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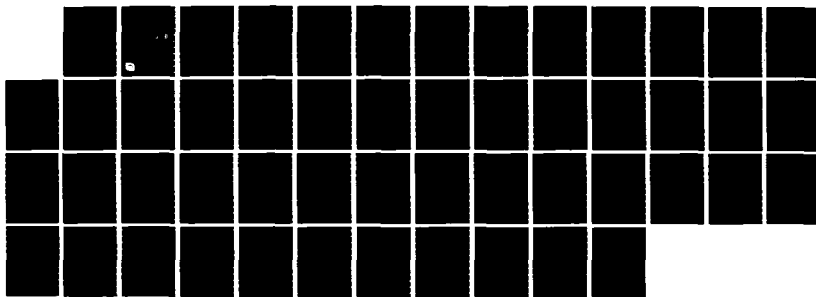
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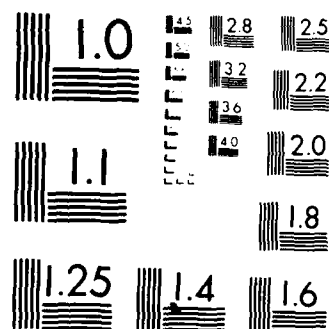
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IDA MEMORANDUM REPORT M-165

PRELIMINARY REPORT
THE COST OF CHEMICAL WARFARE
DEFENSIVE TRAINING

Mark I. Knapp

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April 1986

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Prepared for
Office of the Under Secretary of Defense for Research and Engineering

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<p>This paper documents the preliminary results of research to determine the cost of chemical warfare defensive (CWD) training in the U.S. Army, Navy, Marine Corps, and Air Force. It is part of a study to identify training technology that can improve the cost-effectiveness of CWD training.</p> <p>"Cost" is defined as the funds expended exclusively for CWD training, in the FY 1984-FY 1986 time period, for research and development, investment in equipment and protective clothing, formal training courses, and periodic training in operational units.</p> <p>Results indicate that it is impractical, if not infeasible, at this time to develop a credible estimate of what is being spent on CWD training in the Department of Defense. Solicitations of data led to the conclusion that the principal reason why sources could not respond adequately is that the military services have not been directed to, nor have they perceived a need to collect, evaluate, and centralize this type of cost data. Inquiries for data, therefore, assumed the nature of "one-time requests," which yielded responses of uneven quality.</p> <p>Despite the scarcity of meaningful cost data, partial costs were acquired. Research and development funding to support only CWD training was found to approximate \$5 million from FY 1984 through FY 1986. It is felt that this value can be viewed with a fair degree of confidence. There is no question, however, that funding for equipment, formal training courses, and CWD training in operational units is significantly underestimated (the total is about \$99 million for the three-year period) because sizable resource expenditures, although identified by type and activity, cannot be qualified for lack of suitable data.</p> <p>The paucity of cost data relevant to CWD training limits the conduct of cost-effectiveness (C-E) studies of alternative technologies for CWD training. The current state of CWD training cost data would require that uniform guidelines, collection and analysis procedures, and cost data bases be established and maintained to ensure the consistency essential for rational choices among alternatives.</p>					
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**PRELIMINARY REPORT
THE COST OF CHEMICAL WARFARE
DEFENSIVE TRAINING**

Mark I. Knapp

April 1986



INSTITUTE FOR DEFENSE ANALYSES

Contract MDA 903 84 C 0031
Task T-5-310

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ABBREVIATIONS

AFB	Air Force Base
AMCCOM	Armament, Munitions, and Chemical Command
ARTEP	Army Training and Evaluation Program
ATC	Air Training Command
CBR	Chemical, Biological, and Radiological
C-E	Cost-effectiveness
Cmd	Command
CNET	Chief of Naval Education and Training
CONUS	Continental United States
CSPR	Composite Standard Pay Rate
CW	Chemical Warfare
CWD	Chemical Warfare Defensive (training)
DCS	Deputy Chief of Staff
DPRC	Disaster Preparedness Resources Center
FSD	Full-Scale Development
FYDP	Five-Year Defense Program
HQ	Headquarters
ISD	Instructional System Development
MOS	Military Occupational Specialty
MPA	Military Pay and Allowances
MPN	Military Pay, Navy
MPT	Manpower, personnel, and training
NAVAIR	Naval Air Systems Command
NAVFAC	Naval Facilities Engineering Command
NAVSEA	Naval Sea Systems Command
NBC	Nuclear, biological, and chemical
NCO	Non-commissioned Officer
O&M	Operations and Maintenance
O&MN	Operations and Maintenance, Navy

O&S	Operating and Support
OPN	Other Procurement, Navy
PE	Program element
R&D	Research and Development
RD1&E	Research, Development, Test, and Evaluation
TDAS	Training Device Acquisition Strategy
TRADOC	Training and Doctrine Command
TRANS	Training Simulator Set
TRASANA	Training Studies and Analysis Agency
USAF	United States Air Force
USAREUR	United States Army, Europe
USMC	United States Marine Corps
WMP	War Mobilization Plan

SUMMARY

A. PURPOSE

This paper documents preliminary results of research to determine the cost of training military personnel to survive chemical attack and to operate in a contaminated, post-attack environment. Training to accomplish these objectives is referred to as "chemical warfare defensive (CWD) training." This research is part of a study to identify training technology that can improve the cost-effectiveness of CWD training.¹

B. BACKGROUND

The declared policy of the United States is that it will not be the first to use chemical weapons in offensive operations. Conversely, the Soviet Union has a sizable chemical weapons capability and has demonstrated its willingness to use those weapons offensively (e.g., in Afghanistan). In view of this difference in policies, it is necessary that our military forces maintain an effective chemical warfare defensive posture. Modest plans and programs are in being, and more are being developed by the Services, to improve CWD training equipment and procedures. Evaluation of the costs and effectiveness of the various ways of achieving CWD training objectives is needed to select the best options.

C. APPROACH AND SCOPE

This report responds to the question, "What is the cost of chemical warfare defensive training?" The approach and scope of the task was defined, as follows:

(1) The current year (FY1985) was bracketed by also considering FY1984 and FY1986 in order to identify any short-term trends or perturbations.

¹This work was performed under Task T-5-310, Cost-Effectiveness Methods for Assessing Training Technologies. Technical cognizance was provided by Military Assistant for Training and Personnel, Captain Paul R. Chatelier, USN, and Thomas R. Dashiell, Director of Environmental and Life Sciences, OUSDRE/R&AT.

(2) "Cost" is defined as funds expended, or programmed to be expended, exclusively for CWD training.

(3) Included are cost categories typical of life-cycle cost, i.e., research and development, investment, and operating and support (O&S). The first two categories are addressed explicitly; the third (O&S) comprises formal training courses and periodic CWD training in operational units.

(4) CWD training in the U.S. Army, Navy, Marine Corps, and Air Force is considered in order to encompass Department of Defense-wide activity.

D. RESULTS

Early in the search for cost data it became clear that it is impractical, if not infeasible, at this time to obtain a credible estimate of what is being spent on CWD training in the Department of Defense (DoD). Expenditures of resources for this purpose are not meaningfully documented at the DoD or Service headquarters levels, so it became necessary to identify potential sources by sequential referral. In all, 37 organizations (74 individuals) were contacted; and other potential sources were identified that have not yet been solicited. Comments of those queried in the search for data to determine the cost of CWD training led to the conclusion that the military services have not been directed to, nor have they perceived a need to collect, evaluate, and centralize this type of cost data. Inquiries originated for this task assumed the nature of "one-time requests" which required some effort by the sources who did furnish data to acquire and assemble it.

Since research and development funding is acquired and monitored at the military department headquarters staff level, it is felt that the research and development costs (totaling about \$5 million from FY1984 through FY1986) can be viewed with a fair degree of confidence. There is no question, however, that funding for equipment, formal training courses, and CWD training in operational units is significantly underestimated (at approximately \$99 million in the three-year period) because sizable resource expenditures, although identified by type and activity, cannot be quantified for lack of relevant data.

Lacking a requirement or a perceived need to collect, evaluate, and document relevant data in a methodical manner, the following factors inhibit determination of the cost of CWD training:

- a. Much of the CWD equipment and many of the devices and protective garments are common to all Services and, although qualified for operational use, also are used in training. For such items, the principal procuring agency reported that it is impractical to discriminate as to end-use.
- b. In operational commands the timing, frequency, and intensity of CWD training is the prerogative of unit commanders, who are not required to maintain records that would permit estimation of CWD training costs.
- c. In operational units, CWD training often is performed concurrently with primary-mission training, making the allocation of costs a moot point.
- d. The Services characteristically group nuclear, biological, and chemical (NBC) defensive training as a single entity, so that it is difficult (except via expert judgment) to delineate CWD training costs. This practice affects determination of investment costs, formal training at centers and schools, and in operational units.

In conducting cost-effectiveness (C-E) studies of alternatives, all costs that would be incurred subsequent to a decision that selects from among the alternatives should be accounted for. This implies consideration of life-cycle cost. The findings of this research suggest that the current paucity of cost data relevant to CWD training would inhibit the conduct of C-E studies, particularly in the investment and O&S cost categories in which the largest expenditures are incurred.

Reference to statements of policy, regulations, and directives might permit the analytic derivation of what CWD training might be expected to cost; but such an approach would not respond to the question, "what is being spent...", since it is open to question whether CWD training is being conducted in strict compliance with those policies, regulations, and directives.

Whether and when formal C-E studies of CWD training technologies are appropriate depend upon the costs and benefits of conducting them. In the Services, little emphasis has been placed on the collection and analysis of CWD training costs. Implementation of data collection and analysis procedures, therefore, would require that guidelines be established including, for example, (a) a cost threshold, for alternatives under consideration, below which rigorous C-E analysis need not be performed, (b) a cost

element structure to assure that all germane costs are captured and are expressed consistently among alternatives and, (c) a requirement to establish cost data base(s). The current state of CWD training cost data, as reflected in the findings of this investigation, implies that compliance with such guidelines would consume considerable time and resources.

It should be noted that this is an initial report on the cost of CWD training. It is also a preliminary report because several of the sources queried have not yet submitted their data, and because a number of organizations that surfaced as possible sources of cost data have not yet been solicited.

I. INTRODUCTION

A. PURPOSE

This paper documents preliminary results of research to determine the cost of training military personnel to survive chemical attack and to operate in a contaminated, post-attack environment. Training to accomplish these objectives is referred to as "chemical warfare defensive (CWD) training." This research is part of a study to identify training technology that can improve the cost-effectiveness of CWD training.¹

B. BACKGROUND

The declared policy of the United States is that it will not use chemical weapons in offensive operations. Conversely, the Soviet Union has a sizable chemical weapons capability and has demonstrated its willingness to use those weapons (e.g., in Afghanistan). In view of this imbalance, it is necessary that our military forces maintain an effective defensive posture. Modest plans and programs are in being, and more are being developed by the Services, to improve CWD training equipment and procedures. Evaluation of the costs and effectiveness of the various ways of achieving CWD training objectives is needed to select the best options.

C. APPROACH AND SCOPE

"What is the cost of chemical warfare defensive training?" In order to answer this question, the problem was defined, as follows:

¹This work was performed under Task T-5-310, Cost-Effectiveness Methods for Assessing Training Technologies. Technical cognizance was provided by Military Assistant for Training and Personnel, Captain Paul R. Chatelier, USN, and Thomas R. Dashiell, Director of Environmental and Life Sciences, OUSDRE/R&AT.

1. The question refers to the present situation. The current year (FY1985) is bracketed by also considering FY1984 and FY1986 in order to identify any short-term trends or perturbations.
2. "Cost" is defined as funds expended, or programmed to be expended, exclusively for CWD training. Included are funds for:
 - a. Research and development (RDT&E) for planning studies, simulants, detection and alarm training devices, etc.
 - b. Investment (procurement, military construction, and O&M stock funds) to purchase quantities of equipment and devices, protective clothing, facilities, etc., to be used in CWD training.
 - c. Formal training courses in CWD conducted by the Services' training commands and other organizations.
 - d. Periodic CWD training in operational units.
3. CWD training in U.S. Army, Navy, Marines, and Air Force is addressed in order to encompass Department of Defense-wide activity.

The remainder of this report is in three chapters. Chapter II, The Search for Data, describes the search for CWD training cost data and identifies both the useful and unfruitful sources of information. In Chapter III, The Cost of Chemical Warfare Defensive Training, the data obtained are presented and evaluated. Chapter IV, Findings and Discussion, summarizes the findings of this research effort and discusses possible courses of action required to generate the data that should enable a more credible and complete estimate of the cost of CWD training in the U.S. armed forces.

A list of References and sources appears at the end of this report. Sources are numbered and keyed to numbers in brackets ([]) in the text.

II. THE SEARCH FOR DATA

Research for CWD training cost data was begun with a review of the Five Year Defense Program (FYDP) [1]. It was found that the costs of CWD training, per se, could not be identified in the FYDP because those costs are implicit in aggregated costs given in related program elements (PE). In Program 6 (RDT&E), for example, the titles of more than a dozen PEs suggest the possible inclusion of CWD training costs, but reference to PE definitions in the FYDP Program Structure [2] did not help in identifying costs associated with CWD training.

Review of the FYDP was followed by discussions with officials of each military department in the headquarters organizations that have been referred to as focal points of information on CWD activities [3 through 10]. One [10] provided comprehensive cost data on ground training, two others furnished limited information, and the remaining five referred to other organizations that manage, administer to, or conduct CWD training from which relevant cost data might be obtained. These "second sources" frequently led to "third sources."

Table 1 is a summary, by Service, of the organizations queried for cost data, the availability of data from each, and a qualitative description of the information obtained or reportedly to be furnished.

Of the 37 organizations (74 individuals) contacted as possible sources of cost information, 17 could offer no data, and two others reported that they are preparing responses at this time. Although respondents were asked to identify the elements of cost represented by the data, the information furnished by many of the remaining 18 organizations was fragmentary and lacked specificity as to content. Comments of those queried in the search for data to determine the cost of CWD training led to the conclusion that the military services have not been directed to, nor have they perceived a need to collect, evaluate, and centralize this type of cost data. Inquiries originated for this task assumed the nature of "one-time requests" which required some effort by the sources who did furnish data to acquire and assemble it.

TABLE 1
SUMMARY OF INQUIRIES FOR COST OF CHEMICAL WARFARE DEFENSIVE TRAINING

SERVICE	ORGANIZATION	DATA AVAILABILITY		DESCRIPTION OF INFORMATION OBTAINED
		NONE	FURNISHED FORTHCOMING	
U.S. Army	Headquarters U.S. Army DCS/Operations & Plans Training Directorate Forces Training Div.	X		Referrals to appropriate commands and offices.
	Nuclear & Chemical Dir., Chemical & NBC Div.		X	Unit costs of Stock Fund chemical defensive equipment.
	DCS/Research, Development, & Acquisition			RDT&E and Procurement funding for non-system and system-specific CWD training devices.
	System Support Div.		X	
	DCS/Logistics Directorate of Supply & Maintenance Comptroller Director of Cost Analysis	X X		
	Headquarters Army Material Command DCS/Chem. & Nuc. Matters		X	RDT&E funding for 6.2 program element.

(continued)

TABLE 1 (CONTINUED)
SUMMARY OF INQUIRIES FOR COST OF CHEMICAL WARFARE DEFENSIVE TRAINING

SERVICE	ORGANIZATION	DATA AVAILABILITY			DESCRIPTION OF INFORMATION OBTAINED
		NONE	FURNISHED	FORTHCOMING	
U.S. Army (continued)	Headquarters TRADOC DCS/Combat Development DCS/Resource Management Resource & Economic Analysis Office	X		X	MOS Course Cost Reports for U.S. Army Chemical School.
	Armament, Munitions, and Chemical Command Material Management Dir., Chemical Equipment Br.		X		Identification, procurement quantities and costs for CWD Stock-funded training items for all four Services.
	Health Services Command Academy of Health Sciences Preventive Medicine Div. Combat Medical Specialist Div.		X X		Cost of training medical specialists in CW casualty treatment. Cost of training medical specialists in CW casualty treatment.

(continued)

TABLE 1 (CONTINUED)
SUMMARY OF INQUIRIES FOR COST OF CHEMICAL WARFARE DEFENSIVE TRAINING

SERVICE	ORGANIZATION	DATA AVAILABILITY			DESCRIPTION OF INFORMATION OBTAINED
		NONE	FURNISHED	FORTHCOMING	
	Military Personnel Center Chemical Branch	X			
	Training Studies & Analysis Agency (TRASANA) Training Effectiveness Analysis Division	X			
	Headquarters Forces Command Comptroller, Program and Cost Analysis Division	X			
	U.S. Army Chemical School Resource Management Office	X			The Chemical School does not maintain the data necessary to generate estimates of the CWD training conducted. See entry under HQ TRADOC.
	Headquarters, U.S. Navy DCNO, Manpower, Personnel and Training Asst. for MPT Research, Development and Studies		X		RDT&E funds for nondevice, simulation, and training devices for CWD training
U.S. Navy	Navy Personnel R&D Center	X			Referrals to appropriate commands and offices.

(continued)

TABLE 1 (CONTINUED)
SUMMARY OF INQUIRIES FOR COST OF CHEMICAL WARFARE DEFENSIVE TRAINING

SERVICE	ORGANIZATION	DATA AVAILABILITY		DESCRIPTION OF INFORMATION OBTAINED
		NONE	FURNISHED	
U.S. Navy (continued)	Headquarters Naval Sea Systems Command Theater Nuclear Warfare Program Office Chemical Division	X		Referrals to appropriate commands and offices. Cost of initial provisioning of training items for on-board fleet training and CNET schools, and initial training of instructors and curricula revisions for those items.
	Manpower, Personnel and Training Support (Code 05L16) and Survivability Group (Code 55XC)		X	
	Headquarters Naval Facilities Engineering Command Readiness Planning Division	X		
	Headquarters Naval Air Systems Command Aircraft Combat Survivability Branch		X	RDT&E and Procurement costs of Navy and Marine flying training CWD items.
	Chief of Naval Education and Training (CNET) Surface Technical Training Division		X	CWD training cost per student for courses conducted by CNET at Navy shore installations.

(continued)

TABLE 1 (CONTINUED)
SUMMARY OF INQUIRIES FOR COST OF CHEMICAL WARFARE DEFENSIVE TRAINING

SERVICE	ORGANIZATION	DATA AVAILABILITY		DESCRIPTION OF INFORMATION OBTAINED
		NONE	FURNISHED	
U.S. Navy (continued)	Naval Surface Weapons Center Survivability Program Office		X	RDT&E funding for chemical simulants for fleet training exercises.
	Naval Medical Command Assistant for CBR Defense		X	Costs of CWD training for Navy medical personnel in formal courses at Navy and Army schools.
	Office of Naval Technology Support Technology Division		X	CWD training Exploratory Development (6.2) funds for the Navy.
	Headquarters, USMC DCS for Training		X	Costs of CWD training at entry level and professional development USMC schools, and partial costs of Marine students at the Army Chemical School.
U.S. Marine Corps.				
U.S. Air Force	Headquarters U.S. Air Force DCS/Plans and Operations Deputy Director for Operations Support Air Base Survivability Group	X		Referrals to appropriate Air Force commands and offices.

(continued)

TABLE 1 (CONTINUED)
SUMMARY OF INQUIRIES FOR COST OF CHEMICAL WARFARE DEFENSIVE TRAINING

SERVICE	ORGANIZATION	DATA AVAILABILITY		DESCRIPTION OF INFORMATION OBTAINED
		NONE	FURNISHED	
U.S. Air Force (continued)	Disaster Preparedness Resources Center		X	Instructional System Development assistance for Air Training Cmd. CWD training.
	DCS/Research, Development, & Acquisition Dir. of Development & Production Test & Evaluation Div.	X		Would monitor Engineering Development of Air Force CWD training equipment. None in progress.
	DCS/Studies & Analysis Tactical Support Div. Surgeon General Medical Readiness Div.	X		Referrals to organizations involved in CWD medical training.
	Headquarters Air Force Systems Command Dir. of Life Sciences Dir. of Tactical Systems	X	X	Exploratory and Advanced Development funding for CWD training. Would manage Engineering Development of Air Force CWD training devices.

(continued)

TABLE 1 (CONTINUED)
SUMMARY OF INQUIRIES FOR COST OF CHEMICAL WARFARE DEFENSIVE TRAINING

SERVICE	ORGANIZATION	DATA AVAILABILITY		DESCRIPTION OF INFORMATION OBTAINED
		NONE	FURNISHED FORTHCOMING	
U.S. Air Force (continued)	Air Training Command DCS/Comptroller Cost & Management Analysis Dir.	X		
	DCS/Technical Training		X	Aggregate cost of CWD training in formal technical training courses, only.
	School of Health Care Sciences Medical Readiness Dept.		X	Military personnel-associated costs for indoctrination in personal protection.
Defense Logistics Agency	Defense Personnel Support Center Supply Operations Division		X	Cost of protective overgarments for CWD training in all Services.

Estimates of the cost of CWD training in operational commands could not be obtained. Although the Services acknowledge that these costs may be sizable, they reported that the costs are indeterminate. This topic is discussed at greater length in Chapter III.

Apparently, this search for cost data has not exhausted all possibilities. The following organizations may be able to provide additional, pertinent information not included in this report.

U. S. Army Training and Doctrine Command (TRADOC)

DCS/Training, Ft. Monroe, VA

Training Support Center, Ft. Eustis, VA

Proponent Schools (e.g., Armor at Ft. Knox, KY; Field Artillery at Ft. Sill, OK) at which courses leading to MOS's include CWD training.

U. S. Army Institute of Chemical Defense, Aberdeen, MD, which conducts a Chemical Casualty Management course.

HQ, U.S. Army in Europe (USAREUR), which maintains a number of Area NBC Schools.²

U.S. Air Force School of Aerospace Medicine (Education and Training Division), Brooks AFB, TX.

²Other major commands also maintain Area NBC Schools.

III. THE COST OF CHEMICAL WARFARE DEFENSIVE TRAINING

Information on the cost of CWD training is presented and evaluated in this chapter.

Much of the funding and resources expended for CWD training is not readily identifiable for several reasons:

1. Devices, procedures, and facilities used to train personnel to counter biological and chemical attack are similar, making it difficult to delineate the research and development and procurement costs assignable to each.

2. Formal training curricula often combine instruction in chemical, biological, and nuclear/radiological defense in a single course. Sometimes, CWD training is incorporated in many other specialized training courses. This requires that the portion of course cost attributable to CWD be estimated by persons familiar with the curricula. Similarly, in operational units CWD often is included as one of several training activities that are conducted concurrently.

3. Much of the CWD equipment and many of the devices and protective garments are common to all Services and, although qualified for operations, are also used in training. For such items, it was reported by the principal procuring agency [11] that it is impractical to segregate quantities and costs by end-use.

A. RESEARCH AND DEVELOPMENT

Based upon information acquired to date, Table 2 summarizes the research and development funding (RDT&E appropriation) programmed to support CWD training in FY1984, FY1985, and FY1986. The program elements (PE) of the FYDP in which the funds are included are grouped by Service, identified, and the CWD training projects are described briefly. For many of the PEs listed, the FYDP records higher funding levels than are shown in Table 2 because they include funding for projects in addition to those that support CWD training. The U.S. Marine Corps does not appear in the table because the USMC does not fund R&D for CWD training.

TABLE 2
R&D FUNDING FOR CHEMICAL WARFARE DEFENSIVE TRAINING

Program Element		Millions of Then-Year Dollars			Project	Reference/ Source
No.	Title	FY1984	FY1985	FY1986		
<u>U. S. Army</u>						
62706 A	Chemical & Biological Defense & General Investigation	0.4	0	0	Simulants and disseminating devices for training	6
62727 A	Non-System Training Devices	0.8	0.7	0	Chemical Agent Casualty Assessment System	12
64724 A	Chemical/Biological Detection, Warning, and Training Materiel	0.38	0.1	0	XM-81 Simulator, Detector Unit and Chemical Agent Alarm. Completed FSD April 1985.	12
<u>U.S. Navy</u>						
62757 N	Human Factors & Simulation Technology	0.25	0.34	0.69	Training device technology, effects of stress and counter- measures, sources of perfor- mance degradation, etc.	13
62763 N	Personnel & Training Tech- nology					
62764 N	Chemical, Biological, & Radiological Technology					
63720 N	Education and Training	0	0	0	Excludes simulants, simula- tion, and training devices.	14
63733 N	Training Device Technology	0	0	0		14
64506 N	Chemical Warfare Counter- measures	0.075	0.200	0.055	Simulants for fleet training exercises	15,16
64703 N	Training & Personnel Systems Development	0	0	0	Training devices and simulation	14

(continued)

TABLE 2 (CONTINUED)
R&D FUNDING FOR CHEMICAL WARFARE DEFENSIVE TRAINING

Program Element		Millions of Then-Year Dollars			Reference/ Source
No.	Title	FY1984	FY1985	FY1986	
<u>U. S. Air Force</u>					
62202 F	Aerospace Biotechnology	0.300	0.180	0.200	17
63,45 F	Chemical Warfare Defense	0.285	0.050	0	17
64XXXF	—	0	0	0	18
	TOTAL	2.49	1.57	0.945	

The sum of R&D funding by the Army, Navy, and Air Force from FY1984 through FY1986 is \$5.0 million. Annual funding describes a negative trend: one-half was programmed in FY1984, about one-third in FY1985, and the remaining 19 percent is programmed for FY1986. Closer examination of Table 2, however, suggests that a reversal of this pattern may occur in the late 1980s as the results of relatively low-cost Exploratory Development (6.2) programs are applied in higher-cost Advanced Development (6.3) and Engineering Development (6.4) programs. Note that 77 percent of the funding programmed for the three-year period is devoted to Exploratory Development projects,³ while Engineering Development is supported by only 16 percent. One of the two 6.4 projects was completed in April 1985, leaving only \$55,000 devoted to Engineering Development in FY1986.

In Table 2, the pattern of R&D funding for CWD training reflects the Army's role of "lead service." Although Army funding predominates in Exploratory Development it is declining, indicating earlier expenditures which resulted in a number of CWD training devices that have been type-classified and fielded (for examples, see Table 3). The Army's principal instrument for CWD device R&D is the Army Chemical School's "Training Device Acquisition Strategy" (TDAS) [19], which serves to direct Army acquisition efforts to enhance simulation of the NBC (nuclear, biological, and chemical) threat for training purposes. The Chemical Agent Casualty Assessment System, a subject of the TDAS, was funded more heavily than any other project shown in Table 2.

Unlike the Army's 6.2 funding profile, Navy 6.2 funding (which began in FY1984) is shown as increasing annually; and the Air Force's 6.2 program is at a relatively low, fairly stable level. This is consistent with recent emphasis on upgrading CWD training which (excepting a small project on simulants for fleet training exercises) has yet to result in 6.4 projects. The pattern of Navy R&D funding for CWD training is reflective of the status of planning. The Naval Sea Systems Command (NAVSEA) is the lead command in establishing a CWD training plan for the U.S. Navy. The Naval Facilities Engineering Command (NAVFAC) and the Naval Air Systems Command (NAVAIR) are preparing Addenda 1 and 2, respectively, to the plan. Reportedly, NAVSEA is presently the source of funding for virtually all of the CWD training R&D in the U.S. Navy.

³R&D on simulants and associated disseminating devices are most heavily funded.

B. INVESTMENT COST

Quantities and costs of devices and material programmed for procurement⁴ for CWD training by the U.S. Army and Navy in FY1984, FY1985, and FY1986 are shown in Tables 3 and 4, respectively. U.S. Air Force procurement data were not available from the sources contacted.

The U.S. Army is the lead service for virtually all CWD equipment that is common to all Services. As such, the Army procures those items in quantities sufficient to satisfy multi-service requirements. Many of those items are qualified and issued for operational use, but are also used in training. The Army's principal procuring agency for CWD (AMCCOM [11]), however, could not identify those items; nor, if they were identified, could they readily discriminate as to end-use. Accordingly, those items were omitted from Table 3. Only items that were identified as exclusively for CWD training are included. It follows, then, that summation of the costs in Table 3 would understate the total cost of CWD training equipment procured for its own and sister-Services' use. The trend in procurement of training-peculiar items alone, however, may be indicative of recent improvements in, and/or increased intensity of CWD training. As shown on Table 3 annual costs increased from about \$6 million in FY1984, to \$25 million in FY1985, to \$37 million in FY1986.

Listed in Table 4 is Navy procurement to partially satisfy its own, and USMC, needs for CWD training materiel. NAVSEA [20] and NAVAIR [21] provided data for the initial provisioning of personnel-related items. Information regarding annual replenishment subsequent to initial provisioning was unavailable from the same sources.

The protective suits listed in Table 4 are unique to the Navy. They are used by other commands as well as by NAVSEA.⁵ NAVSEA training requirements for other items of CWD dress (masks, gloves, and boots) have been, and will be, met from existing inventory in the period FY1984 through FY1986 [20].

⁴"Procurement" is used in the general sense. Funding may be by Operations and Maintenance (i.e., Stock Fund) or Procurement appropriations.

⁵Information on quantities and costs of procurement by other users were not obtained during this research.

TABLE 3
PROCUREMENT OF CHEMICAL WARFARE DEFENSIVE TRAINING EQUIPMENT BY THE U.S. ARMY

ITEM	FY1984		FY1985		FY1986	
	Quantity	Cost	Quantity	Cost	Quantity	Cost
1. XM-81 Simulator, Detector Unit & Chemical Agent Alarm	0	0	250	1.25	700	4.8
2. Simulator for Liquid Agent Attack	900,000	2.214	809,000	2.645	480,000	1.180
M-11 Projectile	0	0	30,000	1.26	0	0
M-267 Launcher	0	0	8,250	1.46	0	0
3. Training Simulator Set for M256 Detector Kit (TRAINS)	15,000	2.265	90,000	15.210	173,000	29.237
4. M58A1 Training Aid, Skin Decontamination	900,000	2.214	809,000	2.645	480,000	1.180
5. M58A1 Training Aid, Refill Kit	125,000	1.701	310,000	2.966	101,000	1.375
6. Training Set, Simulants, Chemical Agent, M72A2	1,126	0.084	1,697	0.126	0	0
7. Training Set, Simulants, Chemical Agent, M72A1	750	0.083	0	0	0	0

NOTES:

1. Procurements may satisfy multi-service requirements.
2. Costs are in millions of then-year dollars.
3. Other CWD items certified for operational use, but also used in training, are not listed. AMCCOM cannot discriminate as to end-use.

SOURCES:

- Ref. [12] for items 1 and 2.
Ref. [11] for items 3. through 7.

TABLE 4

PROCUREMENT OF CHEMICAL WARFARE DEFENSIVE TRAINING EQUIPMENT BY THE U.S. NAVY

ITEM	FY1984		FY1985		FY1986	
	Quantity	Cost	Quantity	Cost	Quantity	Cost
<u>NAVSEA initial provisioning of personnel CWD training items:</u>						
On-Board Fleet						
Protective Suits	24,000	1.272	24,000	1.272	24,000	1.272
Other Items	0	0	-	0.178	-	0.178
Chief of Naval Education & Training Schools						
Initial Training ^a	-	0.400	0	0	0	0
	-	0.300	-	0.171	-	0.133
<u>NAVAIR initial provisioning of personnel CWD training items:</u>						
AR-5 Masks ^c	0	0	0	0	70	0.238

Costs are in millions of FY1984 dollars

^a To train instructors in the use of, and to revise curricula to accommodate, personnel CWD training items furnished by NAVSEA.

^c For USMC helicopter training. No plans for "below the neck" item procurement.

SOURCES: Ref. [20], [21].

In Table 4, the absence of initial-provisioning data for NAVAIR reflects the early stage of planning for CWD training. As of mid-1985 training requirements, which precede determination of materiel needs, had not been formally established by NAVAIR [21].

Summing the annual costs in Table 4 would not represent the Navy's total procurements in support of CWD training. Many CWD items common to the Army, Marines, and/or the Air Force are also used by Navy shore-based units, and the problems that precluded determination of the costs of common items used in training have already been discussed.

Not shown in Tables 3 and 4 are protective overgarments for Services other than the Navy. Generally, the obsolescent OG107 overgarment is used for training purposes. Procurement of the OG107 is the responsibility of the Defense Logistics Agency's Defense Personnel Support Center [22]. That organization reported no planned procurements of the OG107 overgarment from FY1984 through FY1986. It is expected that drawdown of existing inventory, occasioned by the introduction of an improved overgarment, will satisfy the training requirements of the users.

C. FORMAL TRAINING

Formal training is accomplished primarily in the Services' training commands and area schools. Typically, CWD training is conducted as relatively small segments of courses of broader scope. Respondents were asked, therefore, to estimate the cost of CWD training by applying a "percent factor" to the cost-per-graduate of each course that includes CWD instruction. The respondents did so, as evidenced by the relatively low costs-per-graduate that can be arithmetically determined from many of the tables that follow.

It became apparent early in this research that comparability in the cost data from the various sources could not be expected. This reflects the "one-time" nature of the inquiries, which required the submission of available information, often without rigorous regard for, or knowledge of the elements of cost that comprise the estimates. In some cases it is clear that pertinent elements of cost are omitted. It would be misleading, therefore, to consider as authoritative a summation of the costs of formal training contained in the following tables.

1. U.S. Army Academy of Health Sciences, Preventive Medicine Division

Table 5 summarizes the costs of chemical defensive training given by the Nuclear, Biological, Chemical (NBC) Sciences Branch. Data were furnished for FY1985 as typical of the three-year period FY1984-1986 [23].

Although a large portion of chemical defense training at the Academy is presented by the NBC Sciences Branch, other teaching divisions deliver occasional lectures and field exercises on the subject. The NBC Sciences Branch and the Combat Medical Specialist Division (addressed below) reportedly provide "about 90 percent" of the CWD training done by the Academy.

In Table 5, the estimated costs of classroom lectures include only the pay and allowances (MPA) of the military instructors and students. The costs of associated equipment, supplies, facilities, base operating support, etc., were not provided. MPA is taken as the Army's average Composite Standard Pay Rates (CSPR, less retirement accrual) for given grades [24]. The typical grades of instructors were reported as O-3 (60 percent) and E-6 (40 percent). Student man-years are based on 160 hours of instruction per month. Estimates of the cost of furnishing instructors who support field training exercises and extramural lectures⁶ are based on man-days expended per year and average CSPR for grades O-3 (10 percent) and E-6 (90 percent).

2. U.S. Army Academy of Health Sciences, Combat Medical Specialist Division

Table 6 presents the estimated costs of training entry-level enlisted personnel and non-commissioned officer (NCO) in CW casualty treatment by the Combat Medical Specialist Division in FY1984, FY1985, and FY1986 [25].

In Table 6, the estimated costs of the two CWD courses include the MPA of students and instructors, printing costs of instructional materials, and the costs of equipment used in training. The costs of travel, per diem, training facilities, and base operating support were not provided. MPA was computed by reducing average annual CSPR (less retirement accrual) [24] for each grade to a per-hour value, based upon the

⁶The NBC Sciences Branch supports (with instructors and training materials) the Chemical Casualty Management Course given at the U.S. Army Institute of Chemical Defense, Aberdeen, MD.

TABLE 5

ACADEMY OF HEALTH SCIENCES (USA), PREVENTIVE MEDICINE DIVISION

	FY 1984 - FY 1986 (Annually)	
	Man-Yrs.	FY1985\$
<u>Classroom Lectures</u> ^a		
Instructors		
Officers ^b	3.8	124,300
Enlisted ^c	<u>2.5</u>	<u>48,500</u>
TOTAL	6.3	172,800
Students		
O-3	24.0	786,000
O-2	8.5	220,000
O-1	<u>10.0</u>	<u>196,000</u>
TOTAL	42.5	1,202,000
<u>Field Training Exercises</u>		
Instructors		
Officers ^b	0.05	1,800
Enlisted ^c	0.5	9,600
Travel, Equipment, Supply	<u>-</u>	<u>5,700</u>
TOTAL	0.55	17,100
<u>Extramural Lectures</u>		
Instructors ^{b, c}	0.05	1,200
Travel, Equipment, Supply	<u>-</u>	<u>3,700</u>
TOTAL	0.05	4,900
TOTAL	<u>49.4</u>	<u>\$1,396,800</u>

^a Classroom course costs are based on Composite Standard Pay Rates (excluding retirement accrual) only; no equipment, supplies, or facility costs.

^b Typically, grade O-3.

^c Typically, grade E-6.

TABLE 6

ACADEMY OF HEALTH SCIENCES (USA), COMBAT MEDICAL SPECIALIST DIVISION

	FY1984	FY1985	FY1986
Medical Specialist Course (300-91A10)			
Students ^a			
Number	10,646	11,042	12,667
Training hours per student	21	21	53
Total MPA (FY1985\$) ^b	769,067	797,674	2,309,447
Instructors ^c			
Instructor man-hours	12,600	12,600	31,800
Total MPA (FY1985\$) ^d	117,810	117,810	197,330
Printing cost (instructional materials)	3,832	3,975	33,060
Equipment cost	<u>3,000</u>	<u>3,000</u>	<u>456,244</u>
TOTAL	\$893,709	\$922,459	\$3,096,081
Medical NCO Course (300-91B)			
Students ^e			
Number	720	720	1,050
Training hours per student	24	24	24
Total MPA (FY1985\$) ^f	137,376	137,376	200,340
Instructors ^c			
Instructor man-hours	708	708	708
Total MPA (FY1985\$) ^d	6,620	6,620	6,620
Printing cost (instructional materials)	1,412	1,412	2,060
Equipment cost	<u>3,770</u>	<u>4,675</u>	<u>6,545</u>
TOTAL	\$149,178	\$150,083	\$215,565
TOTAL COST	\$1,042,887	\$1,072,542	\$3,311,646

^a Grade E1.

^b Based on Composite Standard Pay Rate (CSPR, less retirement accrual), 53-hour work-week, and total student training hours.

^c Grade E6.

^d Based on CSPR, 40-hour work-week, and total instructor man-hours.

^e Grade E5.

^f Based on CSPR, 40-hour work-week, and total student training hours.

average number of hours worked per week. Evidently, the printing and equipment costs furnished are in constant dollars, but the base year was not identified.

The estimates show that the total cost of CWD training by the Combat Medical Specialist Division is expected to triple in FY1986. Examination of the data indicates that the entry-level Medical Specialist Course accounts for 97 percent of that increase, with two-thirds of the cost escalation from FY1985 to FY1986 traceable to student MPA. The addition of training hours per student (from 21 to 53) is primarily responsible. The 150-fold planned increase in the cost of equipment, which accounts for 21 percent of the anticipated increase in the Medical Specialist Course cost, is due to a one-time buy of protective garments, decontamination equipment, auto-injectors, etc., needed to accommodate training course extension.

3. Chief of Naval Education and Training

Table 7 summarizes the costs of CWD training in courses of the Chief of Naval Education and Training (CNET) [26].

Basic CWD training for enlisted personnel was estimated [26a.,b., and c] as one-third of a one-day NBC defense course given at each of six training centers in the U.S. The total course cost per graduate was furnished for FY1984. FY1985 estimates were linearly projected from data provided for the first seven months.

Regarding specialized skill training conducted by CNET, cost estimates were provided for FY1984, only, for 12 courses given at 13 CONUS and overseas locations. Cost per graduate, by course, was derived by reducing cost per input-student by five percent to account for an average rate of attrition [26], and by applying percentage factors that are CNET estimates of the CWD portions of more extensive training courses.⁷

For the Basic NBC Defense courses, CNET provided cost data broken out by appropriation (i.e., O&MN, MPN, and OPN) and student pay and allowances. Included were the costs of instructors and support personnel salaries, classroom supplies, training equipment maintenance/depreciation, family housing, student pay and allowances, and a pro rated share of base operating support. Although the costs of specialized skill training

⁷Portions of courses devoted to CWD training ranges from 0.8 percent (Gunner's Mate Technician "A") to 35 percent (Damage Control Repair Party Leader).

TABLE 7

CHIEF OF NAVAL EDUCATION & TRAINING (USN)

	FY1984	FY1985	FY1986
Basic CWDT for enlisted personnel ^a			
No. of graduates	1326	1419	N.F.
Total Cost (then-yr. \$, millions)	0.354	0.406	N.F.
CWD-related training in specialized skill training courses ^b			
No. of graduates	24,385	N.F.	N.F.
Total cost (then-yr. \$, millions)	4.321	N.F.	N.F.

N. F. = Not furnished by CNET.

^a At six CONUS training centers.

^b From 12 specialized skill training courses at 13 locations, in which part of each course is devoted to CWD training.

courses that include some CWD content were not presented and explicitly defined in the same way, it is assumed that the same methodology was applied.

4. U.S. Marine Corps

Table 8 presents USMC estimates of costs incurred by the USMC for institutional CWD training. All costs represent expenditures for CWD segments of more extensive courses.

The costs of Marines' attendance at the Army chemical school in FY1984, FY1985, and FY 1986 cover personnel travel and per diem, only. The source [10] asserted that the costs of course operations at the Chemical School were not known to the USMC.⁸

Regarding CWD training at USMC entry-level and professional development schools, data were furnished for the current year (FY1985) only. The elements included in the costs, however, were not identified. The source advised that the number of graduates from each course in FY1985 can be considered typical of FY1984 and FY1986; accordingly, comparable costs for those years can be estimated by applying appropriate deflation/inflation factors.

The costs of CWD training at USMC schools represent fractions (not more than two percent) of the costs of more extensive courses in which CWD training is incorporated. Interestingly, the CWD content of two courses (Recruit Training and Basic Officer) account for 95 percent of the CWD training load in Table 8, and 90 percent of the total cost (\$1,045,068) of CWD training shown in the table.

5. U.S. Air Force School of Health Care Sciences, Medical Readiness Department

Table 9 summarizes the military pay and allowances for students and instructors involved in CWD training to be conducted by the School of Health Care Sciences in FY1985 and FY1986. The costs of related equipment, supplies, facilities, and other associated resources were not furnished in the School's response; nor were data provided for FY1984 [27].

⁸U.S. Army Chemical School course costs are to be furnished by Headquarters, U.S. Army Training and Doctrine Command.

TABLE 8
U. S. MARINE CORPS FORMAL CWD TRAINING ^a



COURSE	FY1984		FY1985		FY1986	
<u>At U.S. Army Chemical School</u>						
NBC defense (various)						
No. of students						
Officer	11		30		26	
Enlisted	100		83		50	
Training cost (\$) ^b						
Officer	12,870		48,210		39,988	
Enlisted	58,200		46,239		27,025	
	71,070		94,449		67,013	
<u>At USMC Entry Level and Professional Development Schools</u> ^c						
	No. of Grads	Estimated Cost (\$)	No. of Grads	Estimated Cost (\$)	No. of Grads	Estimated Cost (\$)
Recruit training			40,000	523,200		
Officer candidate (3)			393	1,983		
Platoon leaders (2)			1,389	7,968		
Basic officer	Not Provided for FY 1984		1,445	419,281	Not Provided for FY 1984	
Amphibious warfare			196	59,882		
Command and staff college			168	25,326		
Adv. Communications Officer			48	7,410		
TOTAL				1,045,068		
<u>At Marine Aviation Weapons and Tactics Squadron One</u>						
Weapons and Tactics Instructor			70	2,110		

^a All costs represent the fractions of CWD training in more extensive courses.

^b Represent travel and per diem costs only. Other U.S.A. Chemical School CWD course costs unavailable from HQ USMC.

^c FY 1985 may be used as "planning year." Deflate/inflate costs for FY84 and 86.

TABLE 9
SCHOOL OF HEALTH CARE SCIENCES (USAF ATC)

	FY1984	FY1985	FY1986
<u>No. of students</u>	 Data Not Provided 		
Officers ^a		1,700	1,800
Enlisted ^b		6,000	6,500
<u>Cost of training (FY1985\$)^c</u>			
Students			
Officers		61,455	65,070
Enlisted		102,600	111,150
Instructors ^d		<u>40,000</u>	<u>40,000</u>
TOTAL COST ^c		204,055	216,220

^a Mix of grades O-1 through O-6; lowest rate per grade.

^b Airman Basic (grade E-1).

^c Costs are based on Composite Standard Pay Rates (excluding retirement accrual) only; no equipment, supplies, or facility costs.

^d Typically, grade E-5.

The School of Health Care Sciences does not conduct training in the care of chemical casualties. CWD training is limited to three-hour sessions on personal protection, such as the donning and care of protective garments, and gas chamber indoctrination. Sessions are held 261 days per year for entry-level airmen. A new group of student officers attends the three-hour sessions on each of 11 weekends per year. Five instructors teach each of the 272 groups.

The costs associated with the CWD training are limited to military pay and allowances (MPA). The costs of equipment, supplies, facilities and other resources were not provided [27]. MPA was computed using Composite Standard Pay Rates (CSPR), exclusive of retirement accrual [28]. Student officer costs represent an average distribution of several grades, from O-1 through O-6. Enlisted student costs are based on the airman basic (E-1) grade, since most enlisted students are new to the military. The cost of instructors was computed using their average grade, E-5 [27].

6. U.S. Air Force Air Training Command (ATC).

Table 10 presents, for FY1984 through FY1986, estimates of the total costs of CWD training conducted as segments of technical training courses given at ATC's training centers [29]. As such, the cost estimates do not include CWD training for Air Force aircrew personnel or recruits and officers trained at the ATC's School of Health Care Sciences.

The cost estimates, shown as furnished by the source, were provided with no explanation of content, derivation, or assumptions. Supporting information was requested of the source, who agreed to provide it.

Instructional System Development (ISD) support for CWD training conducted by ATC at Lowry AFB is provided by a collocated branch of the Disaster Preparedness Resources Center (DPRC/PR). The DPRC is not a part of the ATC, so its costs do not appear in Table 10. The chief of that branch could offer only a rough approximation of CWD ISD support cost for FY1985. Based upon the average grade of his staff and the portion of their time expended assisting ATC, military pay and allowances (CSPR, less retirement accrual) is estimated as \$148,000. Associated non-personnel costs were estimated to be about \$40,000. DCPR/PR's output is reproduced in quantity (as slides, manuals, etc.) for use at organizational and base levels by the Air Force Director of

TABLE 10

AIR TRAINING COMMAND (USAF), DCS/TECHNICAL TRAINING

	Millions of Then-Yr. Dollars		
	FY1984	FY1985	FY1986
Cost of training ^a	1.925	2.339	2.898
Cost of equipment	<u>0.027</u>	<u>0.019</u>	<u>0.022</u>
TOTAL	1.952	2.358	2.920

^a Formal technical training courses at Training Centers only. Does not include recruit or aircrew training. Costs represent CW parts of many courses.

Administration at Bolling AFB. That organization, however, could not provide an estimate of the cost of these training materials without detailed identification. Motion picture films for CWD training are produced by the Defense Audio Visual Service at Norton AFB. The branch chief of DPRC/PR suggested \$10,000 as an estimate of training film cost in FY1985.

D. TRAINING IN OPERATIONAL UNITS

Attempts to determine the cost of CWD training conducted in operational units were unsuccessful. Although sources in each Service were in agreement that the costs are sizable⁹ none offered an estimate. The predominant reasons given for their inability to furnish estimates are the following:

1. Service headquarters directives (i.e., Orders, Regulations, Manuals, etc.) require CWD training in operational units. Some directives are explicit as to expected mission capabilities, standards of performance, or time expenditure; however, the timing, intensity, and frequency of such training are the prerogatives of unit commanders at all levels. Generally, unit commanders are not required to maintain records of the time spent in CWD training, nor do they do so. [4,10,30.a.]
2. Budgets for CWD training, per se, are not established. [10,30.a.,b.]
3. CWD training is often carried on in the performance of other primary training objectives, making the costs of CWD training inseparable. [10, 30.a.]

In the Army, CWD training is the subject of publications such as the "Soldier's Manual of Common Tasks," FM 21-2, the "NBC Defense Common Module for ARTEP," AR-220-58¹⁰ and FM 21-40.¹¹ The "NBC Common Module for ARTEP" and FM 21-40

⁹If estimated by considering the time devoted to CWD training and the units' operating costs.

¹⁰"Organization and Training for Nuclear, Biological and Chemical Defense," 15 December 1978.

¹¹"NBC (Nuclear, Biological and Chemical) Defense," 14 October 1977. This manual is to be superseded by FM3-3, "NBC Contamination Avoidance"; FM 3-4, "NBC Protection (Individual and Collective)"; FM 3-5, "NBC Decontamination"; and FM3-100, "Chemical Operations." These superseding manuals are in the process of publication.

specify standards of performance to be met by individuals. In the Air Force, Appendix J ("Chemical Warfare Deterrence and Chemical/Biological Defensive Operations") of the War Mobilization Plan (WMP-1, May 1984) establishes the USAF timetable for achieving step increases in levels of operational capability in a CW environment; assigns responsibilities (including training) to mission-oriented major commands in the CONUS and overseas; and specifies the types, timing, and frequencies of CWD training. In the Marine Corps, Volume 3 of the "Aviation Training and Readiness Manual" (22 July 1983) explicitly prescribes aircrew syllabi for tactical helicopters which include numbers and hours of CWD training flights and associated ground training. The cost of such training, however, would require data on the numbers of ground and flying hours spent in compliance with the syllabi; and this information was not furnished by the USMC.

IV. FINDINGS AND DISCUSSION

The question to which this research effort responds is "What is the cost of chemical warfare defensive training?" It was posed (1) to gain an overview of an area of military capability that has become more critical in recent years, and (2) to generally assess the availability of cost data that would be necessary to estimate the cost-effectiveness of CWD training technology options.

Table 11 is a summary of the costs of CWD training that are detailed in this report. For the three-year period, FY1984 through FY1986, the table includes estimated expenditures in support of CWD training that total \$104 million. There is no question, however, that the total cost of CWD training is significantly higher. It is believed that the Research and Development costs shown in Table 11 can be viewed with a fair degree of confidence; however, sizable resource expenditures in the Investment and Operating and Support cost categories, although identified by type and activity, are omitted because relevant data are not available.

The difficulty experienced in acquiring meaningful, relevant cost data to answer the question suggests that it is doubtful whether the cost-effectiveness of CWD training options can be assessed at this time. Several findings of this investigation led to this conclusion:

1. Research disclosed no official requirement by Department of Defense, military departments, or other headquarters levels to collect, evaluate, or centralize data on the cost of CWD training; nor has any headquarters perceived the need to do so. This research, therefore, assumed the nature of one-time requests of many organizations. These requests yielded responses that lack definition of the cost data submitted and/or comparability in content from one source to another (see p. 3).

2. Research and development funding expended and programmed exclusively for CWD training is monitored at military department staff level. The sum of R&D funding by the Services approximates \$5 million in the period FY1984 through FY1986. Although annual funding describes a negative trend, the maturation of Army CWD training plans,

TABLE 11

SUMMARY OF THE PARTIAL COSTS OF CHEMICAL WARFARE DEFENSIVE TRAINING

(FY1984, FY1985, and FY1986)

SERVICE	Millions of Dollars ^a						OPERATING & SUPPORT ^b		
	RESEARCH & DEVELOPMENT			INVESTMENT					
	FY84	FY85	FY86	FY84	FY85	FY86	FY84	FY85	FY86
Army	1.58	0.8	0	6.347	24.917	36.592	2.44	2.47	4.71
Navy	0.325	0.54	0.745	1.972	1.621	1.821	4.68	0.41	Not Furnished
Marine Corps	0	0	0	0	0	0	1.12	1.14	1.12
Air Force	0.585	0.230	0.200	(Not Available)			1.95	2.56	3.14
TOTAL	2.49	1.57	0.945	8.319	26.538	38.413	10.19	6.58	8.97

^a Dollar values are given in various numbers of significant figures to permit tracking with earlier tables from which this summary was prepared.

^b Institutional training only.

and the completion and implementation of Navy CWD plans (which presage training requirements) may result in a reversal of trend in the late 1980s (see p. 13).

3. The total costs of investment in equipment, devices, and facilities procured exclusively for CWD training cannot be ascertained readily. Much of the equipment and many of the devices qualified for operational use also are used in training, and the principal procuring agency could not discriminate as to end use (see p. 14).

4. The costs of CWD training in operational commands probably are sizable. Estimates of these costs could not be obtained, however, because the timing, frequency, and intensity of such training are the prerogatives of unit commanders who are not required to maintain records that would permit estimation of CWD training costs (see p. 27).

5. The Services characteristically group nuclear, biological, and chemical (NBC) defensive training as a single entity, so that it is difficult (except via expert judgement) to delineate CWD training costs. This practice affects determination of investment costs, formal training at centers and schools, and training in operational units where CWD training often is performed concurrently with primary-mission training (pp. 23-27).

The scope of this task was defined to include cost categories typical of life-cycle cost, i.e., research and development, investment, and operating and support (O&S). The first two categories are addressed explicitly in this report; the third (O&S), comprises formal training courses and periodic CWD training in operational units.

In conducting cost-effectiveness (C-E) studies of alternatives, all costs that would be incurred subsequent to a decision that selects from among the alternatives should be accounted for. This implies consideration of life-cycle cost.¹² The aforementioned findings of this research suggest that the current status of cost data relevant to CWD training would inhibit the conduct of C-E studies, particularly in the investment and O&S cost categories. Cost-effectiveness studies, however, address specific alternatives with, at least, the significant differences among them being well defined. An analyst searching for cost data for a particular C-E study may find, or be able to generate, the limited cost data needed.

¹²Knapp and Orlansky, 1983 [31] proposed a cost element structure that is suitable for training programs, courses, and devices. The need to consider all costs that would occur in the life-cycles of training alternatives is discussed at length in that paper.

Whether and when formal C-E studies of CWD training technologies are appropriate depend upon the costs and benefits of conducting them. In the Services, little emphasis has been placed on the collection and analysis of CWD training costs. Implementation of collection and analysis procedures, therefore, would require that guidelines be established including, for example, (a) a cost threshold, for alternatives under consideration, below which rigorous C-E analysis need not be performed, (b) a cost element structure to assure that all germane costs are captured and are expressed consistently among alternatives and, (c) a requirement to establish cost data base(s). The current state of CWD training cost data, as reflected in the findings of this investigation, implies that compliance with such guidelines would consume considerable time and resources. A "test case," i.e., the life-cycle cost analysis of CWD training equipment or devices already fielded, could provide input to a decision regarding the advisability of formalizing data collection and analysis. The implementation of a common set of guidelines would offer certain advantages; for example, it would (a) permit the conduct of meaningful cost analyses of CWD training options, (b) provide more credible justifications for adoption of preferred alternatives and, (c) improve communication and understanding among decisionmakers, managers, and analysts at all levels.

It should be noted that this is an initial report on the cost of CWD training. It is also a preliminary report because several of the sources queried have not yet submitted their data, and because a number of organizations that surfaced as possible sources of cost data have not yet been solicited.

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