mass destruction (WMD) to provide an advantage to an adversary, they must cause some degradation for the opponent's force. If these weapons do not have an effect on the opposing force, the adversary force may be discouraged from employing WMD. A force that is trained and ready to cope with the challenges of operating in a battlespace where WMD are used negates their advantage of use. NBC defense readiness has been and will continue to be a critical element of deterrence.

The Services have done well in the exercise of their NBC defense responsibilities under Title X of the FY94 Defense Authorization Act. The vision for the future is to build on the Service successes to develop a viable Joint orientation to NBC defense capabilities which includes Joint doctrine and tactics, techniques, and procedures; Joint modeling, simulation and wargaming; and Joint professional training. The counterproliferation acquisition initiative has provided funding necessary to begin this process under the new management of the Joint Services Integration Group (JSIG) discussed in Chapter 1.

5.2 JOINT NBC DEFENSE DOCTRINE

Joint Pub 3-11, *Joint Doctrine for Nuclear, Biological, and Chemical (NBC) Defense*, continues to be the only Joint doctrinal manual. This document provides a general overview of the strategic level of NBC defense operations. Solid operational Joint NBC defense doctrine and tactics, techniques, and procedures that integrate Service operations in the battlespace need to be developed. The Joint NBC defense doctrine initiative is intended to augment Service doctrine, not usurp Service Title X responsibilities. Further, the program will provide a basis on which the CINCs can train and evaluate their Joint forces operations.

5.2.1 Joint NBC Defense Doctrine Program Management

The new NBC defense program management strategy described in chapter 1 provides the mechanism for the management of a Joint NBC defense doctrine program. The JSIG assumes the responsibility for this program. The JSIG will be coordinating with the Services to ensure that the program meets the realistic demands of the battlespace.

5.2.2 Joint NBC Defense Doctrine Development Program

The FY95 program consists of a number of initiatives that will:

- Analyze existing Service doctrine and extant Joint doctrine.
- Develop a requirements list for doctrine programs that will be used to develop a strategy for the generation of new doctrine.
- Prepare a multi-year Joint Doctrine Development Action Plan (JDDAP) that will serve as the road map to ensure an ordered and logical production of doctrine under the auspices of Joint Pub 1-01, *Joint Publication System Doctrine and Joint Tactics, Techniques, and Procedures* development program.

- Validate initial doctrine with emerging simulation developments.
- Begin revising Joint Pub 3-11 to become the capstone document for Joint NBC defense doctrine and tactics, techniques, and procedures.

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 and Units*, establishes Army standards for proficiency for NBC defense training. NBC defense training is conducted at schools and in units.

Individual Training

At the initial training level, NBC defense tasks while wearing Mission Oriented Protective Posture (MOPP) gear are taught during Basic Soldier Training and Warrant Officer Candidate Training to satisfy Military Qualifications Standards Level I. Qualification Standards Level II is achieved from NBC tasks training conducted during Officer (basic and advanced) and Warrant Officer (basic) training. NCOs train on leader NBC skills during Primary Leadership Development Courses (PLDC). Other Officer and NCO courses require training in NBC effects on AirLand operations. At the company level each unit has a NBC NCO specialist and at the battalion or higher level each unit has an NBC Officer/Senior NCO.

Unit Training

NBC training is integrated into unit mission training as well as individual and leader training. The NBC protective mask is worn during weapons qualification training up to twice a year depending on a units 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 warfare is a battlefield condition, and therefore the Army incorporates it's NBC training into mission tasks. Units accomplish mission tasks under NBC conditions during internal and external evaluations.

Mobilization Training

Fort McClellan is a major Reserve Component mobilization center for chemical units. As part of the mobilization process, these units receive individual and unit NBC defense refresher training. During Desert Shield/Storm, instructor personnel from the US Army Chemical School trained numerous units to ensure currency in NBC tasks prior to deployment.

5.3.2 AIR FORCE

Air Force policy is to train and equip only personnel in or deployable to NBC threat areas. The Air Force standards of proficiency are based on two international standardization

agreements: NATO Standardization Agreement 2150 (NATO Standards of Proficiency for NBC Defense), and Air Standardization Coordinating Committee (ASCC) Air Standard 84/8 (Initial, Continuation and Unit NBC Standards). Both agreements are implemented through Air Force Instruction 32-4001, Disaster Preparedness Planning and Operations. The Air Force ensures proficiencies and currency of NBC warfare defense training through classroom training, unit level training, and exercises. All military and civilians designated as emergency essential receive the training annually. The subjects presented in the classroom follow the three principles of NBC defense (avoidance, protection and decontamination) as identified in Joint Doctrine. The classroom training is followed by unit level training on wartime mission critical tasks. Personnel are trained in job tasks by supervisors while wearing full chemical protective equipment. Exercises are used for training and evaluation purposes. Instructors at unit level receive their professional training through Air Force courses at Ft. McClellan, Alabama.

Individual Training

Individual training is of two types. The first is general equipment and procedures training to enable personnel to recognize and protect themselves and others from NBC hazards. The second is task qualification training to enable personnel to perform their wartime tasks in a NBC contaminated environment. Personnel entering the Air Force receive a two hour orientation on NBC defense. More detailed training comes with assignment to a threat area or to a deployable unit. Personnel receive four hours of initial equipment and procedures training plus one hour of mask confidence training within 30 days after arrival in a threat area or 90 days after assignment to a mobility position. NBC refresher training is at the discretion of the major commands, with the majority opting for annual refresher training through additional classroom training and exercise participation. Task qualification training occurs through on-the-job-training and exercise participation.

Unit Training

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

- twice annually at installations in NBC threat areas
- once annually at installations in NBC non-threat areas
- based on threat within the deployment area, an additional exercise for units with a mobility commitment. These exercises are graded.

5.3.3 NAVY

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

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

Individual Training

The Navy provides initial entry level NBC defense training to all officers and enlisted personnel.

Unit Training

Proficiency training is conducted at the unit level by Navy instructors who are graduates of the NBC Defense course conducted by the Army at Fort McClellan, Alabama. Afloat units receive formal training at least once during each deployment. Aviation personnel receive training in a classroom annually. In addition to classroom and shipboard training, exercises are conducted quarterly. These exercises are graded.

5.3.4 MARINE CORPS

The Marine Corps, like the Air Force uses the NATO Standardization Agreement 2150 as the cornerstone for establishing its own training standards. Marine Corps standards of proficiency are also included in the following:

FMFM 11-1	Nuclear, Chemical and Defensive Biological Operations
OH 11	MAGTF Nuclear, Chemical and Defensive Operations
MCO 3400.3	NBC Defense Readiness and Training Requirements
MCO 1510.71	Individual Training Standards for Occupational Field NBC Defense Specialists and NBC Defense Officers

The Marine Corps has four levels of training: individual training, unit training, major exercises/operations, and command level NBC defense courses (schools).

Individual Training

Individual training requires each individual Marine to be capable of performing specific tasks as required by MCO 1510 series and MCO 3400.3.

Unit Training

Unit level training includes classroom and field training and is included in unit training exercises and plans. Unit training requires that each unit be capable of performing its mission

under NBC conditions. Unit NBC defense training is overseen by unit NBC specialists who are graduates of the Army's Chemical Defense Training Facility at Ft. McClellan, Alabama. NBC evaluations are conducted annually for all Marine Corps units. Those units that are part of the Marine Corps' Unit Deployment Program and designated Marine Expeditionary Units are required to undergo an NBC evaluation prior to deployment.

At the command level the Marine Corps has various NBC defense schools. These schools conduct refresher training for unit NBC defense specialists and for unit NBC defense teams. For example, the NEC defense school of the 1st Marine Aircraft Wing on Okinawa, Japan graduated 414 Marines and Sailors from their local school during FY94.

5.4 NBC DEFENSE PROFESSIONAL TRAINING

In compliance with Public Law 103-160, NBC defense professional training for all the Services is now co-located at the US Army Chemical School, Fort McClellan, Alabama. Currently, Services conduct their own training with their own Service instructors.

5.4.1 Joint NBC Defense Professional Training

The U.S. Army Chemical School recently established a Joint Training Steering Group (JTSG) as a forum to discuss issues that pertain to facilities and range scheduling and any other training issues that impact on the ability of the Services to conduct effective training.

Plans are being made to exchange information on Service equipment, doctrine and employment techniques to establish a baseline for development of future Joint doctrine and professional training. The discussion concerning a Joint instructor pool is beginning. The concept is to consolidate classes that teach the same task to the Services using a Service instructor that has that skill. Conceivably, a Marine Corps instructor could teach a task to a class containing Army, Navy, Marine Corps and Air Force students.

5.4.2 Army NBC Defense Professional Training

U.S. Army NBC Defense Professional Training at Fort McClellan, AL consists of three enlisted/noncomissioned officer courses and two officer courses. Initial entry enlisted soldiers receive training in agent characteristics and hazards, smoke and decontamination operations, chemical and radiological survey procedures and individual protective clothing and equipment. This one station unit training program provides 18 weeks of intensive training. It culminates with live/toxic agent training in the Chemical Defense Training Facility. (Toxic agent training is an integral, mandatory component of all professional courses.) Soldiers graduate from this course prepared to be equipment officers in chemical defense companies.

Chemical Corps sergeants attend the 15.6 week Chemical Basic Noncomissioned 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.

Chemicals Corps staff sergeants and sergeants first class attend the 13.4 week Chemical Advanced NCO Course (ANCOC) where they are trained to be an NBC platoon sergeant, an NBC NCO at brigade level, and an NBC NCO in a division or Corps level NBC element. They receive advanced technical operations, hazard estimates, logistics and maintenance management, combined arms operations, smoke and flame support, and training management.

Chemical Corps lieutenants attend a 19.2 week officer basic course which prepares them to serve either as a Chemical Corps smoke or decontamination platoon leader or as a non-chemical battalion chemical staff officer/assistant operations officer. This course provides them with a fundamental knowledge of NBC agent characteristics and hazards, NBC recon (non-FOX), decon and smoke operations, NBC staff functions, and individual/unit tactical operations. The course is a mixture of classroom instruction, hands-on equipment training, and field exercises. Completion of live/toxic agent training is a prerequisite for graduation.

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

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

- NBC Reconnaissance Operations (FOX) (5 weeks)
- Radiological Safety (Installation level) (3 weeks)
- Chemical Weapons Inspector/Escort (OSIA) (1 week)
- Chemical Weapons Convention Module II (6 weeks)
- Decon Procedures (Non-US) (GE, UK, NE) (1 week)
- RADIAC Calibrator Custodian (1 week)

5.4.3 Navy NBC Defense Professional Training

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

The training capitalizes on the unique capabilities of the Army Chemical School. In addition to classroom instruction, the Navy Detachment utilizes the CDTF for live agent training and the Bradley Radiological/Laser Laboratory for training in theory and equipment operation for radiological defense

In addition to being fully qualified to conduct training using the Army's facilities, the Navy Detachment actively participates on the newly established Joint Training Steering Group. Approximately 600 students graduate from the Detachment's three courses annually.

5.4.4 Marine Corps NBC Defense Professional Training

The following reflects the number of Marines who have graduated from several of the resident courses offered at Fort McClellan, Alabama:

USMC NBC Basic Course	160
Chemical Officer Advanced Course	3
NBC Reconnaissance Course	6
Radiological Safety Officer Course	3

The USMC NBC Basic Course was expanded to 10 weeks. This was necessary to enhance the Marine NBC Specialists ability to meet the challenges of an increasing worldwide NBC threat proliferation.

5.4.5 Air Force NBC Defense Professional Training

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

Each course contains a wide range of materials; covering critical aspects of Readiness Flight operations in situations ranging from peacetime, mission 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 (simplified, detailed, and automated) 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 provides training on every major piece of equipment available in the field today, including state-of-the-art items being fielded.

- Air Force instruction stresses national and international procedures that the Air Force has agreed to use.

Readiness is the key to successful Air Force operations. Consequently, the various aspects of Readiness Flight operations, including NBC defense, are also topics of instruction at Senior Officer Indoctrination Courses.

5.5 TRAINING IN A TOXIC CHEMICAL ENVIRONMENT

In 1987 the Army established a "one-of-a-kind" facility called the Chemical Defense Training Facility (CDTF) at Fort McClellan, Alabama. The CDTF allows personnel to train in a real toxic agent environment. Since its opening, the Army has utilized this valuable resource to train over 33,000 US and Allied members from all Services. Over 3,500 were trained in FY94 alone. 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 1,100 active and reserve commanders, service leaders, and toxic agent handlers from each of the services have attended. These experts become instructors for the Services for unit training. In addition to the training opportunity *per se*, 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 which may up to then have been purely theoretical.

There is growing international interest in CDTF training participation. The Germans have been taking advantage of the training opportunity for about four years. The United Kingdom has very recently used the facility for training. Law enforcement agencies have also participated in the training.

5.6 INTEGRATION OF REALISM/WARGAMES/EXERCISES

5.6.1 Wargames

Incorporation of NBC features into relevant simulations, including portrayal of NBC weapons effects commensurate with the simulations purpose and level of battlespace fidelity is essential. Currently, several models which represent the fluid dynamics of NBC contamination are available. However, relatively few robust representations of NBC effects have been fully implemented in the wargaming 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 (CASTFORM) have some NBC capabilities and are continually being improved. JANUS, a division level model, has NBC capabilities that are being improved and updated. Force Evaluation Model (FORCEM) and Tactical Warfare (TACWAR) have been modified for theater level play. Existing NBC play in TACWAR has recently been improved. TACWAR, a theater model has a nuclear capability, but can include approximations of biological effects. TACWAR also has a chemical capability.

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

Each of the services conducts wargames in their respective senior level service schools which incorporate weapons of mass destruction in the scenarios. The Joint Land, Aerospace, and Sea Simulation (JLAS), a joint exercise with all the senior service schools participating, hosted by the Air Force Wargaming Center at Maxwell AFB, Alabama, will for the first time this school year, incorporate electronic simulation of the NBC environment. Additionally, the Chief of Staff of the Air Force's Aerospace Powers Symposium at Maxwell AFB, Alabama used off-line electronic simulations integrated with expert opinions from the Defense Nuclear Agency in November 1993. Finally, the Navy has plans to include realistic NBC situations in all future wargames including the Joint Littoral Wargame, developed by Johns Hopkins University Applied Physics Laboratory, and Total Force 93 sponsored by the Navy Staff at the Navy War College.

5.6.2 Joint NBC Training/Joint and Combined Exercises

In an effort to improve NBC training and add realism to the training, the Joint Staff in Joint Pub 3-11, *Joint NBC Defense Doctrine*, formalizes the doctrine for Joint NBC training and exercises. Although individual training and exercises to test proficiency remain under the purview of the Services, NBC defense will be integrated into individual and collective programs at all levels and into higher echelon operational and tactical exercises, command post and other command, control, and communications system exercises, and joint and combined training exercises. The following discussion provides descriptions of the Services' initiatives to ensure the integration of NBC defense in Joint training and exercises.

Army

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

The Army continues to see positive results in training based on external evaluation of unit Army Training and Evaluation Programs (ARTEPs) conducted at the NTC, JRTC, and other training locations world-wide. These results clearly show and emphasize that through continued training, soldiers can increase their ability to perform combat missions in spite of the degradation caused by the wear of the protective ensemble. Units which (1) have the necessary command support and equipment, (2) balance NBC within their overall training requirements, and (3) execute according to approved training plans perform their overall mission better in a simulated NBC environment. However, increasingly constrained training resources limit training to fundamentals; often this means training for operating in an NBC environment falls into an unfunded category.

Programs of Instruction at branch schools are incorporating more realistic NBC scenarios within situational or field training exercises. This type of instruction is being taught to all soldiers. NBC collective training conducted at the CTCs is increasing the number of NBC events and operations in and around simulated contaminated areas. Rotations at the NTC and JRTC which integrate NBC situations have validated that units do plan for and react to NBC threats and that they can survive and continue to operate in a chemically contaminated environment. Approximately twelve two-week rotations of brigade headquarters with accompanying battalions train at the NTC each year and twelve light infantry battalions train at the JRTC annually. At the JRTC, twenty battalions will train this year. In the past, when units trained at the JRTC, they did not include chemical threat in low-intensity conflict scenarios. A chemical threat was only played in mid-intensity scenarios. Now, the majority of scenarios include a chemical threat.

Air Force

Chemical warfare defense preparedness is an integral part of periodic Operational Readiness Inspections conducted by Major Command 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 MOPP 4. Additionally Air Force units participate in major joint and combined exercises which incorporate realistic NBC situations. Examples of these exercises are:

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

Navy

Due to the unique nature of Naval vessels, NBC defense training is conducted in the same manner whether platforms are operating independently or in a group. Even in a battle group scenario, the task force would still continue with the mission while each unit would conduct NBC defense against certain attacks. Therefore, formal training is conducted by Afloat Training Groups while platforms are operating independently. Required training exercises are conducted by each unit every three months in order to maintain their readiness rating. During scheduled NBC defense training periods, realism is stressed. NBC defense equipment is used extensively. Protective masks and suits are worn by required personnel. All platforms are equipped with a nozzle to spray wintergreen and oil into the local environment to simulate a chemical environment. Even if NBC defense were an integral part of a specific exercise, it would not alter the way the Navy conducts NBC defense training.

Marine Corps

Exercises and operations at all levels include some degree of NBC defense training. The Marine Corps incorporates NBC defense training into combined arms exercises at the Marine Corps Air Ground Combat Training 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 participates in major joint/combined exercises. The level is determined by mission, threat, and task organization. During FY94, the Marine Corps incorporated NBC defense training into such exercises as ULCHI FOCUS LENS, YAMA SUKURA 25, COBRA GOLD Communications Exercise Phase II, BEACH CREST 1-94 and 2-94, and MISTEX 1-94. There were 46 other smaller evaluations (CPX, FEX, TEWT) as well. NBC evaluations are conducted annually for all Marine Corps units. 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.

Simulation

Simulation is also a counterproliferation issue. The JSIG will be designated the focal point for all Joint NBC defense simulations to ensure economy of effort.

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 (P^2NBC^2). These Force Development Testing and Experimentation (FDTE) evaluations have improved our understanding of individual and unit operations and performance degradation while in Mission Oriented Protective Posture (MOPP), and for the first time 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 CANE Implementation Plan (CIP), a systematic review process to ensure identified deficiencies are addressed and corrected. The Commander of the Army's Training and Doctrine Command (TRADOC), reviews the CIP 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 the Third World countries;
- Simulating the NBC environment in training;

- Continuing emphasis and effort to integrate safe, realistic NBC defense in all training;
- Extending wear of MOPP gear in basic and annual training.

5.7.3 AIR FORCE

The Air Force currently has four training and readiness initiatives underway.

The Disaster Preparedness (Civil Engineer Readiness) Technical School moved to Fort McClellan, Alabama during the summer of 1994. The school became operational in October 1994. This move consolidated chemical warfare training for all the Services at one location. Air Force instructors are working closely with the other Services to explore interoperability issues, with an eye towards maximizing the joint aspects of training.

The school is in the validation process for the basic Air Force Specialty Code (AFSC) awarding course. During this validation period, the school is revising all blocks of instruction to ensure they are providing the most current, credible and realistic training possible. The school has an on-going program wherein the scientific reports from each NBC testing facility are analyzed and lesson plans are updated as new information becomes available.

The technical school will begin development of a Readiness Flight Officer training course and an advanced course for enlisted personnel in the coming year. These courses will provide flight leaders the background they need to effectively lead and manage Readiness Flight operations, and will provide mid-level non-commissioned officers the detailed, technical information they need to successfully conduct contingency response operations.

The technical school and Civil Engineer Readiness personnel on the Air Staff are working to include live-agent training in the various Air Force courses. If approved, the school will train Air Force instructors to conduct classes at the Chemical Defense Training Facility (CDTF). Ultimately, every person in the career field will attend live agent training, either through the basic or the refresher course.

The Air Force is developing a computer-based training program for certification testing of NBC specialists. Training will be conducted through audio-visual products and instructional text. The program will test the student, provide the student feedback on areas that require further study, record test results, and serve as a record for the supervisor. This system will also allow individuals to continue their training under field conditions using laptop computers.

5.7.4 NAVY

The Navy's main initiative for NBC defense training is the Integrated Damage Control Training Technology Program. This effort focuses on developing integrated organic shipboard training capabilities that will enhance the Navy's capability in NBC defense. Crew members using a self paced interactive software package will be instructed in a variety of areas at various levels. Senior leadership will be able to monitor individual progress through computer printouts.

The ultimate goal is to train respective crews in a quick yet effective manner while increasing the basic level of knowledge.

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.

Finally, the Navy is researching how to fight fires in a chemical environment on the Damage Control research and development platform, the Ex-Shadwell.

5.7.5 MARINE CORPS

During FY94, the Marine Corps' training initiatives centered on two areas: casualty decontamination operations and staff planning. Many exercises included both. Unit Standard Operating Procedures (SOPs) were updated to include lessons learned from operations in Southwest Asia. An additional area that received much attention during FY94 was joint operations. This area will be of continued interest through FY95 and beyond.

Marine Corps initiatives for FY95 include:

- Establishment of an NBC Staff Planning follow-on course, a training course to prepare NBC defense officers and NCOs to assist in the staff planning process. The purpose of the course is to learn how to develop courses of action and prepare estimates of the situation involving NBC weapons threat.
- Establishment of combat training package for ISMs for reserve forces and follow-on forces in the event of hostilities involving an NBC threat.
- Consolidation of control of all Fleet Marine Force NBC defense schools under Marine Corps Combat Development Command (MCCDC).
- Integration of NBC defense procedures in Mission Oriented Tasks (Garrison and Field).
- Conduct of joint Marine Corps and Navy shipboard decontamination exercises with 7th Fleet.
- Development of bilateral exchange program with the Republic of Korea (ROK) Chemical Corps.

The MCCDC has begun planning for a Biological Defense Wargame. The wargame will be hosted by MCCDC with all Services participating. Lessons learned will be used to develop operational concepts for biological defense.

5.8 READINESS REPORTING SYSTEM

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

issues. It was included in a revision to MOP 11 in December 1992, and is one of many changes to SORTS which will be implemented by the Services.

The Services individually monitor their SORTS data to determine the type of equipment and training needing attention. The SORTS reporting and data collection of measured unit chemical and biological equipment and training status is still being refined and should produce useful data in the near future.

Additionally, under CJCS MOP 53 and Joint Pub 1-03.31, *Preparedness Evaluation System*, the Commanders in Chief (CINCs) of the unified commands are required to report on NBC defense concerns and deficiencies in their biennial CINCs Preparedness Assessment Reports (CSPARs). This information is contained in the data base maintained by the Joint Staff, and used by the Joint Staff, Services and DoD planners.

5.9 NBC DEFENSE TRAINING AND READINESS ASSESSMENT

*** DoD lacks a feedback mechanism on the status of training, equipment, and readiness. It needs a mechanism for assessing operational force capabilities from both the Department perspective and the operational/CINC perspective.**

***SOLUTION*:** Develop and implement adequate NBC defense reporting information in the Joint Status of Resources and Training System (SORTS) currently in use by the Joint Staff and the CINCs.

*** DoD lacks integrated Joint NBC defense doctrine.**

***SOLUTION*:** Initiatives are underway for the development of Joint NBC defense doctrine beginning in FY95. The Joint Service Integration Group is responsible for the development of this doctrine under the sponsorship of the Joint Staff.

*** Funding for Joint NBC defense doctrine, simulation and training development is not reflected in the NBC defense program budget.**

***SOLUTION*:** OSD has identified funding for these initiatives in the FY96 CBD budget. Efforts are underway in the current DoD programming cycle to establish long term support.

*** There are limited WMD features in wargaming and planning models.**

SOLUTION: Funding for this program is identified beginning FY96. Efforts are underway in the current DoD programming cycle to establish long term support.

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CHAPTER 6

PREPARATIONS FOR THE CHEMICAL WEAPONS CONVENTION

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6.1 DEPARTMENT OF DEFENSE PREPARATION

The Department of Defense (DoD) has set up a functional Implementation Working Group (IWG) to plan for implementation of the Chemical Weapons Convention (CWC) and related chemical weapons (CW) agreements. Through regularly recurring meetings, representatives of the Office of the Secretary of Defense (OSD), the Joint Staff, the Military Services, and DoD agencies and activities conduct meaningful planning and coordination to ensure successful implementation of the CWC and related bilateral CW agreements. Formal meetings of the CWCIWG are scheduled monthly and *ad hoc* meetings are conducted as needed to address short-notice requirements.

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

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

In accordance with the DoD Master Program Plan for Research, Development, Test and Evaluation for Arms Control, the Defense Nuclear Agency (DNA) directs the DoD research and development effort to ensure that arms control verification proceeds using the most effective technology available.

OSD, the Joint Staff, the Military Services, OSIA and DNA have provided technical experts to support activity at the CWC Preparatory Commission (PrepCom) in The Hague, The Netherlands on a recurring basis. The PrepCom is charged with developing procedures and implementing the international forum, the Organization for the Prohibition of Chemical Weapons (OPCW), which will oversee international compliance with the CWC. These discussions focus on all requirements of the CWC, including those outlined in Article X of the CWC, “Assistance and Protection Against Chemical Weapons.”

OSD and the Joint Staff have provided representation and OSIA has provided operational advice to US negotiating delegations in Moscow for completion of CW bilateral implementation protocols. Implementation of Phase II of the historic Wyoming MOU was initiated in January 1994 and completed in December 1994. Negotiation of the protocols to enable implementation of the Bilateral Destruction Agreement (BDA) continues.

6.2 TRAINING FOR INSPECTORS

OSIA has prepared a corps of US inspectors and escorts to conduct activities in support of the CWC and related CW agreements. The OSIA training program for both OSIA cadre and

augmentees from Defense agencies and throughout the US Government includes one week of classroom instruction in the Washington area (Module I), one week of field safety training (including operation in a toxic-agent training facility) at Fort McClellan, Alabama (Module II), and specialized training (including specialized equipment and technical training, team and collective training, and CW specific language training) at various locations. To date, 801 persons have been trained through Module I (six courses) and 416 persons qualified through Module II (13 courses). The major emphasis of the OSIA effort in support the CWC has been directed at bilateral CW agreements between the US and the Russian Federation. These bilateral agreements are intended to support and facilitate the CWC.

Building upon the OSIA training model, DNA and the Army Chemical School (supported by OSIA) have developed training courses for international experts who will conduct inspections under the CWC. To date, two pilot courses have been conducted to refine the curriculum for a basic (core level) course. Development continues for advanced technical specialty courses which will prepare inspectors for inspections at highly specialized facilities.

6.3 PREPARATION OF DEFENSE INSTALLATIONS

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

OSIA has expended nearly 6,300 man days conducting site visits, field training exercises, bilateral CW agreement inspections, and other on-site activities (over 158 separate events) in preparation for the CWC and related CW agreements. OSIA has visited, on a recurring basis, every DoD CW-related facility in the US that will be declared under the CWC. In addition to assistance visits and routine training exercises, a total of 64 mock inspections and five inspections under a bilateral CW agreement have been conducted at US facilities over the past three years. Activity is continuing to ensure that all US DoD facilities are in full compliance with the applicable CW mandates.

6.4 PREPARATION OF DOD-CONTRACT INSTALLATIONS

In the event of CWC inspection of DoD-contract activities, the Defense Treaty Inspection Readiness Program (DTIRP), for which OSIA is the DoD Executive Agent, has a trained cadre of technical experts from the security countermeasures and counterintelligence community to assist defense contractors in preparing for a CWC challenge inspection. The DTIRP personnel have conducted CW vulnerability assessments and site assistance visits, and have participated in numerous mock inspections and table top exercises. In order to assist program and facility managers, OSIA has developed a sophisticated arms control risk

assessment model designed to address risks to national security and proprietary information. The DTIRP system enables the assessment of susceptibility, as well as vulnerability, and the determination of the level of preparation needed to protect critical technologies, sensitive programs, and capabilities.

OSIA has implemented an extensive outreach program to provide information about the CWC, security countermeasures, facility preparation, and DTIRP to both government and DoD industry. OSIA provides training and awareness services through such fora as industry seminars, mobile training teams, mock inspections, tabletop exercises, industry associations, national conventions and symposia. DTIRP speakers participated in more than 50 outreach events during the last fiscal year. OSIA also publishes various educational products (printed and video) and administers electronic bulletin boards to provide information concerning the CWC to government and industry.

Through DTIRP, OSIA maintains an operational capability to deploy counterintelligence personnel and specialized equipment to support assistance teams at challenged facilities on short notice. DTIRP is an integral support element to the Military Services, Department of Energy, and others for CW challenge inspections at their undeclared, as well as their declared, facilities. This capability will be available to support DoD and government contractors during implementation of the CWC.

6.5 WYOMING MEMORANDUM OF UNDERSTANDING (MOU)

Implementation Protocols of the bilateral Wyoming MOU were signed in Moscow in January 1994. Correspondingly, detailed CW data on the US CW stockpile was compiled by the Joint Staff and provided to the Russians in the late Spring 1994. In exchange, Russian CW data was received and a series of inspections to confirm the accuracy of the data was conducted by both sides between August and December 1994. Five inspections were conducted in each country. OSIA provided inspection teams and equipment for the inspections conducted in Russia and escort teams for inspections of US facilities. OSIA also conducted equipment certification and subsequent pre- and post-inspection technical equipment examination of the Russian inspection equipment. These technical equipment examinations provided assurances to inspected sites that the Russian equipment posed neither security nor safety risks. The DoD is compiling a lessons-learned report from the regime for applicability to the BDA and the CWC.

6.6 COOPERATIVE THREAT REDUCTION (CTR)

The CW Destruction Assistance Project was established as a part of the CTR Program under a July 1992 agreement between the US DoD and the Russian Federation President's Committee on Conventional Problems of Chemical and Biological Weapons. This project is the primary vehicle for DoD to provide assistance to the Russian Federation's efforts to destroy their CW stockpile. This effort is consistent with both the US-Russian BDA and the CWC. DNA, under the staff supervision of the Assistant to the Secretary of Defense for Atomic Energy, is the DoD lead agency for implementing this and all other CTR projects.

Russian has declared a CW stockpile of 40,000 metric tons located at seven sites, the bulk of which (32,500 metric tons of nerve agent) is located at five of these sites. The declaration states that all nerve agents are weaponized in bombs, spray tanks, missile warheads, artillery projectiles, and rocket warheads.

The CW Project is focused on facilitating and expediting the safe disposal of the Russian CW stocks in a time frame which generally parallels the US CW demilitarization schedule and meets Russian obligations under the CWC and the BDA. It should be noted that, although this program is guided by provisions and requirements of both the CWC and the BDA, it is a stand alone effort and is not dependent on the ratification of either of these agreements by US and Russian legislators. Components of the project are listed as follow:

- Development of a comprehensive concept plan, to include systems analysis and design, for the Russian CW destruction program.

- Provision of detection devices and analytical and alarm systems to support the destruction concept.

- Establishment of a familiarization/intern program designed to acquaint Russian CW experts with the US demilitarization program.

- Visits by Russian technical representatives to CW destruction facilities in the US.

- Demonstration of US protective equipment and conduct of any training or tutorials required.

- Establishment of a Central CW Destruction Analytical Laboratory to support the Russian CW destruction program.

- Accomplishments of the project to date include the following:

- Establishment of the CW Destruction Support Office (CWDSO). This office was established on 15 June 1993 in Moscow and is staffed by US Government personnel (Army, OSIA, and DNA), US contractor experts, and Russian nationals. The primary purpose of the CWDSO is to facilitate continued discussions and to coordinate and plan US destruction efforts.

- Initiation of exchange visits by the US Army to provide Russian officials information on the US CW stockpile disposal program. The focus of these visits is to give Russian officials confidence that CW destruction can be done safely.

- Establishment of a Russian public affairs program to deal with the concerns of the people in areas surrounding potential destruction sites. This program resulted from US observations made during the initial exchange visits. US input to this effort is being coordinated by the Army, OSIA, and the CWDSO.

- Implementation of a Russian intern program. OSIA provided escort, linguistic, and related logistic support services for the extended training of six Russian interns in techniques of CW destruction at three US Army facilities which began in September 1993 and ended in March 1994.

- Award of a $7 million-plus contract in May 1994 to Bechtel National, Inc. of San Francisco to assist the Russian Federation in developing a comprehensive plan for CW destruction.

There are several issues currently under discussion which will govern the next steps in this project. Meetings were held in mid-January 1995 to resolve issues on construction of the Central Analytical Laboratory. In addition, the US has offered to design and construct a pilot-scale CW destruction facility to test the candidate technologies for the Russian CW destruction program. Agreement on these two initiatives will govern the pace and direction of the evolution of this important project under the CTR Program.

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ANNEX A

JOINT CONTAMINATION AVOIDANCE PROGRAMS

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Automatic Detectors and Monitors

Chemical Agent Monitor (CAM)/Improved CAM - Production

Rationale:

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

Key Requirements:

- Monitor low levels of nerve and blister agents
- Be lightweight and operate as a hand-held monitor
- Differentiate between nerve and blister agents
- Be unaffected by common battlefield interferences

Description:

The CAM is a hand-held device for monitoring chemical agent contamination on personnel and equipment. It monitors vapors of chemical agents by sensing molecular ions of specific mobility (time of flight) and uses timing and micro-processor techniques to reject interferences. The monitor discriminates between the vapors of nerve and mustard agents. The CAM consists of a drift tube, signal processor, molecular sieve, membrane, and expendable such as batteries, confidence tester, and dust filters. The improved CAM (ICAM) significantly reduces the level and frequency of maintenance without effecting the CAM's 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.

XM22 Automatic Chemical Agent Detector Alarm (ACADA) - RDTE (FUE FY 97)

Rationale:

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

Key Requirements:

- Detect and identify nerve and blister agents
- Operate in area warning or survey/monitoring roles
- Be man-portable and programmable for new agents

Description:

ACADA is a man portable, point sampling alarm system that provides significant improvements over current capabilities; it detects, identifies and quantifies all nerve agents, mustard and lewisite. 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 M1 CAM as a survey instrument. The ACADA

development effort is focused on selecting an off-the-shelf Non-Developmental Item (NDI) which best satisfies the user requirements.

Agent Water - RDTE

*The Agent Water has been **tentatively** planned as a cooperative RDTE effort, chartered to develop a family of monitors which will detect chemical agents in water. The monitors will feature multi-agent detection, and operate automatically, improving both ease and response time of existing systems. The project will accommodate the four services' requirements for the following:*

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

Rationale:

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

Key Requirements:

- Detect and identify nerve and blister agents in water
- Perform continuous and automatic monitoring
- 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, lightweight, and easy to use, and be decontaminated to a negligible risk level.

Joint Service Chemical Miniature Agent Detector (JSCMAD) - RDTE

The JSCMAD is a fully cooperative RDTE effort, chartered to develop a family of miniature chemical agent detectors. The family of detectors will provide individual 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:

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

Key Requirements:

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

Description:

The JSCMAD will first consist of a small lightweight device to be worn by individual personnel to warn them of a chemical agent attack. Secondly, it will consist of a system that will detect, identify, quantify and warn of the presence of nerve agents and blister agents in vapor form in aircraft interiors. Thirdly, it will consist of a shipboard monitor, capable of detecting nerve agents and blister agents on personnel and in compartments, free of false alarms which are caused by shipboard interferents.

Biological Point Detection - RDTE

Biological Point Detection is a fully cooperative RDTE effort chartered to develop new Biological point detectors and detection systems for quad-services. The program is managed by JPO-BD and will yield two detector variants:

A. Interim Biological Agent Detector (IBAD)/ Biological Agent Detection System (BADS)
B. Biological Integrated Detection System (BIDS)

The BADS and IBADS will be stand-alone systems, while the BIDS effort will encompass development of an integrated system as well as several stand-alone biological detectors:

Biological Detector - RDTE (BD)
Biological Detection and Warning System (BDWS)
Chemical and Biological Agent Sample Kit (CBASK)
Chemical and Biological Mass Spectrometer (CBMS)

Interim Biological Agent Detector (IBAD) - RDTE Prototype
Biological Agent Detection System (BADS) - RDTE (FUE FY 01)

Rationale:

Navy, Air Force, Marine Corps (Requirement)

Key Requirements:

- Automatic point detection and identification of biological warfare agents (IBADS)
- Automatic point detection and classification of biological warfare agents (BADS)
- Automatic stand-off detection of biological warfare agents while ship is underway (BADS)
- Portable monitor for decontamination assessment of biological warfare agents (BADS)
- Operate in a shipboard environment; operated/maintained by ship's force

Description:

IBAD will provide a near term solution to a deficiency in shipboard detection of biological warfare agents. IBAD consists of a particle sizer/counter, particle wet cyclone sampler and a detection unit which uses improved membrane calorimetric tickets (flow-through assay). It is a rapid prototype system scheduled for imminent fielding, tailored to shipboard applications.

BADS will detect in real time biological and toxicological warfare agents at concentrations below incapacitating doses and alarm locally and remote. It will consist of an automatic point detector, remote detector, and portable monitor, each capable of detecting and identifying biological and toxicological warfare agents.

Biological Integrated Detection System (BIDS) - RDTE (Interim FUE FY 97)

Rationale:

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

Key Requirements:

- Detect and identify 5 to 25 agent-containing particles/liter of air (alpha) in the 2-10 micron range in 15-30 minutes
- Provide agent identification, classification and concentration
- Provide collective protection with environmental controls (BIDS)
- Knowledge-based system to process detector information (BIDS)
- FM/HF radios to communicate (BIDS)
- Automatically detect and warn of biological pathogens and toxins (BD, BDWS)
- Detect liquid samples of specified materials (CAT A of ITF-6 Report) (BD)
- Reject common battlefield interferents and re-programmable to detect new agents (BD)
- Be data-linked with a centralized hazard information data collection center (BDWS)
- Characterize new agents; detect, identify, and semi-quantitate CB agents (CBMS)
- Respond to agent vapors, aerosols or liquid droplets (CBMS)
- Have detection thresholds at or below human response levels (CBMS)
- Possess modules to accommodate future advances in technology and CB threat (CBMS)

Description:

BIDS uses a multiple technology approach, both developmental and off-the-shelf materiel, to detect biological agents with maximum accuracy. The interim BIDS is a vehicle-mounted, fully integrated biological detection system. The system, which is collectively protected and housed in a HMMWV shelter, is modular to allow component replacement and exploitation of "leap ahead" technologies. The BIDS program will include a P^3I system which will 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.

The BD is an antibody based, automatic aerosol sampling device capable of detecting specific biological agents on demand. It consists of electronics processing equipment, fluid processing modules, reservoirs for antibody reagents, and a light addressable potentiometric sensor to provide biological detection and identification. The total processing time, from insertion of sample, will be approximately 15 minutes at threshold concentrations. The BD 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. The BDWS will consist of two systems: a unit detector (capable of identifying particular agents), and a miniature individual detector (capable of detecting a class of agents). The CB Agent Sampling Kit (CBASK) will consist of a secure container for safely transporting and preserving agent samples.

The 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 a sample identification device. The mass analyzer chassis houses the mass analyzer, pumps, control electronics, and computers. With the aerosol sampling 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.

Stand-off Detection

XM21 Remote Sensing Chemical Agent Alarm (RSCAAL) - RDTE (FUE FY 97)
M21 Remote Sensing Chemical Agent Alarm (RSCAAL)

Rationale:

Army, Marine Corps (Requirement)

Key Requirements:

- Stand-off detection of nerve and blister agent clouds at line-of-sight distances up to 5 km
- Stand alone surveillance (M21)
- On-the-move operations in reconnaissance (on an NBC reconnaissance vehicle) (XM21)

Description:

The M21/XM21 RSCAAL is an automatic scanning, passive infrared (IR) sensor which detects nerve and blister agent vapor clouds based on changes in the infrared spectrum caused by the agent cloud. It is effective at line-of-sight distances of up to 5 kilometers. The alarm is used for surveillance and reconnaissance missions in both vehicle-mounted and tripod-mounted modes. The detector can scan horizontally 60 degrees. It will be used in the stationary mode for reconnaissance and surveillance missions to monitor avenues of approach and egress, bridges, road junctions, and other point targets to search areas between friendly and enemy force for chemical agent vapors, and to provide advanced detection and warning of chemical hazards. The M21 RSCAAL is a two-man portable, stand-alone tripod-mounted, chemical agent overwatch system. The XM21 is a vehicle mounted system, and will be capable of on-the-move operations.

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

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

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

Rationale:

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

Key Requirements:

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

Description:

The 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 and compact and operate both from a stationary position and on-the-move. The JSLSCAD Michelson interferometer employs a passive infrared system that will detect the presence of chemical agents by completing a spectral analysis of target vapor agent chemical clouds.

Joint Service Chemical Warning and Identification LIDAR (JSCWILD) - RDTE

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

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

Rationale:

Army, Air Force (Requirements)

Key Requirements:

- Automatically detect, range, and map chemical warfare agents at distances of up to 3 km
- Scan atmosphere and terrain to detect chemical vapors, airborne liquids and particles, and ground contamination
- Provide stand-off capability for both fixed site and reconnaissance
- Provide rapid agent concentration mapping

Description:

The JSCWILD will be a lightweight, vehicle-mountable, contamination monitoring system which detects and quantifies, from a distance of 3 kilometers, all types of chemical agent contamination, (including agent rain, vapors, aerosols, and ground contamination), in a stand-off mode. The JCSWILD 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 Stand-off - RDTE

The Biological Stand-off is a fully coordinated joint service program, chartered to develop a biological warning and identification system for the quad-services. The Biological Stand-off will utilize an ultraviolet (UV) and laser induced fluorescence (LIF) technologies to satisfy requirements for:

Long Range Stand-off Bio-Detection System (LRSBDS)
Short Range Stand-off Bio-Detection System (SRSBDS)
Strategic Biological Detection System (SBDS)

Rationale:

Army, Navy (Requirements)
Air Force (Interest)

Key Requirements:

- Standoff detection and limited identification of all biological agent aerosol clouds at a range of 5–20 km
- Discrimination between non-biological and biological agent aerosol clouds
- Provides relative concentration, range, location and tracking of biological aerosol clouds Mountable/dismountable on ground and/or aerial platforms

Description:

The Biological Stand-off program will yield strategic, long and short range stand-off detection systems. LRSBDS (picture shown), SRSBDS, and SBDS will be stand-alone aircraft, or a ground vehicle mounted short to moderate range stand-off biological aerosol detector. SRBSDS uses UV laser and LIF technologies to provide detection of aerosol clouds containing biological material as well as providing relative concentration, range, and tracking of the cloud. The system, which is expected to be approximately 800 pounds and three cubic meters, has three major components: a pulsed UV laser transmitter operating at between 260 and 300 nanometer wavelength; a receiver and telescope; and an information processor and display.

NBC Reconnaissance

M93 NBC Reconnaissance System (NBCRS) Interim System - Production (FUE FY 92)

Rationale:

Army, Marine Corps (Requirement)

Key Requirements:

- Armored vehicle with collective protection
- Chemical agent point detectors and monitors
- Radiation detector and monitor
- Integrate navigation and secure communications systems

Description:

The XM93 is a dedicated system for NBC detection, warning, and sampling equipment integrated into a high speed, high mobility armored carrier capable of performing NBC reconnaissance on primary, secondary, or cross-country routes throughout the battlefield. The XM93 can find and mark chemical and nuclear contamination. Through secure communications system, it provides warnings to follow-on forces. The crew is protected by an on-board overpressure system.

Joint Service NBC Reconnaissance (JSNBCRS) - RDTE

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

XM93E1 NBC Reconnaissance System (NBCRS) System Improvement Phase (SIP) - RDTE
Light NBC Reconnaissance System (LNBCRS)
Lightweight Reconnaissance System (LWRS)

Rationale:

Army, Marine Corps (Requirement)

Key Requirements:

- Armored vehicle with over-pressure collective protection and macro cooling
- Chemical agent stand-off and point detectors and monitors
- Radiation detector and monitor
- Integrate central data processor with all detectors and monitors; navigation and communications systems; jam resistant communications system 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 XM93E1 is a system improvement phase (SIP) to upgrade the XM93 to detect chemical contamination in its immediate environment using the XM21 RSCAAL stand-off detector. It will automatically integrate contamination information from sensors with input from on-board navigation and meteorological systems. It rapidly transmits hazard warnings via a central data processor, a commander's display, a keyboard, and integrated digital jam-resistant communications. The SIP will also replace the MM1 with a CBMS. The XM93E1 permits reducing the crew from four to three individuals. For the first time this program also develops and fields organic maintenance for the FOX NBCRS.

The LNBCRS 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.

Radiacs

AN/VDR-2 Radiac Meter - Production

Rationale:

Army, Marine Corps (Requirements)

Key Requirements:

- Lightweight, and man-portable
- Measures gamma radiation from 0.01 microGrays/hour to 9,999 centiGrays/hour
- Measures beta radiation from 0.001 centiGrays/hour to 5 centiGrays/hour

Description:

The AN/VDR-2 is a digital, auto-ranging dose-rate meter and dosimeter providing detection and measurement of gamma and beta radiation. The major components of the AN/VDR-2 are the radiac meter, probe (which contains gamma sensing Geiger-Mueller tubes), pouch with strap, and the converter cable receptacle. The dose rate is displayed on a three-digit liquid crystal display. The radiac meter has the capability of time-integrating the dose-rate counts displaying the cumulative dose on command. The AN/VDR-2 detects beta radiation and measures gamma contamination (at tactical levels as well as low-dose rates in equipment, supplies, personnel, food and water. Other features available are alarm setting and check, audio-visual alarms, instrument and battery test, attenuation factor set, push-to-read external dose-rate, auto-ranging and illumination of display. The instrument is powered by three BA-3090 batteries when hand-carried or 24V batteries when vehicular mounted or continuous monitoring. The AN/VDR-2 radiac meter is currently being fielded. The AN/VDR-2 is replacing the AN/PDR-27, AN/PDR-63, and the IM-174/PD. The AN/VDR-2, by replacing the above systems, will provide the Marine Corps with a more accurate and reliable radiac meter capable of detecting and measuring both gamma and beta radiation.

Multi-Function Radiation (MFR) Detector - RDTE (FUE FY 96)

Rationale:

Air Force (Requirement)

Key Requirements:

- Capable of detecting and measuring nuclear radiation (alpha, beta, gamma, neutron and x-ray), including low peacetime rates, and dosimeter measurements
- Lightweight, portable system
- Must issue an audible alarm when radiation is detected
- Must be accurate within ±15 percent, and have a response time ranging from 2-5 seconds
- Must be able to operate under field conditions, including during blackout, while in motion, and be ruggedized to prevent damage due to shock or vibration

Description:

Program will target an off-the-shelf buy of 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. Milestone III was achieved in October 1994 and full scale of the MFR is expected will commence FY95.

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ANNEX B

SERVICE UNIQUE CONTAMINATION AVOIDANCE PROGRAMS

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Automatic Detectors and Monitors

Automatic Vapor Agent Detector (AVAD) - Production

Rationale:

Air Force (Requirement)

Key Requirements:

- Detect and identify chemical agents in vapor form
- 95% probability of detecting vapor agents present
- No more than one false alarm in 24 hours, desired: 1 in 100 hours
- Lightweight, transportable by one person in full individual protective equipment

Description:

Adds automatic vapor agent detection capability with minimal development to current capability. Operation Desert Storm highlighted the urgent need to add automatic mustard agent detection capability to current detection capabilities. Current detection capability, using M256 kits, is time-consuming and manual. Current procurement efforts have selected the M90 manufactured in Finland as the "best available." Results of the operational field test will provide a benchmark for follow-on procurement efforts.

Shipboard Automatic Liquid Agent Detector (SALAD) - RDTE

Rationale:

Navy (Requirement)

Key Requirements:

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

Description:

SALAD is an exterior, liquid agent point detection and monitoring system that will detect and alarm in the presence of liquid nerve and blister agents. SALAD will consist of a detector unit that uses chemically treated paper, optical scanners, a central processing unit and alarms (visual and audible) on the bridge and Damage Control Central. Milestone II was achieved on 4 May 1993. Procurement is scheduled for FY97.

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

Rationale:

Navy (Requirement)

Key Requirements:

- Discriminate between nerve and blister agents along with standard shipboard interferents (AFFF, POLs, *etc*.)
- Provide automatic nerve and blister vapor agent detection
- Operated/maintained by ship's force
- Operate in a shipboard environment
- Detect while ship is underway

Description:

Using dual-cell ionization mobility spectroscopy technology, IPDS is being developed to replace CAPDS. IPDS is a fully automatic fixed point air sampling and detection instrument designed to detect nerve and blister agent vapor contamination in the exterior atmosphere around a ship. The software includes a library of signatures representative of both agents and commonly used chemical compounds found on ships called interferents. By comparing the ion-generated signatures of various compounds observed by IPDS with those in the library, the system is able to avoid false alarms.

Warning

Automated NBC Information System (ANBACIS) - RDTE

Rationale:

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

Key Requirements:

- Automates NBC warning and reporting system
- Functional component on C2 systems from company to theater
- Utilizes other functional components on parent C2 system
- Real-time weather and terrain effected hazard predictions
- NBC operations expert systems
- Links to sensors through MICAD

Description:

ANBACIS, in conjunction with MICAD and residing on parent C2 systems, ultimately will integrate every NBC sensor on the battlefield into a single theater wide sensor array to provide real-time NBC warnings to commanders before casualties can result. Marine's NBC

HAZWARN performs similar function. Joint agreement has been tentatively reached to merge ANBACIS and HAZWARN programs in the near-term.

NBC Hazard Information and Warning System (NBC HAZWARN) - RDTE

Rationale:

Marine Corps (Requirement)
Army (Interest)

Key Requirements:

- Accepts NBC 1, 2, and 4 reports
- Capable of producing NBC 3 and 5 reports in accordance with ATP-45
- Capable of printing NBC weapon effects overlays
- Capable of interacting with MAGTF command and control systems

Description:

The NBC HAZWARN system is intended to be used as an early warning system capable of providing Marines and their units with early indications that an NBC attack is taking place. NBC HAZWARN will consist of NBC detectors with transmitter interface, a personal computer with receiver interface, and software. The NBC HAZWARN system will automate what used to be a slow and unreliable means of spreading the word that an NBC attack had taken place. Product improvements will allow further development of the NBC HAZWARN system.

Multipurpose Integrated Chemical Agent Detector (MICAD) - RDTE (FUE FY 00)

Rationale:

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

Key Requirements:

- Interface with existing and developmental NBC sensors, detectors, alarms and communications systems at Battalion level and below
- Provide automatic transmission of NBC alarms and data in NBC message format
- Chemical monitoring of internal and external air samples for vehicles, vans and shelters
- Initiate audible and visual alarms to warn personnel when NBC contaminants are detected
- Provide NBC-1 or NBC-4 reports to the Maneuver Control System (MCS) - Automated Nuclear, Biological, and Chemical Information System (ANBACIS) at lowest MCS node

Description:

The MICAD system consists of the following developmental components: a display/control, a sample transfer system and telemetry link. The MICAD interfaces with the M8A1 Chemical Agent Alarm; the XM22 ACADA; the AN/VDR-2 Radiac Set; other existing and developmental NBC detectors, existing and future command and

control (C2) radios, and vehicle navigation systems. The display/control monitors and displays data received from the NBC detector or via the C2 radio net and automatically formats and transmits an NBC-1 or NBC-4 report upon NBC hazard detection. For vehicles, vans, and shelters, the internally mounted CB detector uses the sample transfer system to sample internal and external air. For battlefield ground units, the MICAD telemetry link allows the transmission of NBC alarms and information from remote chemical detectors to the display/control for processing into a NBC-1 Report.

Radiacs

AN/PDR-75 Radiac Set - Production

Rationale:

Army (Requirements)

Key Requirements:

- Lightweight, and man-portable
- Detects and measures individual exposure of accumulated neutron induced and gamma radiation

Description:

The AN/PDR-75 consists of the Detector, Radiac DT-236/PDR-75, and the Computer Indicator (CP-696/PDR-75). The Radiac Computer Indicator is designed to measure accumulated neutron and gamma radiation dose. The Radiac Detector is worn by personnel who may be exposed to radiation from tactical nuclear weapons. The DT-236/PDR-75 is the individual wrist-watch dosimeter, and the AN/PDR-75 is the device used to read the DT-236. The readings provided by these instruments will be recorded on a radiological chart and used to confirm or alter the radiation status of the unit, and to serve as a guide to the commander in planning to control exposures so that units or individuals with the lowest exposure can be used where operations must be carried out in radiologically contaminated areas.

Point Radiation Detector System - RDTE

Rationale:

Navy (Requirements)

Key Requirements:

- Dosimeter capability of 0–999 cGy (neutrons/gamma-prompt initial and fallout)
- Rate meter capability of 0.1–999 cGy/hr (gamma fallout)

Description:

The Point Radiation Detector System is a compact, hand-held, tactical device capable of measuring the gamma dose-rate and gamma/neutron cumulative dose in a battlefield environment. Its pocket size permits convenient use by troops on foot.

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

Rationale:

Army (Requirements)

Key Requirements:

- Dosimeter capability of 0–999 cGy (neutrons/gamma-prompt initial and fallout)
- Rate meter capability of 0.1–999 cGy/hr (gamma fallout)
- Alarm setting capability for dose and dose-rate
- Mission dose capability
- Digital readout and night visibility (secure lighting)

Description:

The AN/UDR-13 Pocket RADIAC is a compact, hand-held, tactical device capable of measuring the gamma dose-rate and gamma/neutron cumulative dose in a battlefield environment. Its pocket size permits convenient use by troops on foot. Alarms 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.

Stand-off RADIAC System - RDTE

Rationale:

Army (Requirements)

Key Requirements:

- Automatically detect and measure from 10 km gamma radiation (1-1000cGy/hr)
- Data processing and storage
- Compact and lightweight

Description:

The Stand-off RADIAC accurately and automatically measures radiation in the air and on the ground from distances of 10 kilometers. The compact, lightweight system will be tripod or vehicle mounted. It will determine range and position of gamma radiation and store the data on a removable-media memory module. It will transmit data via secure radio to field commanders to plan operations and unit movements.

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ANNEX C

JOINT FORCE PROTECTION PROGRAMS

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JOINT SERVICE PROTECTION

Integrated

21st Century Land Warrior - RDTE

Rationale:

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

Key Requirements:

- Protection from all threats
- Integrated vision, communication, and locator systems and enhanced equipment interface

Description:

The 21st Century Land Warrior is an integrated soldier defense system which will improve the warfighter's combat system interface and ability to detect, recognize, and destroy enemy soldiers and equipment. Monitors and protection systems are integrated into a full body ensemble along with advanced location, communication, micro-computer, and vision systems to maximize the warfighter's battlefield awareness, survivability, and lethality.

Respiratory

M40/M40A1 Protective Mask - Production
M42/M42A1 Combat Vehicle Mask - Production

Rationale:

Army, Marine Corps (Requirements)

Key Requirements:

- Respiratory protection from all CB warfare agents
- Enhanced comfort and external filter/canister
- Improved communication system and canister interoperability (M42A1)
- Quick Doff/Second skin hood, improved vision correction, and laser ballistic eye protection

Description:

The M40 (shown at right) and M42 (shown below) protective masks provides respiratory-eye-face protection from tactical concentrations of CB warfare agents, toxins and radioactive fallout particles. The mask consists of a silicone rubber face-piece with an inturned peripheral face seal and binocular rigid lens system. It accommodates canisters which meets all NATO standards for inter-operability. The filter is face-mounted and can be worn on either cheek. Microphones and air adapters are provided for combat vehicle

applications. The M40 is designed for the individual warfighter while the M42 is designed for combat vehicle crewmen. The M40A1/ M42A1 communication system and canister interoperability enables conversion of the M40 Mask to a combat vehicle compatible M42 Mask. The communication system includes speech amplification and microphone interchangeability. The second skin hood improves the mask's NBC survivability, while new eye-lens outserts provide laser ballistic eye protection.

MCU-2/P, MCU-2A/P Protective Mask - Production

Rationale:

Navy, Air Force, Marine Corps (2/P only) (Requirements)

Key Requirements:

- Respiratory protection from all chemical and biological agents
- Enhanced comfort and field of view

Description:

The MCU-2/P and MCU-2A/P masks provide respiratory-eye-face protection from tactical concentrations of CB warfare agents, toxins and radioactive fallout particles. It accommodates a canister which meets all NATO standards for interoperability. The filter is face-mounted (gas and aerosol filter) and can be worn on either cheek. The mask consists of a uni-molded, silicone rubber face piece, a single polyurethane visor, a polycarbonate covering for the visor which provides additional abrasion protection. It can be worn over spectacles and the flexible lens permit the use of binoculars, a gun sight or other optical equipment. The mask has a drink tube and two voice emitters: one for face-to-face speech and one for use with communication equipment. The MCU-2A/P has an improved voicemitter.

A/P22P-9(V) - Production

Rationale:

Navy, Marine Corps (Requirements)

Key Requirements:

- CB protection compatible with a large variety of aircraft systems; integral hood and mask

Description:

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

MBU-19/P Aircrew Eye/Respiratory Protection (AERP) - Production

Rationale:

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

Key Requirements:

- Improved visibility, fit, chemical protection and comfort
- Weapon system interface and ejector seat compatibility

Description:

This system is a second generation chemical defense system that is designed to improve visibility, fit, protection, and comfort. The system includes a mask and hood, blower unit, intercom unit and passive anti-drown device. The bromobutyl rubber hood incorporates a standard oxygen mask, clear plastic lens, neck dam, drink facility, and communication connection. The integrated mask and hood is compatible with the standard flight helmet.

Disposable Eye/Respiratory Protection (DERP) - RDTE

Rationale:

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

Key Requirements:

- Provide a minimum of two hours protection against vapor hazards
- Capable of being donned within 15 seconds and one size fits all

Description:

The DERP is a temporary use, emergency mask for use when an individual's primary protective mask is unavailable. It will be inexpensive, compact, and disposable and designed to provide short-term, emergency protection.

A/P23P-14(V)N - RDTE

Rationale:

Navy, Marine Corps (Requirements)

Key Requirements:

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

Description:

The A/P 23P-9(V)N is a self contained protective ensemble designed for all forward deployed fixed wing (USN/USMC) and rotary wing (USN) aircrew. The design will incorporate 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 or oxygen for breathing. The system will provide enhanced protection and offer anti-drown features.

XM45 Aircrew Protective Mask (ACPM) - RDTE (FUE FY98)

Rationale:

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

Key Requirements:

- Unpowered protection compatibility with optical sighting systems
- Reduced weight, cost and logistic burden
- Improved RAM versus M43A2

Description:

The ACPM will have close fitting eyelenses mounted in a silicone rubber facepiece with an in-turned peripheral seal, a detachable hood system and a detachable motor blower assembly to reduce the inhalation burden. The mask will provide the required CB protection with or without forced ventilated air and is compatible with aircraft sighting and night vision devices.

Respiratory Protection System 21 (RESPO 21) - RDTE (FUE FY02)

Rationale:

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

Key Requirements:

- Protection against future threats
- Improved system integration over M40 series protective masks
- Reduce breathing resistance by 50% over the M40; reduced mission degradation

Description:

RESPO 21 will provide improved respiratory, eye, and face protection against all known and future CB threat agents. It will feature a compact respirator which will minimize physiological burden and associated soldier degradation and maximize compatibility with future weapon systems. Concepts include multi-layer and lightweight facepiece designs with modular facepiece component substitution according to mission needs.

Ancillary Mask Equipment

Protection Assessment Test System (PATS) - Production

Rationale:

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

Key Requirements:

- Small, lightweight, portable device for determining mask fit

Description:

PATS provides the warfighter a simple, rapid, and accurate means of validating the face-piece fit of their protective mask. The system, approximately 200 cubic inches, 4 pounds, aids in sizing and fitting of protective masks by quantitatively assessing the degree of protection provided by the mask once it has been donned.

Voice Communication Adapter (VCA) - Production

Rationale:

Navy, Air Force, Marine Corps (Requirements)

Key Requirements:

- Small and lightweight voice amplifier

Description:

The VCA is a small clip-on device used to amplify speech while wearing a protective mask. It is compatible with all existing DoD protective mask systems.

Battlefield Protective Suits

CB Protective Overgarment Saratoga - Production

Rationale:

Marine Corps (Requirements)
Army, Navy (Interest)

Key Requirements:

- Provide 24 hour protection against 10mg/m^2 liquid, 5000mg/m^3 vapor, 1000mg/m^3 aerosol (NATO Standard) CB agents threats
- Provide protection after 30 days of wear
- Launderable, flame retardant, and lightweight (less than 4.5 kilograms)

- Compatible with current protective masks

Description:

The Saratoga is a two-piece lightweight CB protective ensemble. It provides 24 hours of protection against all CB agents at NATO standards and retains full protection qualities for extended periods before use against contamination. The ensemble, made with Von Blucher carbon spheres, consists of a jacket with hood and trouser, and is less bulky than the BDO and CPOG.

Joint Service Lightweight Integrated Suit Technology 1 (JSLIST 1)

The JSLIST 1 program is a fully cooperative RDTE effort chartered to develop new CB protective suits and garments 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 1 will provide enhanced CB protective ensembles with reduced physiological heat burden and will generally be lightweight and launderable. These garments will also integrate other types of protection. The JSLIST 1 is the first of a 3 phase program and supports a variety of suits including:

Enhanced Aircrew Uniform Integrated Battlefield (EAUIB)
Lightweight CB Protective Garment (LWCBG)
Vapor Protective Flame Resistant Undergarment (VPFRU)
Advanced Battledress Overgarment (ADBO)
Advanced Chemical Protective Garment (ACPG)
Groundcrew Ensemble (GCE)

Enhanced Aircrew Uniform Integrated Battlefield (EAUIB) - RDTE (FUE FY97)

Rationale:

Army (Requirements)
Navy (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 CB protection after 4 launderings
- Provide flash fire protection (10 watts/cm^2 for 6 seconds)
- Provide lower physiological heat burden and 25% less than the AUIB
- Be compatible with micro climate cooling vest

Description:

The EAUIB provides protection against all CB agents after laundering and extended periods of non-CB wear. It will be worn by aircrew and aviation ground personnel. It will combine CB and flame protection in a single garment. The EAUIB is a two-piece suit design with an integrated hood compatible with M43 and XM45 series masks and second skins. It may be worn as an overgarment for the duty uniform or as a primary garment over underwear.

Lightweight Chemical/Biological Protective Garment (LCBPG) - RDTE (FUE FY97)

Rationale:

Army (Requirements)
Navy, Air Force (Interest)

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 desired)
- Have package volume for size medium no more than 500 in^3 (300 desired)
- Reduce the physiological heat burden of the BDO by at least 20% (30% desired) of BDO

Description:

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

Vapor Protective Flame Resistant Undergarment (VPFRU) - RDTE (FUE FY97)

Rationale:

Army (Requirements)

Key Requirements: (When worn under the Nomex coveralls)

- 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)
- Provide flash fire protection (10 watts/cm^2 for 6 seconds)
- Weigh less than 3 pounds (without coveralls)
- Reduce by 20% the physiological heat burden imposed by the CPU worn with coveralls

Description:

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

Advanced Battledress Overgarment (ABDO) - RDTE (FUE FY97)

Rationale:

Army (Requirement)
Navy, Marine Corps (Interest)

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

Description:

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

Advanced Chemical Protective Garment (ACPG) - RDTE (FUE, FY97)

Rationale:

Navy (Requirements)

Key Requirements:

- Provide 24 hours protection against 10 g/m^2 liquid agent and 5000 CT for 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 CPOG

Description:

The ACPG will be provide 24 hour protect 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 ACPG will be worn as an overgarment for the duty uniform or as a primary garment over underwear depending upon the environment and mission.

Groundcrew Ensemble (GCE) - RDTE

Rationale:

Air Force (Requirements)

Key Requirements.

- Enhance existing capability with lighter, less thermal burdening ensemble

Description:

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

Specialty Suits

Suit Contamination Avoidance Liquid Protection (SCALP) - Production

Rationale:

Army (Requirements)
Marine Corps (Interest)

Key Requirements:

- Liquid CB protection coverall
- Lightweight, quick and easy to doff

Description:

The SCALP is a lightweight overgarment which provides a liquid splash protection to undergarments. The SCALP, which consists of a jacket with hood and trouser, is made from a blend of Gore-tex and butyl rubber-coated nylon.

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

Rationale:

Army (Requirements)

Key Requirements:

- Full encapsulating protection ensemble
- Provides 2 hour CB protection in IDLH environments

Description:

Approved as an interim system for 2-hour depot operations in Immediate Danger to Life and Health (IDLH) environments. 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.

Improved Toxicological Agent Protective (I-TAP) - RDTE

Rationale:

Army, Air Force (*i.e.*, EOD Ensemble) (Requirements)
Navy, Marine Corps (Interest)

Key Requirements:

- Provide 4 hours liquid chemical agent protection at 10 gm/m^2
- Provide wear durability equal to current TAP suit
- Be compatible with M40 Special Purpose Mask and Hood and TAP boots and gloves
- Provide a 1-hour supplied air bottle with capability for switching to filtered air respirator
- Be light in color to reduce solar load and offer a universal cooling system pass through

Description:

The I-TAP will enhance existing capabilities with a lighter, less thermal burdening ensemble. The fabric will be self-extinguishing and decontaminated after a minimum 5 reuses. The I-TAP shall support short term entry and life saving operations requiring supplied air. The respiratory system will weigh under 25 lbs, and air bottles will be replaceable while the suit is worn. The I-TAP will have an improved design with seals at the neck and cuffs to eliminate bellows effect. The suit will have a voicemitter and a pass through for cooling systems.

Protective Accessories

Multipurpose Overboot (MULO) - RDTE (FUE FY97)

Rationale:

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

Key Requirements:

- Provide 24 hours protection against 10 g/m^2 liquid agent as well as environmental protection from water, snow and mud
- Provide 60 days wear in all environments without degradation of protection
- Provide resistance to incidental slashing by POL and self-extinguishing flame resistance
- Capable of being decontaminated to an operationally safe level using standard decontaminants

Description:

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

Improved CB Protective Glove - RDTE (FUE FY97)

Rationale:

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

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

Description:

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

Collective Protection Equipment

CB Protected Deployable Medical Systems (DEPMEDS) - Production

Rationale:

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

Key Requirements:

- Provides CB collective protection and CB hardening
- Corps level hospital use

Description:

The hardening of the Corps hospital will upgrade the existing Deployable Medical System (DEPMEDS) assets to provide CB collective protection to surgical functions of the hospital. These functions are housed in ISO shelters (2:1 & 3:1) and 64 TEMPERS. The TEMPERS are chemically protected by using the Simplified Collective Protection Equipment (SCPE) which includes liners, entryway and filter/blower units. The DEPMEDS efforts also provide chemical hardening to the Environmental Control Unit (C-100) and the heater.

CB Protected Shelter (CBPS) - RDTE

Rationale:

Army (Requirements)
Marine Corps (Interest)

Key Requirements:

- Highly mobile and easy to set up and take down

Description:

The CB protected shelter will provide collective protection (300 sq. ft.) for medical and selected combat, combat support, and combat service support personnel to perform their mission in a CB environment. The CB protected shelter is highly mobile, and easy to set up and take down to accommodate the dynamic integrated battlefield.

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

Rationale:

Army (Requirements)
Navy, Marine Corps (Interest)

Key Requirements:

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

Description:

The AICPS is an NBC filtration system integrated with an environmental control control unit and auxiliary power unit for combat systems. The combined components provide overall size, weight and energy reduction, the eliminate need for additional electrical power for the host system. Advanced filtration technology (regenerable filtration or catalytic-oxidation) significantly reduces filter change logistics burden, meets future threat and alleviates disposal of hazardous materials impregnated carbon filters.

Advanced Deployable Collective Protection Equipment (ADCPE) - RDTE

Rationale:

Army (Requirement)
Navy (Interest)

Key Requirements:

- Enhanced protection from and filtration of all CB agents

- Minimal logistic load and easy to set up
- Integral air handling and environment control system
- compact system footprint (6' x 6' x 4'2")

Description:

The ADCPE for Fixed Site will employ advanced NBC filtration technologies to significantly reduce filter changes and the overall logistics burden of current collective protection systems. The new filtration technology, temperature swing adsorption, will replace current single-pass carbon filter-based systems to protect the forces from future threats and provide for continuous operations. It will also alleviate the need to dispose of contaminated carbon filters.

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ANNEX D

SERVICE UNIQUE
FORCE PROTECTION PROGRAMS

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SERVICE UNIQUE PROTECTION

Respiratory

M43 Protective Mask - Inventory
M43A2 Aircraft Mask - RDTE

Rationale:

Army (Requirements)
Marine Corps (Interest M43 only - No imminent requirement)

Key Requirements:

- CB protection compatible with all Army rotary wing aircraft; and weapon system interface
- Auxiliary motor blower using standard batteries
- Replaceable prescription lenses
- Improved NBC survivability
- Compact and lightweight blower (M43A2 only)

Description:

The M43 and M43A2 Aircraft Mask consists of a form-fitting facepiece 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; a pressure compensated exhalation valve assembly for maintaining over pressure in the mask/hood; an electronic microphone; and a portable motor/blower filter assembly which operates on either battery or aircraft power. The M43 was developed for the AH-64 aviator and is compatible with the AH-64 Integrated Helmet and Display Sighting System and the Optical Relay Tube. The M43A2 is intended for the general aviator and will replace the M24. Both masks provide the required CB protection.

Battlefield Protective Suits

CWU-66/P Aircrew Ensemble - Production (FUE FY93)

Rationale:

Air Force (Requirements)

Key Requirements.

- Enhanced existing chemical protection
- Reduced ensemble weight and thermal burden

Description.

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) - Production

Rationale:

Army (Requirements)
Marine Corps (Interest - no imminent requirement)

Key Requirements:

- Provides 12 hours protection against 10 g/m^2 agent contamination after 15 days of non-NBC field wear
- Lightweight (2 lbs, 11 ozs) and launderable CB protective undergarment

Description:

The CPU is a two-piece lightweight undergarment made of a non-woven fabric with activated charcoal. When worn under the combat vehicle crewmen (CVC) coverall, battledress uniform (BDU), the CPU provides 12 hour protection at NATO standards after moderate non-NBC field wear and one laundering.

Aircrew Uniform, Integrated Battlefield (AUIB) - Production (FUE FY95)

Rationale:

Army (Requirements)
Marine Corps (Interest - no imminent requirement)

Key Requirements:

- Provides 24-hour protection against 10 g/m^2 agent after 15 days non-NBC field wear, and 6-hour protection after 30 days wear
- Lightweight, flame retardant and compatible with aircrew life support equipment

Description:

The AUIB is a two-piece duty uniform which provides aircrew with flame and CB protection in a single uniform. It provides 24 hour protection at NATO standards after moderate wear. The AUIB, which replaces the BDO for aircrews, is worn over the Nomex flight suit. The outer shell is a laminate of 95/5 Nomex/Kevlar and polytetrafluoroethylene film. The inner layer is a laminate of carbon impregnated, flame resistant polyurethane foam and nylon knit. The AUIB is compatible with life support equipment used in rotor-winged aircraft and with developmental cooling vests.

Specialty Suits

CB Protective Firefighter Ensemble (FFEN) - RDTE
Fire Fighter Suit-Combat (FIS-C) - RDTE

Rationale:

Army (Requirements)

Key Requirements.

- Provide 12 hours of CB agent protection against 10 g/m^2 liquid agent
- Provide firefighters CB protection in both structural and crash fire fighting/rescue operations
- Allow firefighters to use mission essential tools and equipment
- Provide resistance to water and all standard fire fighting chemicals (foam, CO_2, aircraft POL)
- Capable of being donned in 3 minutes or less

Description:

Ensemble will consist of a CB undergarment worn under the standard firefighting outergarment and used with a switchable filtered/supplied air respiratory system (same as for the Improved TAP ensemble below). Four types of CB undergarments are being evaluated, including the CPU.

Collective Protection Equipment

Chemically/Biologically Hardened Air Transportable Hospital (CHATH) - RDT&E

Rationale:

Air Force (Requirements)
Army, Navy (Interest - no imminent requirement)

Key Requirements:

- Integrated CB hardening
- Reduce weight and costs for Air Transportable Hospital

Description:

The CHATH enhances the existing 50-bed air transportable hospital by providing CB protection and hardening to the hospital. The CHATH will have an integrated environmental control system which will provide improved sterility within the treatment area. The system weighs less and has a lower life cycle cost than existing systems.

M20A1/M28 Simplified CPE (SCPE) - Production

Rationale:

Army (Requirements)
Navy (Interest - no imminent requirement)

Key Requirements:

- Provide a medical airlock for litter patients (M28 only)
- Increase entry-exit rate
- Provide liquid agent resistance
- Expandable, modular, and interface with tent
- Interface with existing Army environmental control units
- Reduce generated electromagnetic interference

Description:

The SCPE is a low cost method of transforming a room of an existing structure into an NBC collective protection shelter for C^3 and soldier relief functions. Its 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 that provides filtered air to both the liner and the protective entrance; and a support kit that contains ducting, lighting, sealing and repair material and an electronically powered blower. A pre-planned 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.

Standardized Integrated Command Post System and Tent (SICPS) and SICPS P^3I

Rationale:

Army (Requirements)

Key Requirements:

- Environmental protection, heating and cooling
- Integrated CB Protection

Description:

SICPS, the Army's next generation of command posts and tents, will integrate NBC protection into the air filtration and environmental control system. The combined components provide overall size, weight and energy reduction to current stand-alone systems. SICPS will use advanced filtration technology to significantly reduce the filter change logistics burden. It uses the standard modular command post system (MCPS) aluminum frame with and outer fabric of Kevlar based laminate. The tent is over-pressured using the blower and filter from the M-20 CPS. The wall panels are removable to allow

complexing of any number of MCPS together and to SICPS rigid wall shelter using a chemically hardened connector.

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ANNEX E

JOINT DECONTAMINATION PROGRAMS

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JOINT SERVICE DECONTAMINATION

Personnel

M291 Decontamination Kit - Production

Rationale:

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

Key Requirements:

- Decontaminates skin to safe levels
- Lightweight, man portable
- Pose no hazard to individual user

Description:

The M291 will enable the warfighter to perform basic decontamination to remove, neutralize, or destroy CB warfare agents and toxins on contaminated skin. The kit consists of a wallet-like flexible carrying pouch containing six individually packaged, hermetically sealed foiled packets. Each packet contains a folded non-woven fiber applicator pad with an attached strap handle on one side. The applicator pad is impregnated with 2.8 grams of a reactive and sorptive resin polymer mixture, Ambergard XE-555 Decontaminant. The kit provides for 3 decontamination missions, each at 1,300 cm^2 against a 2.5 g/m^2 CB challenge for a single kit. The kit is small and rugged enough to be carried in a trouser pocket of the BDO.

M295 Individual Equipment Decontamination Kit - RDTE

Rationale:

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

Key Requirements:

- Decontaminates equipment to safe levels
- Lightweight, man portable
- Pose no hazard to individual user

Description:

The M295 will enable the warfighter to perform basic decontamination to remove, neutralize, or destroy CB warfare agents and toxins on contaminated personal and load bearing equipment. The squad container consists of 20 individually packaged, hermetically sealed foiled packets. The packet contains a folded non-woven fiber applicator mitt impregnated with 22 grams of a reactive and sorptive resin polymer mixture, Ambergard XE-555 Decontaminant. Each mitt enables the warfighter to decontaminate 1,700 cm^2 of equipment surface area down to a 2.5 g/m^2 CB challenge. The kit is small and rugged enough to be carried in a trouser pocket of the BDO.

Combat Equipment, Vehicles, and Aircraft

M17A2/A3 Lightweight Decontamination System (LDS) - Production

Rationale:

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

Key Requirements:

- Portable engine-driven pump and water heating unit
- Produce hot water at 80º C at 100 psig at 5 gpm flow rate
- Use on vehicle rinse and personnel showers

Description:

The M17A2/A3 LDS is an improved lightweight, compact, engine-driven pump and multifuel-fired water heating system. The system can be used for hasty and deliberate decontamination and is capable of drawing water from any source and delivering it at moderate pressure (up to 100 psig) and controlled temperatures (120º C). The major improvements in the M17A2/A3 include a new gasoline powered engine; and the choice of a 1,500 and 3,000 gallon larger water storage tank.

XM19 Non-Aqueous Equipment Decontamination System (NAEDS) - RDTE

Rationale:

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

Key Requirements:

- Non-aqueous, non-freon based decontamination systems for personal and 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 on personal and sensitive electronic, avionics, electro-optic, and personal equipment. It's 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.

Decontaminant Solutions and Coatings

Sorbent Decontamination System - RDTE

Rationale:

Army (Requirements)
Navy, Air Force, Marine Corps (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 catalytic 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.

Decontaminating Enzymes - RDTE

Rationale:

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

Key Requirements:

- Selectively decontaminates CB warfare agents from large contaminated areas
- Easy-to use and possess no hazard to users
- Non-damaging and non-corrosive to military equipment; environmentally safe to store

Description:

- The catalytic emulsion decontaminant uses hydrolytic and oxidative catalysts to destroy CB warfare agents to a level equivalent to DS2 with less corrosion to the cleaned surfaces. The replacement of reactive components reduces the consumption of reactants and thereby significantly decreases the logistical burden.

Catalytic Coatings - RDTE

Rationale:

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

Key Requirements:

- Self releasing coating
- Decontaminates without reliance upon specialized labor or decontamination equipment

Description:

The catalytic self-decontaminating coating is a follow-on semi-permanent coating applied to military equipment in advance of chemical attacks. The coating contains active sites which will neutralize/destroy CB agents upon contact, thereby reducing the need for extensive decontamination operations.

ANNEX F

SERVICE UNIQUE DECONTAMINATION PROGRAMS

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SERVICE UNIQUE DECONTAMINATION

Combat Equipment, Vehicles, and Aircraft

XM21/XM22 Modular Decontamination System (MDS) - RDT&E

Rationale:

Army (Requirements)
Navy, Air Force Marine Corps (Interest - No Imminent Requirement)

Key Requirements:

- Provide high pressure water for the primary wash process
- Mechanically dispense and scrub decontaminant
- Fit within the payload limits of a 3/4 ton trailer and a 1-1/2 ton trailer
- Use existing equipment to supplement the deliberate decontamination process
- Provide adapters to draw water from fire hydrants

Description:

The MDS will provide the soldier an improved capability to perform detailed equipment decontamination on the battlefield. The system will replace current methods of decontamination application (i.e., mops and brooms or with the portable M13 Decontaminating Apparatus) which are both time consuming and labor intensive. The MDS reduces water usage, equipment processing time, labor intensiveness and improves effectiveness. The MDS consists of a XM21 Decontaminant Pumper/Scrubber module, and XM22 High Pressure/Hot Water module. The XM21 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 XM22 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 (XM21 or XM22) may be transported or operated from a 3/4-ton trailer towed by a M1037 High Mobility Multipurpose Wheeled Vehicle.

Aircraft Interior Decontamination System (AIDECONS) - RDTE

Rationale:

Air Force (Requirements)
Army, Navy, Marine Corps (Interest - No Imminent Requirement)

Key Requirements:

- Decontaminate aircraft interiors without degrading aerospace materials
- Easy to use and not require a post rinse

Description:

The AIDECONS will provide a first ever capability to decontaminate, remove, neutralize, or destroy chemical and biological warfare agents and toxins on contaminated aircraft interiors. It must be operator safe and offer protection from off-gassing and direct liquid exposure during decontamination. It must also not corrode or degrade aerospace materials or avionics equipment.

M17 Diesel Lightweight Decontamination System (LDS) - RDTE

Rationale:

Marine Corps (Requirements)
Air Force, Navy (Interest - No Imminent Requirement)

Key Requirements:

- Be capable of operation using Military Standard (MIL STD) fuels
- Have no component which cannot be moved by a four man crew
- Be capable of decontaminating both sides of a vehicle or aircraft simultaneously
- Generate no new manpower requirements

Description:

The Diesel LDS is a portable, lightweight, compact, engine-driven pump and multifuel-fired water heating system. The system will be capable of performing the same hasty and deliberate decontamination procedures as required of the M17 series LDSs.

ANNEX G

JOINT MEDICAL CHEMICAL, BIOLOGICAL, AND NUCLEAR DEFENSE RESEARCH PROGRAMS

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G.1 JOINT MEDICAL CHEMICAL DEFENSE RESEARCH PROGRAM

Threat Category - Nerve Agents

Countermeasures:

- Pretreatment regimen that protects against incapacitating effects of nerve agents.
- Improved anticonvulsant antidote to treat incapacitation and neuropathology induced by nerve agents.
- Improved antidote to treat incapacitation and lethal effects of nerve agents.

Technical Barriers:

- Appropriate experimental model systems to predict drug or treatment efficacy and safety in humans (a FDA requirement).
- Pretreatment/antidotes with special characteristics, such as quick action, with a long-lasting effects, easy to carry and use.
- Drugs that protect the brain, yet have minimal or acceptable side-effects (*i.e.*, don't compromise soldier effectiveness.)
- The nerve agents are small molecules and cause only minimal immune responses; thus it is very difficult to create antibodies against them.

Status:

- Validated and standardized an *in vivo* model of nerve agent induced seizures.
- Identified six lead compounds for advanced *in vivo* evaluation as an advanced anticonvulsant nerve agent countermeasure.
- Demonstrated pseudo-catalytic activity of a mixture of acetylcholinesterase and the oxime HI-6, which protected against the nerve agent sarin (GB) *in vivo*.
- Two expressed human cholinesterase enzyme mutants shown to have activity equivalent to natural enzyme.

Accomplishments:

- Demonstrated that several types of brain neurotransmitter receptors, including muscarinic, nicotinic, non-NMDA, and beta adrenergic types, are involved in the initiation of nerve agent seizures.
- Demonstrated that antagonists of NMDA receptors can stop nerve agent seizures which are refractory to standard anticholinergic antidotes.
- Demonstrated that loss of a brain protein, Microtubular Associated Protein-2, can be used as a marker of brain injury following nerve agent exposure.
- Identified gangliosides as a potential class of neuroprotectants following nerve agent exposure.
- Demonstrated that the anticonvulsants commonly employed clinically (*e.g.*, phentoin, magnesium sulfate) provide little protection against nerve agent seizures at usable doses.
- Demonstrated that compounds which protect against nerve agent-induced neuropathology are not necessarily protective against nerve agent cardiopathology.
- Demonstrated that the enzyme butyrlcholinesterase survives longer *in vivo* than does cholinesterase.

- Demonstrated continuous *in vivo* and *in vitro* detoxification of nerve agents following pretreatment with fetal bovine acetylcholinesterase and oxime HI-6.
- Produced site directed mutations of human cholinesterases to probe for the active site of inhibition by nerve agents.
- Developed methods for large scale production of genetically-engineered human acetylcholinesterase.
- Expressed active recombinant human butyrlcholinesterase and two mutants of this enzyme.
- Employed analytical method for detection of nerve agents (G agents and VX) in biological samples.

Threat Category - Vesicant Agents

Countermeasures:

- Topical protectants (barriers and reactive) to protect skin against vesicant (blister) and thickened nerve agents.
- Biological/pharmaceutical products to prevent or decrease the severity of vesicant agent injuries to warfighters.

Technical Barriers:

- Appropriate experimental model systems to predict drug or treatment efficacy and safety in humans (an FDA requirement) are unavailable.
- Pretreatments/antidotes with special characteristics, such as quick action, long lasting effects, ease of carrying and use.
- Reactive/catalytic component to detoxify vesicant agents that is effective, yet safe for topical use.

Status:

- Hypotheses of the mode and site of action of vesicant agent has guided identification of pathophysiological changes in cells which lead to blister formation and other agent effects.
- In vitro screens have identified inhibitors of the enzyme poly ADP ribose polymerase as candidates for *in vitro* evaluation as candidate vesicant agent countermeasures.

Accomplishments:

- Determined that inhibitors of the enzyme poly ADP ribose polymerase provide protective efficacy against sulfur mustard. Over 100 compounds were screened *in vitro*, 15 demonstrated substantial efficacy, and the 5 best are scheduled for *in vivo* evaluation.
- Employed analytical method to detect sulfur mustard exposure in human samples up to two weeks post exposure.
- Developed radiolabeled ribonucleic acid (RNA) probes and monoclonal antibodies for inflammatory mediators of sulfur mustard effects.
- Created transfected human skin cells (keratinocytes) with reduced levels of the enzyme poly ADP ribose polymerase to definitively clarify the enzyme's role in producing sulfur mustard's effects.

- Employed immunological methods to measure sulfur mustard-DNA compounds to quantify repair of DNA damage following sulfur mustard.
- Transitioned the isolated perfused pig skin flap for use as an *in vitro* screen for vesicant countermeasures.
- Determined that commercially available skin-equivalent materials were not suitable for assessing sulfur mustard effects or for use as *in vitro* screens for sulfur mustard countermeasures.
- Determined that the addition of a reactive component to the Topical Skin Protectant currently in advanced development enhanced protection against sulfur mustard vapor. This is important as a proof of principle demonstration.

Threat Category - Blood Agents

Countermeasures:

- Pretreatment compounds to protect against the rapid lethal action of these chemical agents.

Technical Barriers:

- Appropriate experimental model systems to predict drug or treatment efficacy and safety in humans (an FDA requirement).
- Pretreatments/antidotes with special characteristics, such as quick action, long lasting effects, easy to carry and use
- Drugs that protect the brain, yet have minimal or acceptable side-effects (*i.e.*, do not compromise warfighter effectiveness.)

Status:

- Two candidate anti-cyanide pretreatments met Milestone 0 during FY94. Both protect against expected battlefield levels of cyanide in animal models.
- One candidate anti-cyanide pretreatment is scheduled for Milestone I during FY95 following final efficacy studies and completion of synthesis and medicinal chemistry data.

Accomplishments:

- Established the efficacy of two methemoglobin forming anti-cyanide pretreatments in animal models.
- Determined that two methemoglobin forming anti-cyanide pretreatments are safe and have acceptable toxicity in animal models.
- Met the Milestone 0 timeline with two methemoglobin forming anti-cyanide pretreatments.

Threat Category - Respiratory Agents

Countermeasures:

- Short-term: Health risk criteria for emerging threat, doctrine, care and treatment strategies
- Intermediate-term: Specific casualty management techniques to improve survival and minimize lost duty time

Technical Barriers:

- Appropriate experimental model systems to predict drug or treatment efficacy and safety in humans (an FDA requirement.)

Status:

- Identified potential countermeasures to respiratory agents.
- Characterized cellular effects of respiratory agents.
- Studies on and development of treatments for battlefield phosgene poisoning are continuing.

Accomplishments:

- Demonstrated that the treatment with eicosatetraenyoic acid, dimethylsulfoxide, and surfactants may reduce the effects of respiratory agents.
- Demonstrated that the initial effect of phosgene on endothelial and epithelial cells was disruption of cytoskeleton.
- Initiated a new extramural effort to develop and evaluate potential treatments for phosgene exposure.

Advanced Development Products

In Advanced Development (6.3.B) the goal is "Proof of Principle" (*i.e.*, proof of the viability of system or concept), and to prepare a product to enter production and fielding (6.4). Efforts in this category are directed toward the solution of identified deficiencies.

The medical R&D process links the Materiel Developer (USAMRMC) with the Combat and Training Developer at the US Army Medical Department Center and School (AMEDDC&S) and the Logistician [US Army Medical Materiel Agency (USAMMA)] in addressing the threat and DoD requirements. Medical chemical defense products now in the advanced development phase are:

Topical Skin Protectant

Concept:

- The new topical skin protectant uses perfluorinated formulations, that solve many of the difficulties encountered in earlier formulations
- The new topical skin protectant forms a non-toxic, non-irritating barrier film layer on skin
- Augments the MOPP
- Protection against vesicant and nerve agents

Status:

- Two candidates were transitioned to demonstration-validation phase, and were found effective against a broad spectrum of threat agents.

Multi-chambered Autoinjector

Concept:

- Speeds administration of life-saving antidotes against nerve agents
- Replace 2 Pen MARK I Kit with single autoinjector

Status:

- Awarded engineering contract in FY94.
- Fielding will require full FDA approval. Approval is expected in near time frame

Nerve Agent Antidote System (NAAS; HI-6)

Concept:

- Replaces 2-PAM Chloride with more effective and more potent antidote
- Provides greater survival
- Broader spectrum of coverage
- Retains capabilities of multichambered autoinjector concept

Status:

- HI-6 transitioned to development 2QFY91
- Technical testing continues
- Leveraging Canadian developmental effort through US-UK-CA MOU with the potential for significant savings in time and resources

Fielded Products

Advances in Army medical R&D significantly impact the war fighting 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. Army medical R&D products (materiel and non-materiel solutions) provide the foundation that ensures the fielding of a flexible, sustainable, modernized force across the spectrum of conflict and in the full breadth and depth of the battlefield. Overcoming medical threats and extending human performance has provided a significant increase in military effectiveness in the past and presents the potential for future enhancement of military operational effectiveness. Some of the fully developed and fielded materiel and non-materiel solutions by Medical R&D are:

Pharmaceuticals

- Nerve Agent Antidote Kit (Mark I), 1983
- Skin Decontamination Kit (M291), 1990
- Nerve Agent Pretreatment (Pyridostigmine). 1990
- Convulsant Antidote for Nerve Agent (CANA), 1990
- Aerosolized Atropine (MANAA), 1993

Materiel

- Resuscitation Device, Individual, Chemical, 1990
- Decontaminable Patient Litter, 1990, 1993
- CW Protective Patient Wrap, 1990
- Computer-Based Performance Assessment Battery, 1993

Information and Doctrine

- Taxonomic Work Station, 1985.\
- USAMRICD Technical Memoranda on Chemical Casualty Care, 1990
- FM 8-285 “Treatment of Chemical Agent Casualties and Conventional Military Chemical Injuries,” 1990
- Handbook “Medical Management of Chemical Casualties,” 1994
- The Medical Management of Chemical and Biological Casualties Course, ongoing.

G.2 JOINT MEDICAL BIOLOGICAL DEFENSE RESEARCH PROGRAM

Threat Category - Bacterial Agents

Countermeasures:

- Vaccines against threat agents
- Produce immunogens against threat agents
- Forward deployed diagnostic systems

Technical Barriers:

- Incomplete genetic information for all the threat agents
- Inability to test effectiveness of pharmaceuticals/biologicals
- Difficulty in field testing rapid identification kits under natural conditions

Status:

- Developed aerosol models for pneumonic plague.
- Determined the efficacy of the whole-cell vaccine in rodents against a lethal aerosol challenge of plague.
- Isolated *Brucella melitensis* DNA that contributes to the organism's pathogenicity in susceptible human cell culture lines.
- Characterized recombinant protective antigen products under consideration for use in improved anthrax vaccines.
- Demonstrated that the licensed human anthrax vaccine conferred protection to non-human primates from an aerosol challenge of 500 LD_{50} of virulent anthrax spores two years after immunization.
- Determined that the Q fever CMR vaccine is less likely than the currently used whole-cell vaccine to produce severe local reactions in sensitized animals.
- Developed a hand-held, flow-through assay that can detect several threat agents (ng/ml) in less than 15 minutes.
- Achieved very low level detection of *B. anthracis*, *Y. pestis*, *V. cholerae*, *C. botulinum* toxins B and E, and *B. globigii* nucleic acids in samples using PCR amplification and detection using a Molecular Devices Threshold Biosensor.

Threat Category - Protein Toxins

Countermeasures:

- Vaccines
- Antibodies (antitoxins) directed against common antigens of protein toxin molecules
- Reagents to rapidly identify protein toxins either specifically or as members of their class
- Drugs for supportive therapy of agent intoxication

Technical Barriers:

- Lack of appropriate model systems for the investigation of countermeasures to toxins that interfere with protein synthesis
- Lack of models for evaluating efficacy of candidate vaccines, antitoxins and drugs

- Required pharmacological characterization of pretreatment drugs and antidotes have not been performed
- Difficulty in generating an immune response against small molecules
- Difficult to produce polyvalent vaccines against toxin classes
- Unsuitable expression vectors for recombinant products (vaccines and antitoxins)
- Inability to detect physiologically significant levels of toxin in biomatrices

Status:

- Demonstrated that immunization with proteosome-SEB toxoid vaccines protects against a 19 LD_{50} aerosol challenge with Staphylococcal enterotoxin B.
- Produced a synthetic gene-based protein vaccine that protects rodents from multiple Staphylococcal enterotoxin serotypes.
- Completed ricin toxoid efficacy study necessary for product transition.
- Produced synthetic gene-based protein vaccine that protects animals from one million lethal doses of botulinum type A.
- Demonstrated that an abbreviated immunization schedule with pentavalent botulinum toxoid protected non-human primates against lethal aerosol challenge.
- Developed a format for a multiple-agent dipstick for antigen detection of plague factor 1, anthrax protective antigen, SEB, and ricin.

Threat Category - Neuroactive Compounds

Countermeasures:

- Antidotes to counteract common neurotoxin and physiologically active compound (PAC) effects
- Antibodies (antitoxins) directed against common antigens of neurotoxin molecules or PACs
- Reagents to rapidly identify neurotoxins and PACs

Technical Barriers:

- Lack of appropriate model systems for the investigation of neurotoxins and PACs
- Inability to test for efficacy
- Pharmacological characteristics of pretreatment and antidotes need to be established
- Central Nervous System (CNS)-active drugs induce CNS side effects
- Difficulty in expressing immune response to small molecules
- Development of a polyvalent vaccine against toxin classes
- Appropriate expression vectors for recombinant products (vaccine and antitoxins)

Status:

- Identified and evaluated the therapeutic effectiveness of aminopyridines (4-aminopyridine and 3,4-diaminopyridine) against saxitoxin- and tetrodotoxin-induced cardiorespiratory failure.
- Demonstrated acute performance impairment in a rodent model following manipulation of endogenous somatostatin via systemic injections of cysteamine.

Threat Category - Viral Agents

Countermeasures:

- Vaccines conveying immunity against multiple agents
- Antibodies - for diagnosis and treatment of viral disease
- Devices to diagnose and identify viral threats

Technical Barriers:

- Appropriate model systems for investigation of viral countermeasures
- Inability to perform human clinical trials to prove efficacy of vaccines
- Production of polyvalent vaccines against viral classes
- Expression vectors for recombinant products (vaccines and antibodies)
- Immune system enhancement
- Rapid virus identification technology

Status:

- Demonstrated that microencapsulation significantly enhances the efficacy of inactivated alphavirus vaccines.
- Produced new, molecularly defined and multiply attenuated vaccine candidates for Venezuelan equine encephalitis (VEE).
- Evaluated immune responses to and antigenic properties of the vaccinia virus needed to maintain the capacity to vaccinate and protect soldiers against smallpox.
- Achieved high level expression of VEE virus structural proteins *in vitro*.
- Produced cDNA clones of eastern and western equine encephalitis virus.
- Demonstrated in animal models the Investigational New Drug (IND) vaccines against VEE do not fully protect against homologous of heterologous aerosol challenge.
- Developed a rapid screeing method for nucleic acid-based diagnostic for VEE virus.

Predevelopment Products - Technical Demonstration (TD)

In this TD phase (6.3A) of the medical materiel life cycle technology candidates are fully evaluated for preclinical (prior to human use) safety and efficacy and the best candidates are selected for transition into advanced development as candidate products. Medical biological defense candidate products that are now in the predevelopment stage are:

<u>Ricin Toxoid</u>

- Status: MS I in 2Q FY95

<u>Staphylococcal Enterotoxin B Toxoid, Microencapsulated</u>

- Status: MS 0 in 2Q FY95

<u>Forward Deployable Diagnostic Kit</u>

- Status: MS 0 in 2Q FY95

Advanced Development Products

These products are in the Demonstration/Validation or Engineering and Manufacturing Development phase of the medical materiel Life Cycle System Management Model. Medical biological defense candidate products that are now in the advanced development (6.3B - 6.4) stage are:

Botulinum Toxoid Type F

- Status: Completed Phase I safety trial of botulinum immune globulin (human). Submitted an IND application to the FDA for Botulinum Toxoid Type F.

Tularemia Live Vaccine

- Status: MS 1 in 3Q FY 93

Q Fever CMR Extract Vaccine

- Status: Completed MS I In-Process Review

Cell Culture Derived Smallpox Vaccine (Vaccinia)

- Status: Submitted an IND application to the FDA for the cell culture-derived smallpox vaccine.

Botulism Immune Globulin

- Status: MS 1 in 2Q FY 94

Botulism F(ab')2 Antitoxin

- Status: MS 1 in 1Q FY 94

Botulinal Toxoid, Type G

- Status: MS 1 in 2Q FY 96

Botulinal Polyvalent Toxoid Type A-E

- Status: MS 1 in 1Q FY 95

Tularemia Live Vaccine

- Status: Completed consistency lot testing of the tularemia vaccine.

Fielded Products

Products are considered fielded when a milestone III decision has been made. Biological defense products in this phase are:

- Venezuelan Equine Encephalitis Vaccine
- Eastern Equine Encephalitis Vaccine
- Western Equine Encephalitis Vaccine

G.3 JOINT MEDICAL NUCLEAR DEFENSE RESEARCH PROGRAM

Threat Category - Prompt Exposures From Nuclear Weapons

Countermeasures:

- Advanced medical treatment strategies for radiation injuries
- Drugs designed to increase resistance to radiation and harden the soldier against the early and late effects of ionizing radiation without compromising performance
- Drugs designed to prevent the onset of radiation induced performance decrements such as fatigue, nausea, vomiting
- Assessment of radiation injury by biological dosimetry techniques

Technical Barriers:

- Availability of drugs to conduct animal studies for advanced treatment strategies
- Known drugs that provide some radiation protective effects have serious performance degrading side effects at drug doses required for operational requirements
- Mechanisms of action of several known treatment and radioprotective drug strategies are not well understood

Status:

- Research in collaboration with pharmaceutical companies using large and small animal models is on-going
- Research using cellular systems and rodents has begun to investigate strategies to mitigate against late effects (e.g., cancer) of radiation
- Biological dosimetry techniques based on cytogenetic techniques are being developed
- Greater emphasis is being provided on molecular and cellular biology strategies to elucidate mechanisms of radiation damage and protection at the level of the DNA

Accomplishments:

- Therapeutic protocols have been devised and tested to show efficacy in reducing the duration of neutropenia and thrombocytopenia.
- Lethal consequences of radiation can be averted with the therapeutic use of cytokines.
- Endotoxin shock can be reversed with the use of new generation blocking agents.
- Drug combinations have been devised that can provide a small margin of safety against ionizing radiation without compromising performance.
- Dose assessment techniques based on cytogenetic techniques have been demonstrated
- Molecular and cellular model systems have been developed to validate new approaches to resistance to ionizing radiation.

Threat Category - Chronic Exposures From Fallout And Other Exposures Scenarios

Countermeasures:

- Advanced medical treatment strategies for protracted radiation injuries from both external and internal sources of radioactivity

- Drugs designed to harden the soldier against the early and late effects of ionizing radiation without compromising performance
- Improved techniques to detect and remove internal sources of radioactivity

Technical Barriers:
- Availability of suitable radiation sources to study the effects of chronic exposure at relevant dose levels
- Difficulty in manipulating cellular repair and second messenger signaling 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

Status:
- New radiation facility to permit protracted exposure experiments for neutrons and gamma rays is being planned
- New biological models for internal and external cellular and whole body chronic exposure studies are being developed
- New programs have been instituted for the study of molecular biology approaches to study gene radiation damage and repair mechanisms

Accomplishments:
- Contracts to study chronic human exposures have been established with scientists within the former Soviet Union
- Demonstrated that synaptic potentials in central nervous system neurons show anomalous dose rate dependence
- Confirmed that low dose rate neutrons have an increased rate of oncogenic transformation for certain specific cell lines

Threat Category - Combined Effects

Countermeasures:
- Radiotherapeutic agents designed to decrease morbidity and mortality from multi-organ system failure due to the combined effects of radiation, trauma, burns, and infection
- Radioprotective drugs designed to harden the soldier against the effects of radiation, trauma, burns, and infection

Technical Barriers:
- Availability of reliable animal models to predict effects in man
- Antimicrobial resistance to current therapeutic agents
- Differences in sensitivity of biological systems at all levels to neutrons and gamma rays
- Mechanism of action of cell growth factors is not well understood

Status:
- Research in collaboration with pharmaceutical companies using small and large animal models continues

- Evaluations of radioprotective and radiotherapeutic agents on going in mixed-field irradiated animal models
- New antimicrobial products under evaluation for the treatment of gram positive bacterial sepsis
- Molecular biology techniques utilized to understand the effects of radiation, trauma, and combined effects
- Molecular biology techniques utilized to understand the beneficial effects of cell growth factors, immunomodulators, and antimicrobial agents

Accomplishments:
- Demonstrated that selected radioprotective drugs reduce mortality from combined effects in small animal models
- Demonstrated that selected antimicrobial agents promote survival from infection when given orally to mixed-field irradiated small animal models
- Demonstrated that combined modality therapy including topical/systemic antimicrobials, immunomodulators, and radioprotective drugs increase survival from combined effects

Predevelopment Products - Technical Developments (TD)

Pre-Transition Information Paper: Radioprotection by a Combination of Iloprost/Misoprostol/3D-MPL/WR-3689

The Armed Forces Radiobiology Research Institute has historically been a laboratory funded exclusively with 6.2 money. Beginning in 1994, several predevelopment products (e.g., biological dosimetry techniques) will be supported with 6.3a funds.

Fielded Products

Medical Effects of Nuclear Weapons Course—Training for approximately 1,000 Medical Department personnel per year.

NATO Handbook AMedP-6, Medical Aspects of NBC Defensive Operations

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ANNEX H

FY 1994 ANNUAL REPORT TO CONGRESS ON RESEARCH, DEVELOPMENT, TEST AND EVALUATION CONDUCTED BY THE DEPARTMENT OF THE ARMY FOR THE PURPOSE OF MEDICAL BIOLOGICAL DEFENSE

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INTRODUCTION

This report is submitted for the purpose of complying with Public Law 101-510, dated 5 November 1990. This report provides the following information on the Biological Defense

Research Program (BDRP):

"(1) A description of each biological or infectious agent or toxin that was used in, or that was the subject of, research, development, test, and evaluation conducted for the purposes of biological defense the fiscal year covered by the report (FY94) and not previously listed in publications of the Centers for Disease Control (CDC) and the location of this research." (Enclosure 1)

"(2) A description of the biological properties of each agent." (Enclosure 1)

"(3) A statement of the location of each biological defense research facility and the amount spent by the Department of Defense during the fiscal year covered by the report (FY94) at each such facility for research, development, test, and evaluation for biological defense research." (Enclosure 2)

"(4) A statement of the biosafety level used at each such facility in conducting that research, development, test and evaluation." (Enclosure 2)

"(5) A statement that documentation of annual coordination with local health, fire, and police officials for the provision of emergency support services has been included in the facility safety plan for each biological defense research facility." (Enclosure 3)

All of the infectious organisms used or studied in the Department of Army (DA) BDRP are listed in the CDC-NIH Guidelines, Biosafety in Microbiological and Biomedical Laboratories, 3rd Edition, May 1993. With the exception of botulinum toxin, biological agents that are not infectious organisms are not listed in the CDC-NIH Guidelines and there is no national consensus document on such agents. In the context of the BDRP, the non-infectious biological agents used or studied are toxins of biological origin or physiologically active compounds (PACs).

The toxins or PACs listed are studied under conditions that approximate CDC-NIH biosafety levels 1 and 2 facilities. The biosafety levels defined in the CDC-NIH guidelines consider three elements: laboratory practices and techniques, safety equipment, and facility design. These biosafety levels were formulated specifically for work with infectious microorganisms and were not intended to apply to toxins or PACs. Accordingly, biosafety level used in conducting RDT&E with toxins and PACs are approximated based upon the CDC determining elements.

Personnel man-hours expended by grade to prepare the annual report are listed in enclosure 4.

ENCLOSURE 1

LISTING OF BIOLOGICAL OR INFECTIOUS AGENTS OR TOXINS USED IN THE BIOLOGICAL DEFENSE RESEARCH PROGRAM DURING FY94.

TOXIN NAME: Staphylococcal Enterotoxin B (SEB).

MOLECULAR WEIGHT: 27,000 to 30,000 daltons.

COMPOSITION: Single peptide chain with single disulfide loop.

NATURAL SOURCE: Bacteria *Staphylococcus aureus*.

TOXIC DOSE: Minimum dose of toxin needed to produce illness is less than 1 μg/kg in human by the oral route.

MECHANISM OF ACTION: A group of exotoxins produced by *Staphylococcus aureus* known to cause disease in humans. Many of the pathogenic effects of the toxins are mediated through their potent activation of specific components of the immune system. Potentiation of the immune response leads to overproduction of a number of naturally occurring mediators. Incapacitating illness can occur in 1 to 6 hours with recovery in 1 to 3 days; common signs include, respiratory distress, diarrhea, nausea, and vomiting. Although rarely fatal, severe cases may result in life threatening shock.

SUPPLIERS:
- Sigma Chemical Co.
  St. Louis, MO
- Toxin Technology
  Sarasota, Florida

LOCATIONS OF RESEARCH:
- U.S. Army Medical Research Institute of Infectious Diseases
  Ft. Detrick, Frederick, Maryland
  Walter Reed Army Institute of Research, Washington, D.C.
- U.S. Army Edgewood Research, Development, and Engineering Center
  Aberdeen Proving Ground, MD
- Dugway Proving Ground, UT
- Hebrew University
  Jerusalem, Israel
- Johns Hopkins University
  Baltimore, MD
- Ophidian Pharmaceuticals, Inc.
  Madison, WI
- Southern Research Institute
  Birmingham, AL
- Veterans Administration Medical Center
  Pittsburgh, PA
- EDITEK
  Burlington, NC
- New Horizons Diagnostics
  Columbia, MD

TOXIN NAME: Ricin.

MOLECULAR WEIGHT: 66,000 daltons.

COMPOSITION: A globular protein composed of two subunits. The amino acid sequence (primary structure) and secondary structure are known and published in the scientific literature.

NATURAL SOURCE: Seed of the castor bean plant, *Ricinis communis*.

TOXIC DOSE: The lethal dose 50 (LD_{50}) of mouse ranges from 3 to 20 μg/kg.

MECHANISM OF ACTION: Protein synthesis inhibitor; exact cause of death unknown.

SUPPLIERS:

- Sigma Chemical Co.
  St. Louis, MO
- Vector Laboratories
  Burlingame, CA
- Inland Laboratories
  Austin, TX
- Chemical and Biological Defense Establishment
  Porton Down, UK

LOCATION OF RESEARCH:

- U.S. Army Medical Research Institute of Infectious Diseases
  Ft. Detrick, Frederick, Maryland
- U.S. Army Edgewood Research, Development, and Engineering Center
  Aberdeen Proving Ground, MD
  Walter Reed Army Institute of Research , Washington, D.C.
- Dugway Proving Ground, UT
- U.S. Navy Medical Research and Development Command Laboratories
  Bethesda and Silver Spring, MD
- Albert Einstein School of Medicine
  Bronx, NY
- Northport Veterans Administration
  Northport, NY
- Oklahoma, University of
  Oklahoma City, OK
- Universal Sensors
  Metairie, LA
- Ophidian Pharmaceutical
  Madison, WI
- Receptor Laboratories, Inc.
  Chicago, IL
- Salk Institute
  San Diego, CA
- Southwest Foundation for Biomedical Research
  San Antonio, TX
- Texas, University of
  Austin, TX

TOXIN NAME: Cholera toxin.

MOLECULAR WEIGHT: Whole toxin 87,000 daltons
Subunit A 29,000 daltons
Subunit B 55,000 daltons

COMPOSITION: Single A subunit containing two polypeptide chains connected by a disulfide linkage and a B subunit containing 5 polypeptide chains. Subunits are noncovalently associated and arranged in a pentameric form. The toxin is largely proteinaceous.

NATURAL SOURCE: *Vibrio cholerae* bacteria

LD_{50} (mouse): 250 μg/kg

MECHANISM OF ACTION: The toxin binds irreversibly to receptors on the brush border in intestinal epithelial cells. This binding causes an increased concentration of intracellular cAMP production which leads to rapid water loss. Death occurs when profuse diarrhea leads to dehydration and hypovolemic shock.

SUPPLIERS:
- ICN Biochemicals
  Costa Mesa, CA
- Sigma Chemical Company
  St. Louis, MO

LOCATION OF RESEARCH:

- U.S. Army Edgewood Research, Development, and Engineering Center
  Aberdeen Proving Ground, MD
- Universal Sensors
  Metairie, LA

TOXIN NAME: Conus Peptides.

MOLECULAR WEIGHT: 1200 to 3200 daltons.

COMPOSITION: Linear peptides with 4-6 cysteines and some with gamma-carboxyglutamic acid.

NATURAL SOURCE: *Conus snails*

MECHANISM OF ACTION: Post and presynaptic neurotoxic and sodium channel blockers.

LD_{50} (mouse): 50-200 μg/kg

SUPPLIER:
- Sigma Chemical Company
  St. Louis, MO

LOCATION OF RESEARCH:

- U.S. Army Edgewood Research, Development & Engineering Center
  Aberdeen Proving Ground, MD

TOXIN NAME: Basic Peptide.

MOLECULAR WEIGHT: 6450 daltons.

COMPOSITION: Linear Peptide

NATURAL SOURCE: *Naja Naja atra* (Chinese species)

LD_{50}: None (non-toxic peptide)

MECHANISM OF ACTION: Unknown; no known toxicity.

SUPPLIER: Research sample provided by Gifu Pharmaceutical University, Japan

LOCATION OF RESEARCH:

- U.S. Army Edgewood Research, Development & Engineering Center
  Aberdeen Proving Ground, MD

TOXIN NAME: Sodium channel toxins: saxitoxin and tetrodotoxin.

MOLECULAR WEIGHTS: Approximately 300 to 1,000 daltons. Saxitoxin (prototype): 299 daltons ($C_{lO}H_{17}N_70_4$).

COMPOSITION: Complex organic chemicals, derivatives of tetrahydropurine. The structures are published.

NATURAL SOURCE: *Saxitoxin and derivatives*: *dinoflagellates of the genus Protogonyaulax*; *tetrodotoxin*: *puffer fish* (fugu), certain species of *newts*. Toxins enter the food chain through shellfish and fish.

LD_{50} (mouse): ranges from 6 to 10 μg/kg.

MECHANISM OF ACTION: These toxins act on one of the five sites on the voltage-dependent sodium channels in nerve and muscle tissue, and interfere with normal transmission of nerve impulses.

SUPPLIERS: Sigma Chemical Co.
St. Louis, MO

Sherwood Hall, Ph.D.
Food and Drug Administration, Washington, D.C.

EAL Biochem Corporation
San Diego, CA

LOCATION OF RESEARCH:

- U.S. Army Medical Research Institute of Infectious Diseases
  Ft. Detrick, Frederick, Maryland
- U.S. Army Medical Research Institute of Chemical Defense
  Aberdeen Proving Ground, MD
- Baylor College of Medicine
  Houston, TX
- Hahnemann Medical College
  Philadelphia, PA
- Minnesota, University of
  Minneapolis, NW

TOXIN NAME: Cytotoxin I, II, III, & IV.

MOLECULAR WEIGHT: 6500 to 6700 daltons.

COMPOSITION: Linear peptides with 4 disulfide linkages and 8 cysteines.

NATURAL SOURCE: *Elipidae snakes*

LD_{50} (mouse): 200 μg/kg

MECHANISM OF ACTION: Cardiotoxin (cytotoxin).

SUPPLIER: No commercial source. Research Sample provided by Gifu Pharmaceutical University, Gifts, Japan.

LOCATION OF RESEARCH:

- U.S. Army Edgewood Research, Development & Engineering Center
  Aberdeen Proving Ground, MD

TOXIN NAME: Trichothecene mycotoxins.

MOLECULAR WEIGHT: 282 to 532 daltons (the prototype T-2: 466 daltons).

COMPOSITION: A family of closely related chemical compounds called sesquiterpenoids.

NATURAL SOURCE: Various species of fungi (*Fusarium, Myrothecium, Trichoderma, Cephalosporium, Verticimonosporium, and Stachybotrys*). The trichothecene toxins occur naturally in moldy grains and other agricultural products.

LD_{50} (mouse): ranges from 1 to 70 mg/kg.

MECHANISM OF ACTION: These toxins inhibit protein synthesis *in vitro. In vivo,* the exact cause of death is unknown; lesions are seen in multiple organ systems.

SUPPLIER: Myco Labs

NAME: Venoms: Phospholipase A2 neurotoxins; textilotoxin, taipoxin, notexin, B-bungarotoxin, pseudexin, crotoxin, concolor, Mojave toxin, vegrandis toxin, ammodytoxin, and caudoxin.

MOLECULAR WEIGHTS: 14,000 to 60,000 daltons.

COMPOSITION: These toxins are proteins and peptides. The sequences of most are published.

NATURAL SOURCE: Snakes from around the world.

LD_{50} (mouse): ranges from 1 to 1250 μg/kg.

MECHANISM OF ACTION: These toxins inhibit the release of neurotransmitters at the presynaptic nerve terminal. Death occurs from respiratory arrest.

SUPPLIERS: Sigma Chemical Co.
St. Louis, MO

Miami Serpentarium Laboratories
Miami, FL

LOCATION OF RESEARCH:

- U.S. Army Medical Research Institute of Infectious Diseases
  Ft. Detrick, Frederick, Maryland
- Hahnemann University
  Philadelphia, Pennsylvania
- University of Wyoming
  Laramie, Wyoming

NAME: Venoms: Postsynaptic alpha-like toxins; alpha bungarotoxin, cobrotoxin, cobratoxin.

MOLECULAR WEIGHTS: 1,500 to 7,000 daltons.

COMPOSITION: Proteins and peptides, sequences of most are published.

NATURAL SOURCE: Snakes and sea snails from around the world.

LD_{50} (mouse): ranges from 20 to 200 μg/kg.

MECHANISM OF ACTION: These toxins all bind to the acetylcholine receptor and inhibit neuromuscular function. Death occurs from respiratory arrest.

SUPPLIERS: Sigma Chemical Co.
St. Louis, MO

Miami Serpentarium Laboratories
Miami, FL

LOCATION OF RESEARCH:

- U.S. Army Medical Research Institute of Infectious Diseases
  Ft. Detrick, Frederick, Maryland

NAME: Venoms: Cardiotoxins.

MOLECULAR WEIGHTS: Approximately 7,000 daltons.

COMPOSITION: Proteins, sequences of most are published.

NATURAL SOURCE: Snakes, primarily cobras.

LD_{50} (mouse): ranges from 2000 to 3000 μg/kg.

MECHANISM OF ACTION: Acts on cardiac tissue to cause membrane damage. Death due to cardiac arrest.

SUPPLIERS: Sigma Chemical Co.
St. Louis, MO

Miami Serpentarium Laboratories
Miami, FL

LOCATION OF RESEARCH:

- U.S. Army Medical Research Institute of Infectious Diseases
  Ft. Detrick, Frederick, Maryland
- Hahnemann University
  Philadelphia, PA

NAME: Venoms: Scorpion toxins.

MOLECULAR WEIGHTS: Approximately 6,000 to 7,000 daltons.

COMPOSITION: Proteins, sequences of most are published.

NATURAL SOURCE: Scorpions.

LD_{50} (mouse): Toxicity of individual scorpion toxins ranges from 20 μg/kg to non-lethal.

MECHANISM OF ACTION: The scorpion toxins act on one of the five sites on the voltage-dependent sodium channels in nerve and muscle tissue, and interfere with normal transmission of nerve impulses.

SUPPLIERS: Sigma Chemical Co.
St. Louis, MO

Miami Serpentarium Laboratories
Miami, FL

LOCATION OF RESEARCH:

- U.S. Army Medical Research Institute of Infectious Diseases
  Ft. Detrick, Frederick, Maryland

TOXIN NAME: Microcystin Toxins.

MOLECULAR WEIGHT: 994 daltons.

COMPOSITION: Cyclic peptides.

NATURAL SOURCE: Freshwater cyanophytes (blue-green algae); various strains of *Microcystis aeruginosa.*

LD_{50} (mouse): ranges from 25 to l00 μg/kg.

MECHANISM OF ACTION: Believed to disrupt cellular integrity. Death is believed to result from massive hepatic necrosis, hemorrhage, and resultant shock state.

SUPPLIER: Sigma Chemical Co.
St. Louis, MO

LOCATION OF RESEARCH:

- U.S. Army Medical Research Institute of Infectious Diseases
  Ft. Detrick, Frederick, MD

TOXIN NAME: Anatoxin A.

MOLECULAR WEIGHT: 165 daltons respectively.

COMPOSITION: Alkaloids.

NATURAL SOURCE: Freshwater cyanophyte (Blue-green algae) of the species *Anabaena flosaquae*.

LD_{50} (mouse): ranges from 40 to 200 μg/kg.

MECHANISM OF ACTION: Anatoxin A is a nicotinic acetylcholine receptor antagonist (activator). It causes death through skeletal muscle paralysis.

SUPPLIERS: BioMetric Systems, Inc.
Eden Prairie, NW

Henry Rapaport
University of California
Berkeley, CA

LOCATION OF RESEARCH:

- Walter Reed Army Institute of Research
  Washington, D.C.

TOXIN NAME: Physiologically Active Compounds (PACs).

including: Adenosine triphosphate, corticotropin releasing factor, dynorphin, enkephalin, glutamate, morphine modulatory peptide, N-acetyl-aspartyl-glutamate, nitric oxide, norepinephrine, serotonin, substance P, tumor necrosis factor, vasoactive intestinal peptide.

MOLECULAR WEIGHT: 100 to 5000 daltons.

COMPOSITION: Primarily amino acids linked to make peptides, as well as other small low molecular weight compounds.

NATURAL SOURCE: Endogenous mammalian compounds such as hormones, neurotransmitters, and neuropeptides.

LD_{50} (mouse): has not been determined for most PACs. Low microgram per kg range to nonlethal in most cases tested.

MECHANISM OF ACTION: Exposure to these compounds results in stimulation or over stimulation of the natural physiological state of the organism resulting in incapacitation or disruption of homeostasis. This action usually occurs by direct action on an endogenous receptor for the PAC.

SUPPLIERS: Aldridge Chemical Co., Milwaukee, WI

Amersham, Arlington Heights, IL

Bachem, Torrance, CA

Boehringer Mannheim, Germany

Calbiochem, La Jolla, CA

Cambridge Research Biochem, Wilmington, DE

Genzyme, Boston, MA

Peninsula Labs, Belmont, CA

Peptide Int, Louisville, KY

Research Biochemicals Inc., Natick, MA

Sigma Chemical Co., St. Louis, MO

Tocris Neuramin, Bristol, UK

LOCATION OF RESEARCH:

- Walter Reed Army Institute of Research
  Washington, D.C.

ENCLOSURE 2

FISCAL YEAR 1994 DISBURSEMENTS BY LOCATION AND BIOSAFETY LEVEL (BL)

DEPARTMENT OF ARMY (DA)

LOCATION	DOLLARS ($K)	BL
U.S. Army Medical Research Institute of Chemical Defense Aberdeen Proving Ground, MD	2,862	1-2
U.S. Army Medical Research Institute of Infectious Diseases Fort Detrick, Frederick, MD	23,847	1-4
Walter Reed Army Institute of Research Washington, D.C. and Rockville, MD	5,615	1-3
U.S. Army Edgewood Research, Development and Engineering Center Aberdeen Proving Ground, MD	1,807	1-2

OTHER DOD AGENCIES FUNDED BY DA:

LOCATION	DOLLARS ($K)	BL
U.S. Navy Medial Research and Development Command Laboratories Bethesda and Silver Spring, MD	2,396	1-2
U.S. Air Force Detachment Edgewood Research, Development and Engineering Center, Aberdeen Proving Ground, MD	174	1-2
Joint Program Office for Biological Defense	502	2-3

FISCAL YEAR 1994 DISBURSEMENTS BY LOCATION AND BIOSAFETY LEVEL (BL)[1]

CONTRACTORS

LOCATION	DOLLARS ($K)[2]	BL
Alabama, University of at Birmingham[3] Birmingham, AL	43	1-2
Albert Einstein College	405	1-2
Bronx, NY Baylor College of Medicine Houston, TX	515	1-2
Brigham Young University[3] Salt Lake City, UT	122	1-2
California University of, the Regents[3] Berkely, CA	265	1-2
California University of, San Diego[3] La Jolla, CA	281	1-2
California, University of, San Francisco[3] San Francisco, CA	194	1-2
Dana-Farber Cancer Institute[3] Boston, MA	51	1-2
Elcatech, Inc. [3] Winston-Salem, NC	168	1-2
Hahnemann University School of Medicine Philadelphia, PA	59	1-2
Hebrew University of Jerusalem Jerusalem Israel	150	1-2
Illinois, University at Urbana Champaingn[3] Urbana, IL	96	1-2
Imperial College of Science, Technology[3] London SW7 2AZ	250	1-2

LOCATION	DOLLARS ($K)[2]	BL
Jefferson Medical College[3] Philadelphia, PA	63	1-2
Johns Hopkins University Baltimore, MD	352	1-2
Kentucky, University of[3] Lexington, KY	70	1-2
Louisiana State University[3] Shreveport, LA	50	1-3
Mayland, University of[3] Baltimore, MD	176	1-2
Massachusetts, Univerity of[3] Amherst, MA	91	1-2
Massachusetts, University of, Medical Center[3] Worchester, MA	119	1-2
Minnesota, University of Minneapolis, MN	85	1-2
North Carolina, University of [3] Chapel Hill, NC	350	1-2
Northport Veterans Administration Northport, NY	76	1-2
Oklahoma, University of Oklahoma City, OK	133	1-2
Ophidian Pharmaceutical, Inc. Madison, WI	205	1-2
OTC/Biotechnology Research Institute[3] Rockville, MD	150	1-2
Porton Products Limited Washington, DC	1,635	1-3
Receptor Laboratories, Inc. Chicago, IL	70	1-2

LOCATION	DOLLARS ($K)[2]	BL
Salk Institute Swiftwater, PA	1,536	1-3
Southern Research Institute Birmingham, AL	263	1-2
Southwest Foundation for Biomed Research San Antonio, TX	214	1-2
Texas, University of Austin, TX	98	1-1
Veterans Administration Medical Center Pittsburgh, PA	168	1-2
Virginia Tech.[3] Blacksburg, VA	53	1-3
Washington, University of[3] St. Louis, MO	232	1-2
Wisconsin, University of[3] Madison, WS	67	1-3
Wyoming, University of Laramie, WY	312	1-2
Yale University New Haven, CT	300	1-2
New Horizons Diagnostics Columbia, MD	15	2
EDITEK Burlington, NC	15	2
Universal Sensors Metairie, LA	50	2

[1] Facilities listed are those where RDT&E of subject agents was conducted during FY 94. Contract obligations not related to use of subject toxins are not listed.
[2] Obligated dollars as of 6 Oct 94.
[3] The contracted effort pertains to work with agents listed in CDC publications.

ENCLOSURE 3

STATUS OF MEDICAL BIOLOGICAL DEFENSE RESEARCH SAFETY PROGRAM REQUIREMENTS FOR FISCAL YEAR 1994

Documentation of annual coordination with local health, fire, and police officials for the provision of emergency support services has been included in the facility safety plan for each biological defense research facility in the DA BDRP. Information on individual contractors has been verified by the Medical Research and Materiel Command Safety and Occupational Health Office (Memorandum dated September 7, 1994).

ENCLOSURE 4

COST OF CONGRESSIONAL REPORTING REQUIREMENTS

REPORT: FY94 Annual Report to Congress on Research, Development, Test and Evaluation Conducted by the Department of the Army for the Purpose of Medical Biological Defense.

PAGE#

SUBJECT: DoD Annual Report to Congress on the Medical Biological Defense Research Program.

In-House Report:

Estimated Effort Involved:

#People	Grade	Man-hours
1	GS-09	2.0
1	GS-11	7.0
2	GS-12	12.0
2	GS-13	1.5
4	GS- 14	2.5
1	GM-15	2.0
3	0-4	50.0
1	0-3	5.0
15		82

CONTRACTED REPORT:
Estimated Effort involved
Cost: 0

ANNEX I

DEPARTMENT OF DEFENSE ANNUAL REPORT TO CONGRESS ON THE RESEARCH, DEVELOPMENT, TEST AND EVALUATION OF THE CHEMICAL/BIOLOGICAL DEFENSE PROGRAM 1 OCTOBER 1993 THROUGH 30 SEPTEMBER 1994

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ANNEX I
ENCLOSURE A

DEPARTMENT OF THE ARMY
ANNUAL REPORT TO CONGRESS
ON THE RESEARCH, DEVELOPMENT, TEST AND EVALUATION OF
THE CHEMICAL/BIOLOGICAL DEFENSE PROGRAM
1 OCTOBER 1993 THROUGH 30 SEPTEMBER 1994

SECTION I

OBLIGATION REPORT ON THE CHEMICAL DEFENSE RDTE PROGRAM

During the fiscal year (FY) 94, the Department of the Army obligated $168,340,000 for general research investigations, and the development and testing of chemical defensive equipment.

FUNDS OBLIGATED			
Current Fiscal Year (CFY)	$162,115,000		
Prior Year (PY)	6,225,000		
TOTAL	$168,340,000	In House	$90,886,000
		Contract	$77,454,000

Breakdown of Program Areas

1. BASIC RESEARCH				
In-House Laboratory Independent	CFY	$875,000		
Research (ILIR)	PY	115,000		
		$990,000	In House	$851,000
			Contract	$139,000
Research in Chemical Warfare	CFY	$1,960,000		
Defense	PY	6,000		
		$1,966,000	In House	$1,739,000
			Contract	227,000
Science Base/Medical Chemical				
Defense	CFY	$7,980,000		
	PY	57,000		
		$8,037,000	In House	$3,024,000
			Contract	$5,013,000
TOTAL BASIC RESEARCH	CFY	$10,815,000		
	PY	178,000		
		$10,993,000	In House	$5,614,000
			Contract	$5,379,000

2. CONCEPT EXPLORATION AND DEFINITION (CE/D)				
Warning and Detection Investigations	CFY	$2,942,000		
	PY	-0-		
		$2,942,000	In House	$1,545,000
			Contract	$1,958,000
Physical Protection Investigations	CFY	$8,585,000		
	PY	-0-		
		$8,585,000	In House	$6,627,000
			Contract	$1,958,000
Decontamination	CFY	$3,410,000		
	PY	-0-		
		$3,410,000	In House	$2,770,000

			Contract	$640,000
Supporting Technologies	CFY	$6,287,000		
	PY	12,000		
		$6,299,000	In House	$5,053,000
			Contract	$1,246,000
Medical Defense - Chemical Agents	CFY	$15,535,000		
	PY	211,000		
		$15,746,000	In House	$12,815,000
			Contract	$ 2,931,000
TOTAL - CE/D	CFY	$36,759,000		
	PY	223,000		
		$36,982,000	In House	$28,810,000
			Contract	$8,172,000

3. DEMONSTRATION/VALIDATION (DEM/VAL)				
Collective Protection	CFY	$7,140,000		
	PY	1,956,000		
		$9,096,000	In House	$2,557,000
			Contract	$6,539,000
Decontamination	CFY	$5,191,000		
	PY	-0-		
		$5,191,000	In House	$2,758,000
			Contract	$2,433,000
Individual Protection	CFY	$9,125,000		
	PY	55,000		
		$9,180,000	In House	$5,160,000
			Contract	$4,020,000
Warning and Detection	CFY	$8,487,000		
	PY	61,000		
		$8,548,000	In House	$5,366,000
			Contract	$3,182,000
Medical Chemical Defense Life Support Materiel	CFY	$11,688,000		
	PY	230,000		
		$11,918,000	In House	$3,297,000
			Contract	$8,621,000
Medical Defense Against Chemical Agents	CFY	$5,523,000		
	PY	945,000		
		$6,468,000	In House	$1,388,000
			Contract	$5,080,000
TOTAL - DEM/VAL	CFY	$47,154,000		
	PY	3,247,000		
		$50,401,000	In House	$20,526,000
			Contract	$29,875,000

4. ENGINEERING AND MANUFACTURING DEVELOPMENT (EMD)				
Collective Protection	CFY	$4,770,000		
	PY	227,000		
		$4,997,000	In House	$3,393,000
			Contract	$1,604,000
Warning and Detection	CFY	$40,144,000		
	PY	26,000		
		$40,170,000	In House	$15,544,000
			Contract	$24,626,000
Individual Protection	CFY	$4,331,000		
	PY	2,213,000		
		$6,544,000	In House	$2,905,000
			Contract	$3,639,000
Medical Chemical Defense Life Support Materiel	CFY	$1,079,000		
	PY	1,000		
		$1,080,000	In House	$192,000
			Contract	$888,000
TOTAL - EMD	CFY	$50,324,000		
	PY	2,467,000		
		$52,791,000	In House	$22,034,000
			Contract	$30,757,000

5. MANAGEMENT AND SUPPORT (M/S)				
NBC Survivability	CFY	$3,033,000		
	PY	-0-		
		$3,033,000	In House	$2,758,000
			Contract	$275,000
Simulant Test Support	CFY	$1,774,000		
	PY	-0-		
		$1,774,000	In House	$1,774,000
			Contract	$-0-
Management and Admin Support	CFY	$12,256,000		
	PY	110,000	In House	$9,370,000
		$12,366,000	Contract	$2,996,000
TOTAL - M/S	CFY	$17,063,000		
	PY	110,000	In House	$13,902,000
		$17,173,000	Contract	$3,271,000

SECTION II
EXPLANATION OF OBLIGATION

1. BASIC RESEARCH

(a) In-house Laboratory Independent Research (ILIR): PE 61101, Project A91A - Supports in-house, innovative and entrepreneurial research projects. Provides a pathway to the development of novel and high quality research projects.

FY94 Accomplishments:
- Demonstrated that aerosol antibodies remain active for a sustained period of time when exposed to air.

(b) Research in Chemical Warfare (CW) Defense: PE 61102, Project A71A - Basic research in support of new and improved defensive systems for biological agents, toxins, and chemical threat agents; new concepts in decontamination, aerosol and obscuration studies; and determinations of the environmental fate and impact of militarily unique chemicals.

FY94 Accomplishments:
- Demonstrated microbial degradation of hydrolyzed munitions-grade mustard.
- Developed a procedure for the hydrogenolysis of hindered tertiary alcohols as a synthetic pathway to target alpha 2-adrenergic sedatives with potential as non-lethal chemicals.
- Developed an approach to perform precise mass determination of trapped micron-sized particles by optical means.
- Measured absorption equilibria of CW agent simulants on developmental adsorbent materials for protective masks.
- Continued the analysis of the effect of phase transfer catalyst in both the oxidation and the hydrolysis reactions of sulfur mustard and determined synthetic parameters for controlled large scale synthesis of starburst polymers.

(c) Science Base/Medical Chemical Defense: PE 61102, Project BS11 - Basic research studies are performed to delineate mechanisms and site of action of identified and emerging chemical threats to generate required information for initial design and synthesis of medical countermeasures.

FY94 Accomplishments:
- Characterized cellular mechanisms and markers of injury and developed new models of sulfur mustard injury.
- Characterized mechanisms and markers and developed new models of cyanide toxicity.
- Characterized cellular and brain mechanisms controlling nerve agent-induced seizures and pathology involving anticonvulsant and other therapy.
- Explored potential biological scavengers for chemical agents and applied biotechnological approaches to the development of scavengers.
- Proposed hypothesis and developed models to define mechanisms of action of CW threat agents.

2. CONCEPT EXPLORATION AND DEFINITION

(a) Chemical/Biological (CB) Defense and General Investigations: PE 62622, Project A553 - Addresses urgent need to provide all Services with defensive materiel to protect individuals and groups from CB threat agents.

(1) Contamination Avoidance: Supports development of multi-agent sensors and detectors providing real-time detection and identification of CB threat agents.

FY94 Accomplishments:
- Fabricated and tested Infrared and Laser Stand-off Chemical Detector breadboard systems, determined operational parameters and limitations, and conducted system modeling.

(2) Individual Protection: Supports increased protection against current and future threat agents, while minimizing the physiological burden imposed by CB protective gear.

FY94 Accomplishments:
- Finalized component design and evaluated facepiece and components for the Advanced Respiratory Protection Mask.
- Investigated new materials and manufacturing technologies for future/novel respiratory designs and conducted physiological performance evaluations for new mask concepts.

(3) Collection Protection: Supports continuous air filtration for unit sustainment in a CB environment while eliminating the burden of changing filters.

FY94 Accomplishments:
- Evaluated new sorbents and sorbent mixtures for improved filtration performance.
- Tested a new foreign designed filter canister scheduled for transition to production in FY 95.
- Completed fabrication of a laboratory scale temperature swing absorption (TSA) filtration controller and data acquisition system and initiated data base development of TSA performance characteristics for collective protection.

(4) Armored Systems Modernization: Supports nuclear, biological, and chemical (NBC) technology base investigations to address specific armored vehicle integration requirements.

FY94 Accomplishments:
- Established design parameters for pressure swing adsorption/catalytic air filtration and prepared for transition to a field artillery system.
- Investigated filtration, detection, and obscuration system concepts for combat systems.

(5) Decontamination: Supports development of multipurpose decontaminants and requisite dispensing systems with emphasis on noncorrosive, all-agent decontaminants for personal equipment and sensitive electronics.

FY94 Accomplishments:
- Evaluated reduced-pH hydrolysis catalysts and investigated methodology for examining agent decontaminant interaction in solid matrices.
- Continued work on an improved sorbent decontaminant which is scheduled for transitioning to the DEM/VAL phase in 1QFY96.

(6) Supporting Capabilities: Identify and evaluate potential CB threat agents, develop special test technologies, and analyze foreign intelligence samples.

FY94 Accomplishments:

- Integrated the Vapor Liquid Solid Tracking Model into a conventional Army war game.
- Investigated new CB threat agents and test methodology for evaluating performance of equipment in a CB environment.

(b) Clothing and Equipment Technology: PE 62786, Project AH98 - Supported evolution of concepts for individual protection against potential threat agents for Joint Service application; development of a technical base to study the mechanism of CB protective material.

FY94 Accomplishments:
- Identified and evaluated selectively permeable membranes for application in future CB protective garments.
- Evaluated thermoplastic elastomer coated fabrics.
- Demonstrated a fully automated, multi-stage robotic vapor test system for use in vapor challenge testing of permeable chemical protective materials and transferred this technology to a government procurement activity for quality assurance testing of chemical protective materials.
- Transitioned a thin, stretchable material which contains absorptive carbon for use in form-fitting chemical protective undergarments, gloves and socks to Engineering and Manufacturing Development (EMD) .
- Transitioned chemical protective butyl rubber formulations, which are resistant to flame, petroleum, oils and lubricants, to EMD.
- Demonstrated an improved material resistance test methodology which simulates convection effects and transferred this technology to other Government agencies and industry.

(c) Medical Chemical Defense: PE 62787, Project A875- This project supports concept exploration of prophylaxes, pretreatment, antidotes, decontaminants, and therapeutic compounds that will counteract the lethal, physical, and behavioral toxicity of chemical agents. It also supports development of medical chemical defense material that insures adequate patient care, field resuscitation, and patient procedures.

FY94 Accomplishments:
- Characterized and screened candidate countermeasures against sulfur mustard.
- Investigated reactive components for a topical skin protectant.

- Characterized and validated countermeasures to cyanide.
- Characterized and validated countermeasures to nerve agent-induced seizures and pathology.
- Refined methods to detect agents in biological fluids.
- Characterized and validated the catalytic approach to scavengers for nerve agents and employed biotechnological approaches to the development of these scavengers.
- Characterized and validated decontamination, diagnostic, prognostic, and treatment procedures directly applicable to chemical casualty management.

3. DEMONSTRATION AND VALIDATION

(a) Collection Protection Concepts:

Fixed Site Collective Protection: PE 63759, Project DE83-20 - Demonstrates technology advancements which will speed maturing of advanced technologies to reduce risk in system-oriented DEM/VAL.

FY94 Accomplishments:
- Fabricated fixed site collective protection prototypes and conducted an effective demonstration.

Aviation Life Support Equipment: Project DB45 - Supports cockpit NBC filtration as part of advanced development of life support items peculiar and necessary to Army aircrews for survival on the integrated battlefield.

FY94 Accomplishments:
- Completed design of a turbo expander with an integral electric power alternator for providing cool clean air for the catalytic air purification system.

(b) Decontamination Concepts:

Sorbent Decon: PE 63759, Project DE83-19 - Demonstrates technology advancements which will speed maturing of advanced technologies to reduce risk in system-oriented DEM/VAL.

FY94 Accomplishments:
- Completed optimization, characterization, and demonstration of sorbent decontamination.

Soldier Support and Survivability: PE 63747, Project DC09 - Supported development of the Laundry and Dry Cleaning System (LADS).

FY94 Accomplishments:
- Redesigned LADS to replace a water based, trailer mounted, field laundry with a dry cleaning system.
- Revised the Operational Requirements Document (ORD) to eliminate decontamination requirement.

- Finalized the ORD and received approval.
- Completed contractor user and environmental testing on original prototype.
- Initiated fabrication of advanced prototypes for technical testing (TT).
- Coordinated development of a draft Test and Evaluation Master Plan for TT of advanced prototypes.

(c) Individual Protection:

Respiratory Protection 21 (RESPO 21): PE 63759, Project DE83-18 - Demonstrates technology advancements which will speed maturing of advanced technologies to reduce risk in system-oriented DEM/VAL.

FY94 Accomplishments:
- Fabricated RESPO 21 prototypes and supported 21st Century Land Warrior/special applications.

Clothing and Equipment: PE 63747, Project D669 - Supported development of improved clothing and individual equipment items to enhance the effectiveness, lethality, sustainability and quality of life of the individual soldier.

FY94 Accomplishments:

Individual Microclimate Cooling System (IMCS):
- Established a panel to assess original user requirements and near-term cooling technologies.
- Recommended withdrawal of original user's requirements document and subsequently rescinded Statement of Need-Clothing and Individual Equipment.
- Postponed transition to EMD.
- Identified and surveyed alternative user communities and demonstrated IMCS capabilities.
- Recommended development of a new requirement's document to satisfy alternative user communities' needs.

Self-Contained Toxic Environment Protective Outfit (STEPO):
- Finalized the Test and Evaluation Master Plan.
- Prepared draft training and technical manuals for STEPO.
- Procured test prototypes and initiated Phase I TT and user testing (UT).
- Conducted heat insulating testing and heat stress modeling on the STEPO suit.
- Conducted a physiological study to verify endurance time while wearing STEPO.

(d) Warning and Detection

NBC Contamination Avoidance Systems: PE 63806, Project D601 - This project supports the development of reconnaissance, detection, and identification equipment.

FY94 Accomplishments:

CB Mass Spectrometer:
- Initiated design modifications for the software and aerosol sampler interface.
- Initiated technical documentation preparation.
- Initiated agent profiling.
- Fabricated prototype hardware.

(e) Medical Chemical Defense Life Support Materiel:

Medical Chemical Defense Life Support Materiel-Non-Systems Specific DEM/VAL: PE 63002, Project D995 - Analytical stability studies and safety and efficacy screening, in addition to pre-clinical toxicology studies, are performed prior to EMD on promising pretreatment or treatment compounds. Capabilities are maintained for reformulation, formulation, and scale-up of candidate compounds using current good laboratory practices (CGLP).

FY94 Accomplishments:
- Evaluated candidate medical countermeasures to sulfur mustard.
- Produced reactive components for topical skin protectant.
- Prepared a methemoglobin forming pharmaceutical for protection against cyanide.
- Developed a pseudo-catalytic model of catalytic nerve agent scavengers.
- Validated methods to detect agents in biological fluids.
- Investigated advanced biotechnological approaches to the development of catalytic scavengers for nerve agents.

Medical Chemical Defense Life Support Materiel : PE 63807, Project D993- This project funds DEM/VAL of countermeasures for chemical agents including life support equipment, pretreatment and therapeutic drugs, and individual/casualty decontamination compounds.

FY94 Accomplishments:
- Conducted studies of the nerve agent antidote system, HI-6.
- Awarded a contract for the fabrication of a prototype multichambered autoinjector.
- Demonstrated efficacy of a topical skin protectant against CW agent.
- Evaluated products for use with the chemical protective patient wrap to improve air circulation.

4. ENGINEERING AND MANUFACTURING DEVELOPMENT

(a) Collective Protection Systems

NBC Protection Systems: PE 64806A, Project D604 - This project provides for development of the Advanced Integrated Collective Protection System (AICPS).

FY94 Accomplishments:
- Awarded a development contract.
- Developed three different configuration design concepts.
- Conducted a user interface and system integration analysis.

Tactical Rigid Wall Shelters: PE 64804, Project D429 - Supports development of a series of rigid wall shelters with added capabilities and enhanced survivability.

FY94 Accomplishments:

Chemically and Biologically Protected Shelter (CBPS):
- Completed fabrication of test items.
- Conducted TT/UT in support of type classification.
- Established user's Urgency of Need requirement for the CBPS.
- Completed the Technical Data Package.

Standard Integrated Command Post System (SICPS):
- Completed UT of the Limited Production Version.
- Received approval of the Test and Evaluation Master Plan for the Objective Version.
- Conducted technical testing of the Objective Version.

Enhanced Water Operations in a NBC Environment: PE 64804, Project DL39 - Supports the development of supplemental equipment and recommends operating procedures to increase the NBC survivability of Army water treatment equipment. The equipment supported included the 600 gallon per hour (GPH) Reverse Osmosis Water Purification Unit (ROWPU) and the 3000 GPH ROWPU.

FY94 Accomplishments:
- Designed contamination avoidance covers (CACs) for the 600 GPH and 3000 GPH ROWPUs.
- Conducted a CAC demonstration test on the 600 GPH ROWPU.
- Initiated a cost and operational effectiveness analysis to determine the best means of improving the NBC Survivability of the Army's ROWPUs.
- Prepared developmental drawings of the CACs for the 600 GPH and 3000 GPH ROWPUs.

Reverse Osmosis Water Purification Unit Preplanned Product Improvement (ROWPU P3I) Program: PE 64804, Project DL39- Supports work to evaluate the use of natural zeolite materials to remove nuclear and chemical warfare agents from water. The inexpensive zeolites could replace costly granular activated carbon and ion exchange resins used in ROWPU post-treatment columns.

FY94 Accomplishments:
- Awarded a contract to evaluate potential zeolites.
- Reviewed a contractor developed test plan.

(b) Warning and Detection Systems

NBC Contamination Avoidance System: PE 64806, Project D020- This provides for the development of new nuclear and chemical defensive equipment to enhance United States (U.S.)

capability to detect and identify threat agents on the battlefield. The project supports : (1) Automatic Chemical Agent Detector Alarm (ACADA), (2) Multipurpose Integrated Chemical Agent Alarm (MICAD), and (3) the XM93E1 FOX NBC Reconnaissance System (NBCRS).

FY94 Accomplishments:

ACADA:
- Completed inventory delivery and data item submission on the EMD contract.
- Initiated Comparative Testing and Evaluation of the ACADA non-developmental item (NDI).
- Conducted a market survey of candidate NDI detectors and selected four for further evaluation.

MICAD:
- Conducted a preliminary Design Review.
- Conducted a Hardware Critical Design and Review.
- Conducted a Software Design and Phase I Review.

NBCRS:
- Completed the technical manuals for Initial Operational Test and Evaluation (IOT&E).
- Completed refurbishment of the NBCRSs used during TT for their use in the IOT&E.
- Completed IOT&E.
- Completed Pre-production Qualification Testing .
- Completed failure analysis.
- Initiated preparation of the Milestone III In-Process Review documentation.
- Conducted an update and incorporated changes in the Technical Data Package.
- Continued the logistics provisioning, packaging, and manuals preparation.
- Processed and implemented engineering record revisions in support of configuration control and change management.

(c) Individual Protection Equipment

Individual Protection Equipment: PE 64801, Project DC45 - Supports a follow-on lightweight blower for the M43A1E1 Chemical Protective Mask and an Aircrew Microclimate Conditioning System (AMCS) to provide cooling for aircrew encumbered in the NBC ensemble during desert or tropic operations to prevent incapacitating heat stress as part of engineering development of life support items peculiar and necessary to Army aircrews for survival on the integrated battlefield.

FY94 Accomplishments:
- Completed initial acceptance test of five candidate lightweight blowers for the M43A1E1.
- Issued solicitation packages for second submission of candidate blowers for the M43A1E1and for test support packages.
- Completed physiological testing of AMCS to determine required cooling capacity.

- Completed modification procedures to accept AMCS for flight testing on two aircraft types.
- Initiated AMCS flight testing.

Combat Feeding, Clothing and Equipment: PE 64713, Project DL40 - Supported engineering and manufacturing development for state-of-the-art individual clothing and equipment to improve the effectiveness, sustainability, and quality of life of the individual soldier.

FY94 Accomplishments:

Fire Fighter's Suit - Combat (FIS-C)
- Finalized user requirements and received concept approval of the Statement of Need-Clothing and Individual Equipment.
- Awarded a contract for the respiratory component of the FIS-C ensemble.
- Initiated technical testing.

Improved Toxicological Agents Protective (ITAP) System
- Prepared and approved a Joint Service Operational Requirements Document.
- Integrated user requirements into overall system design.
- Conducted market survey to evaluate commercial items.
- Selected two contractors to supply the initial design of the Personal Ice Cooling System.
- Initiated additional procurement actions to fabricate and integrate equipment.

Multipurpose Rain, Snow, Chemical/Biological Overboot (MULO)
- Revised the compound formulation to include a non-odorous flame retardant additive.
- Integrated MULO user requirement matrix into the Joint Service, Lightweight Integrated Suit Technology I (JSLIST I) Program's Operational Requirements Document.
- Developed and coordinated compatibility/acceptability evaluation plan.
- Awarded contract for MULO test items for JSLIST I TT/UT.

JSLIST: PE 64713, Projects DL40 and D668 - Supported development of JSLIST I chemical protective garments; including Vapor Protective, Flame Resistant Undergarment/Enhanced Aircrew Uniform, Integrated Battlefield /Advanced Battledress Overgarment (BDO)/Lightweight Chemical Protective Overgarment and JSLIST II Program.

FY94 Accomplishments:
- Completed JSLIST I prototype design development.
- Completed JSLIST I materials testing and evaluation of candidate fabrics.
- Completed JSLIST I material down-selection of candidate fabrics.
- Prepared technical and procurement documentation for integrated acquisition of JSLIST I TT/UT items, Low Rate Initial Production and Production Delivery Options.

- Initiated development of a JSLIST I Test and Evaluation Master Plan to support TT/UT.
- Established JSLIST II Program Management Plan and Strategy.
- Developed JSLIST II performance criteria matrix for chemical protective materials.
- Prepared JSLIST II market survey announcement and information release for industry.
- Drafted JSLIST II Memorandum of Agreement.

Soldier Enhancement Program (SEP): PE 64713, Project D668 - Supports multiple projects to identify, test, and evaluate equipment for the individual soldier (focusing on non-development items whenever possible) to improve soldier lethality, survivability, and combat effectiveness.

FY94 Accomplishments:

Improved Chemical/Biological Protective Glove:
- Transitioned chemical protective, flame retardant, petroleum, oil and lubricant resistant butyl rubber formulations from CE/D to EMD for impermeable, butyl gloves - Type C.
- Transitioned a thin, chemical protective stretchable material which contains absorptive carbon from CE/D to EMD for permeable, form-fitting glove liners.
- Integrated the Improved CB Protective Glove user requirements matrix into the JSLIST I Program's Operational Requirements Document.
- Awarded a contract to design and procure semipermeable and permeable test items, Type A and B handwear, for JSLIST I TT/UT.

(d) Medical Chemical Defense Life Support Materiel: PE 64807, Project D848- This project funds EMD of medical materiel necessary to field an effective capability for medical defense against chemical agent threats facing U.S. forces in the field.

FY94 Accomplishments:
- Conducted extended stability testing of the medical aerosolized nerve agent antidote, convulsant antidote for nerve agents, and the nerve agent pretreatment pyridostigmine.
- Submitted sections of a New Drug Application for pyridostigmine to the Food and Drug Administration.

5. MANAGEMENT AND SUPPORT

a. NBC Survivability: PE 65710, Project DJ30 - This projects provides for test and analytical methodology, generic material testing, and database support for design and analysis of numerous weapon system programs to insure that NBC survivability is readily and adequately addressed during the acquisition cycle.

FY94 Accomplishments:
- Assisted Program Executive Officers/Project Managers, Research, Development and Engineering Centers, defense decision makers, and the Army Battle Labs to meet NBC survivability requirements and field sustainable equipment.
- Continued development of chemical databases and predictive techniques to determine the effects of agents and decontaminates against materials.

- Expanded the database work, including the Nuclear Survivability Status Tracking System, to develop an interface between the NBC databases and Army-wide modeling and simulation programs.
- Hosted the annual NBC Contamination Survivability Symposium.

b. Simulant Test Support: PE 65710, Project DO49 - The objective of this program is to plan, conduct, evaluate, and report on joint tests (for other than developmental hardware) and accomplish operational research assessments in response to requirements received from the Commanders-In-Chief and Services; to serve as the Department of Defense joint point of contact for chemical and biological defense tests and technical data; and to publish and maintain the CB Technical Data Source Book.

FY94 Accomplishments:
- BDO Penetration Test: Completed a field test evaluating the protection provided by NBC protective equipment against dusty agents and showed that only a small amount of CW agent exuded when wet with water or sweat.
- Concentration Fluctuations Measurements Test: Completed an assessment evaluating results of a tripartite field test to determine the cloud fluctuation of a chemical attack in support of development efforts for a new or a modification of an existing chemical agent detector system.
- Decontaminating Protective Clothing to Prolong Effective Life: Completed a laboratory test determining whether immediate decontamination of the BDO can extend the BDO's effective life and discovered that the wear time may be extended to withstand four agent attacks.

- Effects of Fog Oil on the BDO: Completed a laboratory test which showed that, when the BDO was exposed to fog oil, the protective capability of the BDO against nerve agent (GD) and mustard agent (HD) was degraded by 35 percent.
- Field Expedient Decontamination Devices: Completed an assessment summarizing and evaluating potential field expedient decontamination devices that would be available in the areas where special operations forces may be deployed.
- Commercial and Field Expedient Chemical Agent Decontamination: Completed an assessment providing existing and potential threat agents and field expedient decontaminants for each country/theater of operations.
- Effects of Fielded Decontaminants on Overgarments: Completed a laboratory test determined that when the BD0 was exposed to decontaminants, protective capability was degraded by 15 percent.
- Updated the Joint Chemical/Biological Data Source Book: Blister, Blood, Choking Agents, Part 4: Nitrogen Mustard, Sulfur Mustards, Lewisite, and Mustard Lewisite.
- Updated the Joint Chemical/Biological Data Source Book: Anti-personnel Viral, Rickettsial and Fungal Diseases, Part 1: Coccidioidomycosis and Part 3: Venezuelan Equine Eucephalomyelitis.
- Continued to transfer the Joint Technical Information Center (61,000 documents that chronicle the U.S. CB Program) to optical disc to enable automatic retrieval of unclassified documents.

c. Management and Admin Support:. **PE 65801, Projects MM55 and AC3; PE 65896, Project M1ZZ; PE 65709, Project D650; PE 65502, Project MM40; and PE 65803, Project C16** - The objectives of these programs are to provide maintenance support of laboratories; to conduct studies and analyses in support of research and development programs; and to support military construction of research, development, test and evaluation facilities.

FY94 Accomplishments:

- Awarded 20 Small Business Innovative Research type contracts.
- Purchased several pieces of state-of-the-art laboratory equipment.
- Continued to purchase various computer network system upgrades.

SECTION III
OBLIGATION REPORT ON THE BIOLOGICAL DEFENSE PROGRAM

During FY94, the Department of the Army obligated $43,319,000 for biological research, concept exploration and definition, and industrial preparedness for physical and medical defense.

FUNDS OBLIGATED			
Current Fiscal Year (CFY)	$42,794,000		
Prior Year (PY)	525,000		
		In House	$30,786,000
TOTAL	$43,319,00	Contract	$12,533,000

Breakdown of Program Areas

1. BASIC RESEARCH				
Medical Bio Defense	CFY	$16,696,000		
	PY	397,000		
		$17,093,000	In House	$10,081,000
			Contract	$7,012,000
Non-medical Bio Defense	CFY	$2,162,000		
	PY	-0-		
		$2,162,000	In House	$1,539,000
			Contract	$ 623,000
TOTAL BASIC RESEARCH	CFY	$18,858,000		
	PY	397,000		
		$19,255,000	In House	$11,620,000
			Contract	$7,635,000
2. CONCEPT EXPLORATION/ DEFINITION (CE/D)				
Medical Bio Defense	CFY	$14,838,000		
	PY	128,000		
		$14,966,000	In House	$13,073,000
			Contract	$1,893,000
Non-medical Bio Defense	CFY	$8,198,000		
	PY	-0-		
		$8,198,000	In House	$5,274,000
			Contract	$2,924,000
TOTAL CE/D	CFY	$23,036,000		
	PY	128,000		
		$23,164,000	In House	$18,347,000
			Contract	$4,817,000
3. INDUSTRIAL PREPAREDNESS				
	CFY	$900,000		
	PY	-0-		
		$900,000	In House	$819,000
			Contract	$81,000

SECTION IV
EXPLANATION OF OBLIGATION

1. BASIC RESEARCH

a. Medical Bio Defense

Science Base/Medical Biological Defense: PE 61102, Project BS12 - Basic research is conducted to develop medical countermeasures to provide an effective medical defense against validated biological threat agents including bacteria, toxins, viruses, and other agents of biological origin.

FY94 Accomplishments:
- Investigated the genetics and physiology of designated bacterial threat agents to understand how they cause disease.
- Conducted basic research on the genetic composition of designated viral threat agents.
- Conducted basic research on the physiological sites of action for biological toxins.
- Formulated intervention strategies for identified biological threat agents.

b. Non-medical Bio Defense

In-house Laboratory Independent Research (ILIR): PE 61101, Project A91A
Supports in-house, innovative and entrepreneurial research projects. Provides a pathway to the development of novel and high quality research projects.

- Demonstrated a new computational prototyping network for use in designing stand-off detection devices.

Biological Defense Research: PE 61102, Project A71A- This supports basic research for non-medical aspects of biological defense such as rapid detection, identification, and decontamination of and protection from biological threat agents.

FY94 Accomplishments:
- Designed and tested deoxynucleic acid (DNA) probes and primers for the identification of pathogenic Clostridia, Clostridium perfringins, and Clostridium toxin producers.
- Devised a method to identify bacterial genes and their regulators that are inactive outside the body but active once inside a host.
- Demonstrated a preliminary optical detection scheme for several different bacteria using antibodies, fluorescence, and light scattering.
- Modeled fluorescence of solvated aromatic amino acids in biological systems.

2. CONCEPT EXPLORATION AND DEFINITION

(a) Medical Biological Defense: PE 62787, Project A871- Exploratory research on the development of vaccines and drugs to provide an effective medical defense against validated biological threat agents including bacteria, toxins, viruses and other agents of biological origin.

FY94 Accomplishments:
- Utilized animal models to evaluate the efficacy of bio-engineered vaccines against bacterial agents.
- Evaluated procedures for preparing viral bio-engineered candidate vaccines to Venezuelan equine encephalitis and formulated strategies for bio-engineering vaccines to other viral threat agents.
- Evaluated pharmacologic agents for prophylaxis and therapy of biological toxin intoxication.
- Tested the initial prototype of a field diagnostic system and utilized emerging biotechnology for improved methods in analyzing biological threat agents in the field.
- Formulated specific intervention strategies for biological threat agents based on acquired paradigms.

(b) Non-medical Biological Defensive Concepts

Chemical/Biological (CB) Defense and General Investigations: PE 62622, Project A553 - Addresses urgent need to provide all services with defensive materiel to protect individuals and groups from CB threat agents.

FY94 Accomplishments:
- Transitioned the bio-detection kit program to production.
- Contracted to demonstrate a low power, tunable ultraviolet laser for improved biological discrimination.
- Developed a computerized biological toxin information data base for bioaerosol background detection purposes.
- Conducted studies on recombinant antibodies and developed a DNA library for genes of specific antibodies and expressed them in a bacterial system.

3. INDUSTRIAL PREPAREDNESS

Manufacturing Technology: PE 78045, Project DE74 - Provided for manufacturing process studies for antibodies and enzymes used for biological detection systems.

FY94 Accomplishments:
- Completed bench-scale (5 liter) optimization of fermentation process for urease-producing thermophilic organism, U408.
- Initiated purification process studies for thermostable urease, U408.
- Developed a standard plan for initial characterization and test of hybridoma cell lines for producing monoclonal antibodies.
- Developed a protocol for determining growth kenetics of hybridoma cell lines.

APPENDIX B

DEPARTMENT OF THE AIR FORCE

ANNUAL REPORT TO CONGRESS

ON THE RESEARCH, DEVELOPMENT, TEST AND EVALUATION OF

THE CHEMICAL/BIOLOGICAL DEFENSE PROGRAM

1 OCTOBER 1993 THROUGH 30 SEPTEMBER 1994

RCS: DD-USADRE(A) 1065

SECTION I
OBLIGATION REPORT ON THE CHEMICAL DEFENSE RDTE PROGRAM

During the FY94, the Department of the Air Force obligated $9,235,000 for development and testing of chemical defensive equipment.

FUNDS OBLIGATED			
Current Fiscal Year (CFY)	$9,070,000		
Prior Year (PY)	165,000		
	$9,235,000	In House	$3,146,000
		Contract	$6,089,000

Breakdown of Program Areas

1. CONCEPT EXPLORATION/ DEFINITION (CE/D)				
Nuclear, Biological, and Chemical Operability	CFY	$1,120,000		
	PY	-0-		
		$1,120,000	In House	$20,000
			Contract	$1,100,000
2. DEMONSTRATION AND VALIDATION (DEM/VAL)				
Detection	CFY	$203,000		
	PY	-0-		
		$203,000	In House	$33,000
			Contract	$170,000
Contamination Control	CFY	$78,000		
	PY	-0-		
		$78,000	In House	$10,000
			Contract	$68,000
TOTAL - DEM/VAL	CFY	$281,000		
	PY	-0-		
		$281,000	In House	$43,000
			Contract	$238,000
3. ENGINEERING AND MANUFACTURING DEVELOPMENT (EMD)				
Detection	CFY	$4,919,000		
	PY	11,000		
		$4,930,000	In House	$1,968,000
			Contract	$2,962,000
Individual Protection	CFY	$2,750,000		
	PY	120,000		
		$2,870,000	In House	$1,115,000
			Contract	$1,755,000
Collective Protection	CFY	$ -0-		
	PY	34,000		
		$ 34,000	In House	$ -0-
			Contract	$34,000
TOTAL - EMD	CFY	$7,669,000		
	PY	165,000		
		$7,834.000	In House	$3,083,000
			Contract	$4,751,000

SECTION II
EXPLANATION OF OBLIGATION

1. CONCEPT EXPLORATION AND DEFINITION

Chemical and Biological (CB) Defense and General Investigations: PE 62622, Project A553 - Addresses urgent need to provide all Services with defensive material to protect individuals and groups from CB threat agents. (NOTE: Funds were directed to an Army PE; however, they were identified for the Air Force.)

FY94 Accomplishments:

NBC Operability
- Analyzed current and emerging threat to modify predictive chemical simulation models.
- Updated threat data to challenge concentrations to air bases.
- Predicted necessary detection and protection performance for chemical and biological warfare defense equipment for Air Force operations.

2. DEMONSTRATION AND VALIDATION

a. Crew Systems Technology (Detection): PE 63231F, Project 2722 - Supported development of an aircraft interior chemical agent detector.

FY94 Accomplishments:
- Improved, fabricated, and successfully flight tested a surface acoustic wave detector on a C-130 aircraft using various chemical agent simulants.

b. Crew Systems Technology (Contamination Control): PE 63231F, Project 2722 - Supported development of aircraft interior decontamination.

FY94 Accomplishments:
- Developed methods/techniques to assess flight control procedures to remove high concentrations of vapor (in less than one hour) from a C-130 aircraft interior.

3. ENGINEERING MANUFACTURING DEVELOPMENT

a. Nuclear, Biological and Chemical (NBC) Defense Equipment (Detection): PE 64601F, Project 3321 - Supported procurement of an automatic chemical agent detector and surveys of other detectors.

FY94 Accomplishments:

- Provided technical support for the purchase of the non-development item, Automatic Mustard Agent Detector.

- Conducted surveys of potential candidates for (1) an in-line detector of CB agents in water supplies, and (2) an aircraft interior chemical agent detector.

b. NBC Defense Equipment (Individual Protection): PE 64601F, Project 3337 - Supported development/integration of : (1) aircrew masks in various aircraft, (2) an emergency mask, and (3) ground crew protective clothing.

FY94 Accomplishments:
- Designed aircraft modifications for airborne command, control and communications aircraft to accept aircrew masks.
- Integrated aircrew eye/respiratory protective masks into F-16 aircraft.
- Conducted various development tests on the disposable eye/respiratory protective mask.
- Conducted decontamination testing and second skin integration with the Air Force standard ground crew mask.
- Provided support to the purchase of the Aircrew Protective Ensemble.

c. NBC Defense Equipment (Collective Protection): PE 64601F, Project 3762 - Supported efforts to complete and shelve the re-procurement package for a collective protection system.

FY94 Accomplishments:
- Prepared an engineering change proposal for shipping containers for the Transportable Collective Protection Shelter.

SECTION III
OBLIGATION REPORT ON THE BIOLOGICAL DEFENSE RDTE PROGRAM

During the FY94, the Department of the Air Force obligated $ 639,000 in support of the Biological Defense Research Program.

FUNDS OBLIGATED			
Current Fiscal Year (CFY)	$639,000		
Prior Year (PY)	-0-		
	$639,000	In House	$ 60,000
		Contract	$579,000

Breakdown of Program Areas

1. CONCEPT EXPLORATION/DEFINITION				
Detection	CFY	$639,000		
	PY	-0-		
		$639,000	In House	$60,000
			Contract	$579,000

SECTION IV
EXPLANATION OF OBLIGATION

1. CONCEPT EXPLORATION AND DEFINITION

Chemical and Biological (CB) Defense and General Investigations: PE 62622, Project A553 - Addresses urgent need to provide all Services with defensive material to protect individuals and groups from CB threat agents. (NOTE: Funds were directed to an Army PE; however, they were identified for the Air Force.)

Detection

FY94 Accomplishments:

- Improved solid state detection and alarm technology provided to the Air Force during Operation Desert Storm.
- Explored technology for identification of biological warfare agents.

APPENDIX C

DEPARTMENT OF THE NAVY

ANNUAL REPORT TO CONGRESS

ON THE RESEARCH, DEVELOPMENT, TEST AND EVALUATION OF

THE CHEMICAL/BIOLOGICAL DEFENSE PROGRAM

1 OCTOBER 1993 THROUGH 30 SEPTEMBER 1994

RCS: DD-USADRE(A) 1065

SECTION I
OBLIGATION REPORT ON THE CHEMICAL DEFENSE PROGRAM

During the FY94, the Department of the Navy obligated $12,871,000 for development and testing of chemical defensive equipment.

FUNDS OBLIGATED				
Current Fiscal Year (CFY)	$10,899,000			
Prior Year (PY)	1,972,000			
	$12,871,000	In House	$8,638,000	
		Contract	$4,233,000	

Breakdown of Program Areas

1. CONCEPT EXPLORATION/ DEFINITION

	CFY	$2,867,000		
	PY	170,000		
		$3,037,000	In House	$2,436,000
			Contract	$ 601,000

2. DEMONSTRATION AND VALIDATION (DEM/VAL)

Includes Aviation Survivability, Ship	CFY	$2,205,000		
Combat Survivability, and Advanced	PY	791,000		
Technology Demonstrations		$2,996,000	In House	$1,824,000
			Contract	$1,172,000
Nuclear, Biological and Chemical	CFY	$1,457,000		
(NBC) Contamination Avoidance	PY	-0-		
Systems		$1,457,000	In House	$195,000
			Contract	$1,262,000

3. ENGINEERING MANUFACTURING DEVELOPMENT (EMD)

	CFY	$4,370,000		
	PY	1,011,000		
		$5,381,000	In House	$4,183,000
			Contract	$1,198,000

SECTION II
EXPLANATION OF OBLIGATION

1. CONCEPT EXPLORATION AND DEFINITION

Readiness, Training, and Environment Quality Technology: PE 62233N, No Project Number - Supported Chemical and Biological (CB) Defense technologies which will improve safety, enhance personnel performance capabilities, and maintain operational capabilities on ships in a CB warfare environment.

FY94 Accomplishments:

- Continued developing inputs for Navy wargames and provided some initial factors to the Defense Nuclear Agency.
- Completed the necessary changes to incorporate the Battle Area Dense Gas Effects Model module for heavier than air gases and initiated incorporation in the Chemical Warfare Naval Simulation Model.
- Completed an evaluation of the effects of seawater wetting of the protective properties of the chemical agent protective overgarment.
- Established a data exchange agreement with Germany to share information on shipboard damage control in a CB environment.
- Investigated a Technical Cooperation Program with the United Kingdom for studying agent pick-up during air operations.
- Participated in various international forums to extend United States perception beyond a land-based conflict and provided the Navy with insights on foreign research and development, doctrine, and operational responses.

2. DEMONSTRATION AND VALIDATION

Aviation Survivability: PE 63216N, Project W0584 - This project develops technology for functionally integrated Navy unique aircrew and life support systems designed to ensure crew protection and enhance crew performance in a CB threat environment.

FY94 Accomplishments:

- Completed a CB Threat and Vulnerability Analysis for aircrew CB protection which will be used to develop design concepts to integrate CB sensors in advanced life support sytems, in particular, the Air Warrior Ensemble for rotary wing aircrew and the Advanced Integrated Life Support System for tactical air personnel.

Ship Combat Survivability: PE 63514N, Project S2053 - Supported DEM/VAL of CB defensive systems for surface ships required to sustain operations in a CB threat environment. Systems developed will counter threats in the near term and predicted emerging threats as validated by Office of Naval Intelligence CB Threat Assessment.

FY94 Accomplishments:
- Completed a catalytic oxidation evaluation for Advanced CB and Radiation Filtration Systems.
- Completed a shipboard inherent contamination task which generated a Collective Protection System Filter Life Prediction Model.
- Continued technical performance analysis for a Chemical Agent Remote Detector project.
- Completed, as part of a joint service program, initial design, test and evaluation of lightweight integrated suit technologies for chemical protective garments.

Marine Corps Advanced Technology Demo for Chemical and Biological Defense: PE 63640M, Project C2082 - This project provides for Marine Corps unique requirements in CB Defense. Efforts are coordinated with the Army and focus on leveraging Army technology for developing a Lightweight Integrated Suit, a Lightweight Stand-off Chemical Agent Detector, and Survivability Technology for Amphibious Vehicles.

FY94 Accomplishments:
- Supported the transition of technology to the Program Manager, Combat Service Support for Acquisition Activities for the following systems: (1) NBC Reconnaissance System mounted on the High Mobility Multipurpose Wheeled Vehicle, (2) Light Weight Integrated Suit Technology System, and (3) Light Weight Stand-off Chemical Agent Detector System.

Advanced Technology Demonstration: PE 63792N, Project R1889 - This program demonstrates high-payoff technologies that could significantly improve Joint Chiefs of Staff's Future Warfighting Capabilities. Each demonstration is designed to assess the extent to which the technology is feasible, affordable and compatible with operational concepts and projected force structure.

FY94 Accomplishments:
Completed laboratory scale testing on the Pulsed Power Corona Air Purification Unit and conducted an electrical analysis.

NBC Contamination Avoidance: PE 63806, Project D601 -This project supports the development of reconnaissance, detection, and identification equipment. (NOTE: Funds were directed to an Army PE; however, they was identified for the Marine Corps.)

Universal Second Skin For M40 Mask

FY94 Accomplishments:
- Finalized test plan, procured protoypes, and conducted development testing.

Joint Service Lightweight Integrated Suit Technology

FY94 Accomplishments:
- Completed documentation to support Milestone II decision.
- Initiated chemical agent testing methodology program.

Lightweight NBC Reconnaissance System

FY94 Accomplishments:
- Initiated preparation of program support documentation.

NBC Hazard Warning System

FY94 Accomplishments:
- Completed documentation to support Milestone II decision.
- Conducted development testing.

3. ENGINEERING AND MANUFACTURING DEVELOPMENT

Aircrew Systems Development: PE 64264N, Project W0606 - Supports development of Aviation Life Support Systems to protect aircrews from current known and future CB threats. This particular effort is a non-development item program for an Aircrew Mounted Respirator System for use in Navy and Marine Corps tactical and rotary wing aircraft.

FY94 Accomplishments:
- Initiated a major revision to the Request for Proposal (RFP) contract package based on new mandatory Department of Defense (DOD) policy of not requiring specifications and standards in RFPs for new acquisitions.

Ship Survivability: PE 64516N, Project S0410 - Supported development of CB defensive systems for surface ships required to sustain operations in a CB threat environment. Systems developed will counter threats in the near term and predicted emerging threats as validated by Office of Naval Intelligence CB Threat Assessment.

FY94 Accomplishments:
- Completed fabrication of a model of an improved Chemical Agent Point Detector System and initiated shipboard testing.
- Continued fleet introduction of a Selective Area Collective Protection System.
- Completed a Collective Protection System (CPS) operations evaluation, recommended actions, and supported follow-on test and evaluation on the Guided Missile Destroyer, DDG-54.
- Completed an evaluation of CPS high pressure fans.
- Conducted a feasibility analysis of non-development item units for the Portable Shipboard Chemical Agent Monitor project and coordinated this effort with the Army's detector program.

SECTION III
OBLIGATION REPORT ON THE BIOLOGICAL DEFENSE RDTE PROGRAM

During the FY94, the Department of the Navy obligated $3,078,000 in support of the Biological Defense Research Program.

FUNDS OBLIGATED			
Current Fiscal Year (CFY)	$3,049,000		
Prior Year (PY)	29,000		
	$3,078,000	In House	$2,882,000
		Contract	$196,000

Breakdown of Program Areas

1. CONCEPT EXPLORATION/DEFINITION (CE/D)				
	CFY	$1,078,000		
	PY	29,000		
		$1,107,000	In House	$932,000
			Contract	$175,000
2. DEMONSTRATION AND VALIDATION (DEM/VAL)				
Ship Combat Survivability	CFY	$1,000,000		
	PY	-0-		
		$1,000,000	In House	$1,000,000
			Contract	-0-
NBC Contamination Avoidance Systems	CFY	$21,000		
	PY	-0-		
		$21,000	In House	-0-
			Contract	$21,000
3. ENGINEERING MANUFACTURING DEVELOPMENT (EMD)				
	CFY	$950,000		
	PY	-0-		
		$950,0.00	In House	$950,000
			Contract	-0-

SECTION IV
EXPLANATION OF OBLIGATION

1. CONCEPT EXPLORATION AND DEFINITION

Readiness, Training, and Environment Quality Technology: PE 62233N, No Project Number - Supported Biological Defense technologies which will improve safety, enhance personnel performance capabilities, and maintain operational capabilities on ships in a biological warfare environment.

FY94 Accomplishments:
- Developed a Vapor, Liquid, and Solid Tracking Hazard Prediction Model and it was accepted as a DOD joint model.
- Conducted a laboratory demonstration of the Proximal Probe Detector.
- Demonstrated the Optical Waveguide Biosensor at a joint service field trial.

2. DEMONSTRATION AND VALIDATION

Ship Combat Survivability: PE 63514N, Project S2053 - Supported development of CB surface ship defensive systems for use in sustaining operations in a CB threat environment.

FY94 Accomplishments:
- Continued evaluating detector technologies for the automatic Biological Agent Point Detector System (BADS).
- Supported development of joint operational requirements.
- Completed attachment chemistries for assays for initial list of threat agents.
- Completed alarm algorithm for the Interim Biological Agent Point Detector (IBAD).
- Initiated development of an acquisition decision memorandum.
- Initiated component testing and a cost and operational effectiveness analysis for the BADS.

NBC Contamination Avoidance: PE 63806, Project D601 -This project supports the development of reconnaissance, detection, and identification equipment. (NOTE: Funds were directed to an Army PE; however, they were identified for the Marine Corps.)

Biological Detector

FY94 Accomplishments:
- Conducted a study to determine the feasibility of miniaturization of current technology to a small, lightweight unit.

3. ENGINEERING MANUFACTURING AND DEVELOPMENT

Ship Survivability: PE 64516N, Project S0410 - Supported development of CB defensive systems for surface ships required to sustain operations in a CB threat environment. Systems

developed will counter threats in the near term and predicted emerging threats as validated by Office of Naval Intelligence CB Threat Assessment.

FY94 Accomplishments:

- Completed an operational assessment.
- Initiated IBAD prototype acquisition and component/system testing.
- Finalized laboratory and component testing of the IBAD.
- Installed the first completed prototype IBAD onboard a fleet flag ship.
- Initiated an operational assessment of the IBAD.

APPENDIX D

JOINT BIOLOGICAL DEFENSE PROGRAM

ANNUAL REPORT TO CONGRESS

ON THE RESEARCH, DEVELOPMENT, TEST AND EVALUATION OF

THE CHEMICAL/BIOLOGICAL DEFENSE PROGRAM

1 OCTOBER 1993 THROUGH 30 SEPTEMBER 1994

RCS: DD-USADRE(A) 1065

SECTION I
OBLIGATION REPORT ON THE JOINT BIOLOGICAL DEFENSE PROGRAM

During the FY94, the Department of Defense obligated $40,393,000 for the Joint Biological Defense Program which supports the development and testing of joint physical and medical defense systems.

FUNDS OBLIGATED			
Current Fiscal Year (CFY)	$40,052,000		
Prior Year (PY)	341,000		
	$40,393,000	In House	$26,905,000
		Contract	$13,488,000

1. DEMONSTRATION/ VALIDATION (DEM/VAL)				
Medical Bio Defense	CFY	$20,302,000		
	PY	330,000		
		$20,632,000	In House	$14,007,000
			Contract	$6,625,000
Non-Medical Bio Defense	CFY	$16,722,000		
	PY	- 0-		
		$16,722,000	In House	$10,946,000
			Contract	$5,776,000
TOTAL - DEM/VAL	CFY	$37,024,000		
	PY	330,000		
		$37,354,000	In House	$24,953,000
			Contract	$12,401,000
2. ENGINEERING MANUFACTURING DEVELOPMENT (EMD)				
Medical Bio Defense	CFY	$887,000		
	PY	11,000		
		$898,000	In House	$237,000
			Contract	$661,000
Non-Medical Bio Defense	CFY	$2,141,000		
	PY	-0-		
		$2,141,000	In House	$1,715,000
			Contract	$426,000
TOTAL - EMD	CFY	$3,028,000		
	PY	11,000		
		$3,039,000	In House	$1,952,000
			Contract	1,087,000

SECTION II
EXPLANATION OF OBLIGATION

1. DEMONSTRATION AND VALIDATION

(a) Medical Biological Defense

Industrial Base/Medical Biological Defense Vaccines and Drugs: PE 63002, Project D807- This project funds research on pre-clinical development of safe and effective prophylaxis and therapy (vaccines and drugs for exposure to biological threat agents). This project also supports the advanced technology development of kits to rapidly diagnose exposure to biological agents in clinical samples.

FY94 Accomplishments:
- Demonstrated protective immunity by candidate vaccines directed against bacterial threat agents.
- Conducted advanced screening for safety, efficacy, and toxicity of candidate Venezuelan equine encephalitis vaccines.
- Prepared documentation for transitioning ricin toxoid to EMD.
- Assessed candidate solutions for biological toxins other than ricin.
- Conducted demonstrations of a candidate technology for field diagnosis of biological threat agents.
- Conducted advanced pre-clinical prophylaxis studies on medical countermeasures to biological threat agents.

Medical Biological Defense Drug and Vaccine: PE 63807, Project D809- This project funds development of vaccines and drugs to provide an effective medical defense against validated threat agents including bacteria, viruses, and other agents of biological origin.

FY94 Accomplishments:
- Completed Phase I subcutaneous trials of cell culture derived smallpox vaccine.
- Completed Phase I trials of Type F Botulinum toxoid.
- Completed Phase I safety trial of Botulism Immune Globulin (Human).
- Completed pilot plant production of botulinum toxoid Type G.

(b) Non-medical Biological Defense Systems

NBC Contamination Avoidance Systems: PE 63806A, Project D601 - This project supports the development of the Army's Biological Detector.

FY94 Accomplishments:

Biological Detector:
- Continued development for integration into the Biological Integrated Detector System (BIDS) Preplanned Product Improvement Program (P3I).

- Conducted technical feasibility testing.

Biological Defense Development: PE 63724D, Defense Project
Supported development of the Army's BIDS Non-development Item (NDI), the BIDS P3I, the Long Range Biological Stand-off Detection System (LRBSDS) NDI, the LRBSDS P3I, and the Short Range Biological Stand-off Detection System.

FY94 Accomplishments:
- Completed design and fabrication of three NDI BIDS.
- Completed preparation for final technical feasibility testing.
- Conducted Milestone I/II of the NDI BIDS.
- Fabricated prototypes of the NDI LRBSDS.
- Developed and received approval of the Operational Concept and Operational Requirements Documents for the NDI LRBSDS.
- Initiated technical feasibility testing of the NDI LRBSDS.

2. ENGINEERING AND MANUFACTURING DEVELOPMENT

(a) Medical Biological Defense: PE 64807, Project D847- This project funds EMD of vaccines and drugs to provide an effective medical defense against validated biological threat agents including bacteria, toxins, viruses, and other agents of biological origin.

FY94 Accomplishments:
- Prepared a product license application for a tularemia vaccine.
- Developed limited quantities of Anti-Botulism Immune Globulin (Human) for contingencies.

(b) Non-medical Defense Systems

NBC Contamination Avoidance System: PE 64806A, Project D020- This project supported development of the Army's Bio Detector Kits.

FY94 Accomplishments:

Bio Detector Kit
- Initiated an engineering analysis for Bio Detector Kit integration into the BIDS.

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ANNEX J

ACRONYMS AND ABBREVIATIONS

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ACRONYMS AND ABBREVIATIONS

Organizations:

AFFRI - Armed Forces Radiobiology Research Institute
AMC - U.S. Army Materiel Command
ASBREM - Armed Services Biomedical Research Evaluation and Management
ATSD(AE) - Assistant to the Secretary of Defense (Atomic Energy)
BMDO - Ballistic Missile Defense Organization
CBDCOM - Chemical Biological Defense Command (U.S. Army)
CDEPAT - Chemical Defense Equipment Process Action Team
CWCIWG - Chemical Weapons Convention Implementation Working Group
CWDSO - Chemical Weapons Destruction Support Office
DAB - Defense Acquisition Board
DATSD(AE)(C/BM) - Deputy Assistant to the Secretary of Defense (Atomic Energy)(Chemical and Biological Matters)
DCSOPS - U.S. Army Deputy Chief of Staff for Operations
DDR&E - Director, Defense Research and Engineering
DLA - Defense Logistics Agency
DMARC - Defense Medical Acquisition Review Committee
DMROC - Defense Medical Requirements Oversight Committee
DNA - Defense Nuclear Agency
DoD - Department of Defense
DPSC - Defense Personnel Support Center
ERDEC - Edgewood Research, Development, and Engineering Center (U.S. Army)
FDA - Food and Drug Administration
JCS - Joint Chiefs of Staff
JPCBD - Joint Panel for Chemical and Biological Defense
JPO-BD - Joint Program Office for Biological Defense
JSCC - Joint Service Coordination Committee
JSIG - Joint Service Integration Group
JSMG - Joint Service Materiel Group
JTCG - Joint Technology Coordinating Group
JTSG - Joint Training Steering Group
NRDEC - Natick Research, Development, and Engineering Center (U.S. Army)
OPCW - Organization for the Prohibition of Chemical Weapons (in The Hague)
OSD - Office of the Secretary of Defense
OSIA - On-Site Inspection Agency
SARDA - Assistant Secretary of the Army for Research, Development, and Acquisition
SOF - Special Operations Forces
USAMMA - U.S. Army Medical Materiel Agency
USAMRICD - U.S. Army Medical Research Institute of Chemical Defense
USAMRIID - U.S. Army Medical Research Institute of Infectious Diseases
USAMRMC - U.S. Army Medical Research and Materiel Command
USD(A&T) - Undersecretary of Defense (Acquisition and Technology)

Systems, Programs, Documents and other terms:
21CLW - Twenty-First Century Land Warrior
AARS - Advanced Airborne Radiac System
ACADA - Automatic Chemical Agent Detector (XM22)
ACPG - Advanced Chemical Protective Garment
ACPM - Aircrew Protective Mask (XM45)
ACTD - Advanced Concept Technology Demonstration
ADBO - Advanced Battledress Overgarment
ADCPE - Advance Deployable Collective Protective Equipment
ADS - Area Detection System
AERP - Aircrew Eye/Respiratory Protection
AICPS - Advanced Integrated Collective Protective System
AIDECONS - Aircraft Interior Decontamination System
AIDET - Aircraft Interior Detector
AN/VDR-13 - Compact, digital whole body radiation meter
AN/VDR-2 - Portable dose-rate gamma/beta radiation meter
ANBACIS - Automatic Nuclear, Biological, and Chemical Information System
ATD - Advanced Technology Demonstration
AUIB - Aircrew Uniformed Integrated Battlefield protective garment
AVAD - Automatic Vapor Agent Detector (M90)
BADS - Biological Agent Detection System
BDA - Bilateral Destruction Agreement
BDWS - Biological Detector and Warning System
BES - Budget Estimate Submission
BIDS - Biological Integrated Detection System
CAM - Chemical Agent Monitor
CANA - Convulsant Antidote, Nerve Agent autoinjector
CANE - Combined Arms in a Nuclear/Chemical Environment
CARDS- Chemical Agent Remote Detection System
CAWM - Chemical Agent Water Monitor
CB - chemical and biological
CBASK - Chemical Biological Agent Sample Kit
CBAWM - Chemical Biological Agent Water Monitor
CBD - chemical and biological defense
CBPS- CB Protected Shelter
CBR - chemical, biological, and radiological
CBSD - Chemical Biological Stand-off Detector
CBW - chemical and biological warfare
CDE - Chemical Defense Equipment
CDTF - Chemical Defense Training Facility (at the U.S. Army Chemical School)
CFY - Current fiscal year
CHATH - Chemically/Biologically Hardened Air Transportable Hospital
CIP - CANE Implementation Plan
CMAD - Chemical Miniature Agent Detector
CP - chemical protective (also, counterproliferation) (also, collective protection)

CPE - Collective Protection Equipment
CPS - Collective Protection System
CPU - Chemical Protective Undergarment
CTR - Cooperative Threat Reduction
CWC - Chemical Weapons Convention
CWICS - Chemical Weapons Interior Compartment System
CWILD - Chemical Warning and Identification LIDAR Detector
DEPMEDS - CB Protected Deployable Medical Systems
DERP - Disposable Eye Respiratory Protection
DISC/DIAL - Differential Scattering/Differential Absorption of Light
DIW - Detection, Identification and Warning
DPG - Defense Planning Guidance
DS2 - Decontamination Solution 2
DTIRP - Defense Technical Inspection Readiness Program
EOD - Explosive Ordnance Disposal
FFEN - CB Protective Firefighter Ensemble
FIS-C - Firefighter Suit -Combat
FUE - First Unit Employed
FY - fiscal year
GA - tabun, a nerve agent
GB - sarin , a nerve agent
GCE - Ground Crew Ensemble
GD - soman, a nerve agent
HAZWARN - NBC Hazardous Warning System
HD - sulfur mustard, a blister agent
IBADS - Interim Biological Agent Detection System
IBMC - Industrial Base Maintenance Contract
ICDS - Improved Chemical Detection System
IDLH - Immediate Danger to Life and Health
IL CBDWS - In-Line Chemical Biological Defense Water System
IND - Investigational New Drug
IPDS - Improved Point Detection System
IPE - Individual Protective Equipment
ISD - Individual Soldier Detector
ITAP - Improved Toxicological Agent Protective suit
IVD - Individual Vapor Detector
J-/JS- - Joint-/Joint Service-
JDDAP - Joint Doctrine Development Action Plan
JSA - Joint Service Agreement
JSLIST - Joint Service Lightweight Integrated Technology (individual protection)
L - lewisite, a vesicant agent
LAM - Louisiana Maneuvers
LDS - Lightweight Decontamination System
LIDAR - LIght Detection And Ranging
LRSBDS - Long-Range Stand-off Bio-Detection System

LSCAD - Lightweight Stand-off Chemical Agent Detector
LSCD - Laser Stand-off Chemical Detector
LWRS - Lightweight Reconnaissance System
MAITS - Mobility Automated Inventory Tracking System
MBDRP - Medical Biological Defense Research Program
MCDRP - Medical Chemical Defense Research Program
MCU-2P - an Air Force mask
MDS - Modular Decontamination System
MFR - Multi-Function Radiac Set
MICAD - Multipurpose Integrated Chemical Agent Detector
MNDRP - Medical Nuclear Defense Research Program
MNS - Mission Needs Statement
MOPP - Mission Oriented Protective Posture
MULO - Multi-purpose Overboot
NAAK - Nerve Agent Antidote Kit
NAEDS - Non-Aqueous Equipment Decontamination System
NBC - Nuclear, Biological, and Chemical
NBCRS - NBC Reconnaissance System (Fox Vehicle)
NDI - Non-Developmental Item
NICP - National Inventory Control Points
OMA - Operations & Maintenance, Army
OPA - Other Procurement, Army
ORD - Operational Requirements Document
P^3I - Pre-Planned Program Improvement
PATS - Protective Assessment Test System
PBT - pyridostigmine bromide tablets
PICS - Personal Ice Cooling System
POM - Program Objectives Memorandum
PY - Prior year
RAM - Reliability, availability, and maintainability
RDA - Research, Development, and Acquisition
RDTE (Also, RDT&E) - Research, Development, Test and Evaluation
RESPO 21 - 21st Century Respiratory Protection System
RSCAAL - Remote Sensing Chemical Agent Alarm (M21/XM21)
S&T - Science and Technology
SALAD - Shipboard Automatic Liquid Agent Detector
Saratoga - a CB protective overgarment
SBDS - Strategic Bio-Detection System
SBSS - Standard Base Supply System
SCALP - Suit Contamination Avoidance Liquid Protection
SCAMP - Shipboard Chemical Agent Monitor Portable
SD - Stand-off Detector
SD/ASM - Stand-off Detector for Armor System Modernization
SEB - Staphyococcal enterotoxin B, a biological warfare agent
SICPS - Standardized Integrated Command Post System and Tent

SOFCAS (or SOFCAD) - Special Operation Forces Chemical Agent System (Detector)
SORTS - Joint Status of Resources and Training System
SRSBDS - Short-Range Stand-off Bio-Detection System
STEPO-I - Interim Self-Contained Toxic Environment Protective Outfit
TAV - Total Asset Visibility
VEE - Venezuelan equine encephalomyelitis, a biological warfare agent
VPFRU - Vapor Protective Flame Resistant Undergarment
VX - a nerve agent
WMD - weapons of mass destruction

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