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Form Approved
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1. AGENCY USE ONLY (Leave blank) 2. REPORT DATE
cl 15 June 91 3. REPORT TYPE AND DATES COVERED
J Final

4. TITLE AND SUBTITLE
U.S. Army Armored Systems Nuclear, Biological,
and Chemical Requirements and Plans to Meet Them

5. FUNDING NUMBERS
NA

6. AUTHOR(S)
NA

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Assistant Secretary of the Army for
Research, Development and Acquisition
Washington, DC

8. PERFORMING ORGANIZATION
REPORT NUMBER
NA

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
NA

DTIC
S NOV 5 1991 D
C.

10. SPONSORING/MONITORING
AGENCY REPORT NUMBER
NA

11. SUPPLEMENTARY NOTES
NA

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release:
Distribution Unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)
The Joint Appropriations Conference Report 101-938, October 24, 1990, requested the Army report on requirements for Nuclear, Biological and Chemical (NBC) protection for armored systems and plans to meet those requirements. The Army's report covers NBC protection requirements for armored systems fighting on the NBC contaminated battlefield. NBC requirements seek to achieve a balance between personnel and equipment survivability when NBC protection and materiel survivability capabilities are incorporated into armored systems. The elements of the NBC protective system requirements are embodied in protection, detection, decontamination, and NBC contamination survivability. Forty-seven armored vehicles were surveyed for NBC protection requirements and contamination survivability. The report identifies the status of current vehicles and the direction the Army is pursuing to protect armored systems from NBC hazards.

14. SUBJECT TERMS
SURVIVABILITY, NBC SURVIVABILITY, ARMORED SYSTEMS, DETECTION, DECONTAMINATION, INDIVIDUAL PROTECTION, COLLECTIVE PROTECTION, HARDNESS, COMPATIBILITY, DECONTAMINABILITY, SMOKE, INDIVIDUAL PROTECTIVE CLOTHING, NBC CHEMICAL.

15. NUMBER OF PAGES
16. PRICE CODE
NA

17. SECURITY CLASSIFICATION
OF REPORT
UNCLASSIFIED

18. SECURITY CLASSIFICATION
OF THIS PAGE
UNCLASSIFIED

19. SECURITY CLASSIFICATION
OF ABSTRACT
UNCLASSIFIED

20. LIMITATION OF ABSTRACT
UNLIMITED

91-14916

01 110A 017

REPORT TO THE CONGRESS

U.S. ARMY ARMORED SYSTEMS

**NUCLEAR, BIOLOGICAL AND CHEMICAL
DEFENSE REQUIREMENTS**

AND PLANS TO MEET THEM

15 JUNE 1991

PREPARED BY:

**NBC ARMY FOCAL POINT
CHEMICAL RESEARCH, DEVELOPMENT AND
ENGINEERING CENTER**



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DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
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Availability Codes	
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EXECUTIVE SUMMARY

In the Joint Appropriations Conference Report 101-938, October 24, 1990, the Army was tasked to "...review the requirement for NBC protection on armored systems and report to the Committees on Appropriations of the Senate and House of Representatives no later than June 15, 1991, on the Army's requirement and plans to meet it." The response herein reflects the Army's armored systems' NBC requirements, and the Army's current and future plans to meet them.

Army doctrine integrates NBC protection with operational concepts to fight and win on the battlefield. Our armor battlefield readiness posture acknowledges the NBC threat and anticipates the presence of NBC environments. With more and more countries possessing biological and chemical weapons, the importance of readiness is underscored. This readiness was demonstrated by our willingness and ability to fight a chemical war, had it been necessary, during Operation Desert Storm. Today, the Army's battlefield doctrine is evolving from AirLand Battle (ALB) to AirLand Operations wherein the four distinct operational phases of Detect, Fire, Maneuver, and Reconstitute are executed. The doctrine of AirLand Operations is aimed at rapidly destroying the enemy's forces, not retaining enemy terrain. Armored systems play a significant role in each of these phases by performing a number of critical combat tasks. Proper execution of these tasks results in combat effectiveness, survival, and successful mission completion. These tasks include Fire and Maneuver, Sustainment, Counterfire, and Combat Support.

The Army's armor NBC protection requirements are driven by the operational need to fight in these environments. Requirements have changed to respond to perceived threats. Since 1984, requirements for materiel survivability have been added to armored systems NBC requirements to achieve a balance between personnel and equipment survivability. The U.S. Army Training and Doctrine Command (TRADOC) defines these requirements based on mission, doctrine, and operational concepts.

The elements of the NBC protective system requirements are embodied in protection, detection, decontamination, and NBC contamination survivability. In terms of functional configuration, armored systems are placed into two operational categories: open and closed. In open armored systems, combat tasks are performed with the crew and equipment exposed directly to the combat environment. Protection of the individual and NBC contamination survivability of the equipment is paramount. In closed armored systems, combat tasks are performed in a crew compartment and the crew and equipment may not be directly exposed to the threat environment. However, even in closed systems, various exterior and interior regions involved in resupply, refueling, and field maintenance are directly exposed, necessitating consideration of

NBC contamination survivability. Requirements for individual or crew (collective) protective filtration systems are driven by the concept of operation and mission of the specific armored system. Detection and decontamination capabilities may be required for either operational category.

For open systems, the crew NBC protection requirements are a combination of individual protective equipment (IPE) which includes mask/hood (individual or forced air respirator - ventilated facepiece), battledress overgarment, boots and gloves. Environmental control systems are an option for providing heat stress relief. For closed systems, individual protection can be accomplished by utilizing the IPE system approach for the open armored systems or by utilizing filtered air to overpressurize the entire crew compartment. This overpressure approach reduces or eliminates the dependency on IPE permitting "shirt sleeve" operations, but requires tight controls on the vehicle air leakage. Ventilating facepieces may also be combined with this capability. This combination of overpressure and ventilated facepiece protection is called "hybrid" collective protection. Again, environmental control may be used for relief of heat stress caused by high workload rates or in systems requiring cooling of electronic equipment. This cooling may be of the crew compartment (macro-climate cooling) or of the individual crew members (micro-climate cooling).

Detectors are required for warning and identification of agent attack in order to permit the prompt use of protective equipment and to allow combat units to perform evasive maneuvers to avoid contaminated areas, if required. Detectors are also used to minimize the adverse operational effects of prolonged use of protective equipment by indicating when the threat is no longer present. The option for mounting detection and warning devices on armored systems is designed and built into each weapon system platform. Deployment and use of a detector on an armored vehicle is determined by the field commander based on the perception of the threat, his operational concept and mission requirements.

Generally, essential decontamination equipment which may be used during combat operations is required for each armored system. Complete armored system decontamination is performed in rear areas by Army Chemical Corps assets.

Materiel survivability consists of the use of technology and hardware to ensure materiel hardness, decontaminability, and compatibility with operations in individual protective equipment.

Although smoke is not considered NBC protection, it is an element of the chemical mission area and can serve as a significant combat multiplier for selected armored systems.

The Army has organized this response to Congress by recapping NBC protection requirements and the plans to meet them within each of the specific Battlefield Functional Areas (BFA) of Close Combat Heavy/Light (CCH/L), Fire Support (FS), Air Defense (AD), Intelligence and Electronic Warfare (IEW), and Combat Support (CS). The armored systems in each of these areas are as follows:

- **Close Combat Heavy/Light**

- Main Battle Tanks (M60 Family, M1 Family, and Armored Systems Modernization (ASM) Block III Tank)
- Armored Personnel Carriers (M113 Family)
- Armored Fighting Vehicles (Bradley - M2 and M3 Series, ASM Future Infantry Fighting Vehicle - FIFV)
- Armored Anti-Tank Systems (Improved TOW Vehicle - ITV, Line of Sight Anti-Tank - LOSAT)
- Armored Assault Vehicles (M551A1 Sheridan, Armored Gun System - AGS)

- **Fire Support**

- Coordination (Fire Support Team Vehicle - FISTV)
- Missile and rocket launcher (Multiple Launch Rocket System - MLRS M270 Launcher)
- Artillery (M110A2 Howitzer, M109 series Howitzers, ASM Advanced Field Artillery System - AFAS)
- Resupply/Ammunition Carriers (Field Artillery Ammunition Supply Vehicle - FAASV, ASM Future Armored Resupply Vehicle - Ammunition - FARV-A)

- **Air Defense**

- Line of Sight-Forward-Heavy (LOS-F-H)
- Armored Short Range Air Defense (SHORAD) systems (Vulcan, Chapparal)

- **Intelligence and Electronic Warfare**

- Ground Based Common Sensor (GBCS)/Electronic Fighting Vehicle System (EFVS)

- **Combat Support**

- Armored Engineering Vehicles (M728 Combat Engineer Vehicle, M9 Armored Combat Earthmover, ASM Combat Mobility Vehicle - CMV)
- Armored Recovery Vehicles (M88 Family, M578)
- Armored Vehicle Launched Bridge (M60A1 chassis)
- NBC Reconnaissance Vehicles (XM93 series)

The specific rationale for the NBC protective system of choice is provided for each vehicle in Section II of this report. Status of development, product improvements, and other program initiatives are also provided in Section III.

After reviewing the Army's current and future NBC requirements and plans for these armored systems, it is clear that the current Army systems are able to fight on the NBC contaminated battlefield. Highlights of this review follow and illustrate the Army's approach to satisfy NBC requirements. This approach reflects tradeoffs between cost, schedule, and NBC protection technology availability to meet operational requirements.

- **Close Combat Heavy/Light**

- **Main Battle Tanks (MBT)**: The M60A1 and A3 variants have ventilated facepieces, Chemical Agent Resistant Coating (CARC) paint, and a decontamination capability. The M1 fielded system has matured from ventilated facepieces only, to a combined overpressure and ventilated facepiece system (hybrid), with micro-climate cooling for the M1A1. Detection and decontamination capabilities are provided. The M60 series tank is being phased out of this mission area by the M1 series tanks, which, in the early 21st century, will be followed by the ASM Block III Tank.

The ASM common chassis advanced technology demonstration program for the Block III MBT is leading the way to integrated NBC (protection, detection, decontamination and contamination survivability) systems from the onset of design. The ASM is the first family of armored systems where materiel survivability is being designed into the platform, and is essential to ensure enhanced combat effectiveness for our 21st century armor forces. The Block III MBT will have an integrated NBC hybrid collective protection system with micro-climate cooling to provide protection. The Block III NBC protection concept also includes an advanced filtration technology which eliminates the need for frequent filter replacement. Decontamination capabilities and interior/exterior detection will be provided.

- **Armored Personnel Carriers (APC)**: The M113 APC has individual protection only with mounting provisions for detection and decontamination capability. The M113 family is CARC painted.

- **Armored Fighting Vehicles**: The Bradley Infantry and Cavalry Fighting Vehicle (IFV/CFV) fielded systems have also progressed from individual protection only to ventilated facepieces with mounting provisions for detection and decontamination capability. Although there were requirements for a ventilated facepiece system in the M2A0 and M3A0, these requirements were not implemented due to other needs. There is currently no firm approval of funding in place to convert/upgrade the M2A0 or M3A0 with ventilated facepiece protection. A ventilated facepiece

system was installed in the M2/3 A1 and A2 versions. The A1 and A2 versions of the Bradley are CARC painted. The Future Infantry Fighting Vehicle (FIFV) is the ASM variant to replace the IFV/CFV and M113, and will provide hybrid collective protection, micro-climatic cooling, and advanced detection and decontamination capability.

•• Armored Anti-Tank Systems: The Improved Tow Vehicle (ITV) has a requirement for individual NBC protection only, and detection and decontamination capability. The ITV will be replaced by the Line of Sight Anti-Tank (LOSAT) which integrates the launcher onto a modified Bradley (XM1071 LOSAT Carrier) chassis. LOSAT will integrate a hybrid collective protection system with micro-climate cooling. Decontamination and detection capabilities will be provided. Both the ITV and LOSAT are CARC painted.

• **Fire Support**

•• Coordination: The M981 Fire Support Team Vehicle supports the M1 and M60 tank units and the M113 APC maneuver forces and provides the crew with ventilated facepieces, detection and decontamination capabilities.

•• Missile and Rocket Launchers: The Multiple Launch Rocket System (MLRS M270 Launcher) is a Bradley chassis derivative with an overpressure system for rocket fume and NBC protection. It has a ventilated facepiece and detection capability. MLRS is CARC painted.

•• Artillery: The M109 Self-Propelled Howitzer (SPH) series offers a classic example of product improvements in NBC protection. The M109A6 Paladin is the result of the Howitzer Improvement Program (HIP). Paladin is an improvement of the M109A2/A3, which is an improvement of the 1960s vintage M109. The M109A4/A5 added a ventilated facepiece system. Both the A2/A3 and A4/A5 upgrades offer a decontamination capability. The Paladin added micro-climate cooling for the vehicle crew members to the NBC protection suite of the M109A4/A5. The M110A2 SPH is an open system designed in the 1950s with the crew required to operate with individual protection only. Both the M109 and M110 are CARC painted. The ASM Advanced Field Artillery System (AFAS) will replace the M109 Howitzer series and offers an advanced hybrid collective protection system, micro-climate cooling, and macro-climate cooling. Decontamination capability and an advanced interior/exterior automatic detection and warning system will also be offered.

•• Resupply/Ammunition Carriers: The Fire Support mission area requires ready resupply of ammunition. The Field Artillery Ammunition Supply Vehicle (FAASV) system supports the M109 series howitzers. The M992 FAASV uses ventilated facepieces and individual protection. Detection and decontamination

capabilities are provided. The ASM Future Armored Resupply Vehicle-Ammunition (FARV-A) will have an advanced hybrid collective protection system with micro-climate cooling. Decontamination capability and an advanced interior/exterior automatic detection and warning system will also be incorporated.

- **Air Defense (AD)**

- Forward Area AD (FAAD): The FAAD Line of Sight-Forward-Heavy (LOS-F-H) objective system is being integrated onto a modified Bradley chassis (XM1069) and offers NBC protection consisting of a hybrid system of ventilated facepiece and overpressure. Micro-climate cooling, decontamination and detection capabilities are also provided. LOS-F-H will be CARC painted.

- Short Range AD (SHORAD): The armored SHORAD systems are the M163A1/A2 Vulcan and M730A1/A2 Chapparral. The Vulcan is an open crew system operated in individual protective equipment. The Chapparral also offers a ventilated facepiece and individual protection for mission execution. The Chapparral and Vulcan have a decontamination capability and the Chapparral is CARC painted.

- **Intelligence and Electronic Warfare (IEW)**

- Armored Intelligence and Electronic Warfare Vehicles: The Electronic Fighting Vehicle System (EFVS) is a component of both the Ground Based Common Sensor (GBCS) - Heavy and the Joint Surveillance Target Attack Radar System (J-STARS) programs. The enclosure which houses the IEW electronics is mounted on a Bradley Fighting Vehicle chassis. The electronic enclosure will be equipped with an overpressure and environmental control system which allows the EFVS crew to operate in an NBC contaminated environment in a reduced individual protective posture. Crew members operating in the cab of the vehicle will be provided with ventilated facepieces for NBC protection. Detection and decontamination capabilities will be incorporated. The system will be CARC painted.

- **Combat Support**

- Armored Engineering Vehicles: The M9 Armored Combat Earthmover (ACE) has a ventilated facepiece system for NBC protection with detection and decontamination capabilities. The M728 Combat Engineer Vehicle (CEV) is equipped with a ventilated facepiece and decontamination equipment. The ASM Combat Mobility Vehicle (CMV) will be the future baseline platform for these vehicles and offers a hybrid collective protection system with micro-climate cooling. The ACE and CEV are CARC painted. The protection concept for the CMV includes CARC painting.

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•• Armored Recovery Vehicles: The M88 (medium) and M578 (light) recovery vehicles are equipped with ventilated facepieces and decontamination capability. Both are CARC painted.

•• Armored Vehicle Launched Bridges (AVLB): The M60A1 AVLB is based on a converted M60A2 chassis and has a ventilated facepiece, detection and decontamination capability.

•• NBC Reconnaissance Vehicles: The XM93 and XM93E1 are variants of the German FUCHS vehicle. The XM93 is equipped with overpressure collective protection and macro-climate cooling systems. In addition, the XM93 has an M8A1 Chemical Agent Alarm, Chemical Agent Monitor (CAM), AN/VDR-2 radiation detector and an MM-1 mass spectrometer for agent vapor and liquid detection. The XM93E1 will add a ventilated facepiece system to make the collective protection a hybrid system. Micro-climate cooling for the crew will also be added. In addition to the XM93 suite of detectors, the XM-21 Remote Sensing Chemical Agent Alarm will be added to the XM93E1 for a stand-off agent detection capability. The XM93E1 is programmed for a remote chemical alarm system. Both vehicles will be equipped with a decontamination capability and will be CARC painted.

Table 1 summarizes the requirements and armor program NBC protection status. Sections II and III provide the details of our review of requirements and the current plans to address these requirements.

This review shows the Army armor concept of battle and the integrated nature of the NBC systems to address this threat. Operational requirements are being satisfied. Armored systems have been and continue to be upgraded to enhance mission sustainment and effectiveness in the NBC environment. The Army recognized the importance of NBC contamination survivability of equipment through publication of Army Regulation 70-71 in 1984. This AR requires NBC Contamination Survivability for all mission essential materiel. However, most of the armor systems surveyed predate this regulation. Both the need for and the feasibility of achieving NBC contamination survivability of materiel in fielded systems is the subject of an ongoing Army effort.

Regarding future systems, the armored systems modernization program represents the Army's plan for acquisition of future armored platforms and represents the first initiative to incorporate materiel survivability and NBC protective systems from the onset of design. As envisioned, the ASM common chassis and combat variants are moving toward reduced individual vulnerability and, therefore, closed compartment concepts. Hardware and technologies to support these demanding future requirements, including materiel survivability, are being aggressively developed.

In summary, the current Army armored systems are able to fight on the NBC contaminated battlefield. In the future, the ASM variants will enhance battlefield operations with improved NBC defense capabilities for the armor forces. Sustained mission effectiveness and materiel survivability with reduced logistical and maintenance burden are the major combat attributes of ASM's NBC defense capabilities for armored systems in AirLand Operations.

EXPLANATION OF TABLE 1 COLUMN HEADERS AND ENTRIES

ARMORED SYSTEM

- Short form of Vehicle Nomenclature

PROGRAM

- Req't Date : Mo/Da/Yr of Requirements Document
- LC Phase : Life Cycle Phase (DEvelopment, DEpployment, PROduction, PROduction/DEployment, Low Rate Initial Production, Pre-planned Product Improvement)

ESSENTIAL REQUIREMENTS

- Those Items Identified in the System's Requirement Document as "Must Have" by the User

ES
1
9

- Protection: Individual Protection (IP) is Provided to all Armored Force Personnel
• VFP : Ventilated Facepiece (Filtered Air Provided to a Respirator)
• OP : Over Pressure (Filtered Air Provided to an Enclosure)
• HYB : VFP and OP Applied Together

- Cooling : Micro-climate (Individual) Cooling (uc); Macro-climate (Compartment) Cooling (MC)

DETECTORS AND DECONTAMINATION

- RQD : User Requirement
- ON VEH : Mounted Location/Hookup Identified

SMOKE

- RQD : User Requirement
- ON VEH : Mounted Location/Hookup Identified

OTHER

- AR 70-71 RQD : Was AR 70-71 in effect at the time the requirements document was written?
- CARC Painted : Does the Vehicle have Chemical Agent Resistant Coating?

10-Jun-91

PROGRAM	ESSENTIAL REQUIREMENTS			CURRENT PLANS			DETECTION			SMOKE			OTHER						
	INDIVIDUAL PROTECTION PLUS:			INDIVIDUAL PROTECTION PLUS:			DECOM7			AR 70-71 CARC			ROD7 PAINTED?						
	REQ DATE	LC	PMAGE	VIP?	OP?	HTB?	UC?	MC?	UFP?	OP?	HTB?	UC?	MC?	ROD7 ON	VEN?	ROD7 ON	VEN?	AR 70-71 CARC	ROD7 PAINTED?
ARMORED SYSTEM																			
M1 COMBAT SYSTEM																			
M1 TANK	06/30/80	DEP		YES			NO	NO	YES		NO	NO	NO	YES	YES	YES	YES	NO	NO
M1P TANK	06/30/80	DEP		YES			NO	NO	YES		NO	NO	NO	YES	YES	YES	YES	NO	NO
M1A1 TANK	06/30/80	PROD		YES			YES	NO	YES		YES	NO	NO	YES	YES	YES	YES	NO	NO
M1A2 TANK	06/30/80	DEV		YES			YES	NO	YES		YES	NO	NO	YES	YES	YES	YES	NO	NO
BRAZLEY FVS																			
M2A1	03/02/78	DEP		YES			NO	NO	YES		NO	NO	NO	YES	YES	YES	YES	NO	NO
M2A1	03/02/78	DEP		YES			NO	NO	YES		NO	NO	NO	YES	YES	YES	YES	NO	NO
M2A2	03/02/78	DEP		YES			NO	NO	YES		NO	NO	NO	YES	YES	YES	YES	NO	NO
M2A3	03/02/78	DEP		YES			NO	NO	YES		NO	NO	NO	YES	YES	YES	YES	NO	NO
M2A1	03/02/78	DEP		YES			NO	NO	YES		NO	NO	NO	YES	YES	YES	YES	NO	NO
M2A2	03/02/78	DEP		YES			NO	NO	YES		NO	NO	NO	YES	YES	YES	YES	NO	NO
M2A3	03/02/78	DEP		YES			NO	NO	YES		NO	NO	NO	YES	YES	YES	YES	NO	NO
M270 MLRS	02/08/80	P/DEP		YES			NO	NO	YES		NO	NO	NO	YES	YES	YES	YES	NO	NO
LOS-F-N ADATS	03/25/87	DEV		INIT			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
EFVS (CMCS)	12/21/90	DEV		YES			NO	VFS-N	YES		NO	VFS-N	NO	YES	YES	YES	YES	YES	YES
M113 SYSTEM																			
M113A2 APC	01/05/83	DEP		YES			NO	NO	YES		NO	NO	NO	YES	YES	YES	YES	NO	YES
M113A3 APC	01/05/83	DEP		YES			NO	NO	YES		NO	NO	NO	YES	YES	YES	YES	NO	YES
M90A1 T1V	01/05/83	DEP		YES			NO	NO	YES		NO	NO	NO	YES	YES	YES	YES	NO	YES
M230A1/A2 CAMPARAL ADV	06/17/81	DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M31A1/A2 MLCAM AD SYS	06/17/81	DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M90T FISTV	01/05/83	DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M568A1 6in CARGO	01/05/83	DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M106A1/A2 107mm MORTAR	01/05/83	DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M106A4 120mm MORTAR	01/05/83	DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M577A1/A2 CP	01/05/83	DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M1059 CARRIER, SMOKE	PIP			YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M60 SERIES																			
M40 AVLB	01/05/83	DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M60A1 TANK	01/05/83	DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M60A3 TANK	01/05/83	DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
ARTILLERY																			
M109A2/A3 155mm	PIP:11/75	P31		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M109A6/A5 155mm	PIP:6/87	DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M109A6 155mm PALADIN	PIP:5/88	DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M992 FAASV	01/05/81	DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M110A2	PIP:1/78	DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
ARMORED SUPPORT VEHICLES																			
M80A1 MED BV	61	DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M80A1E1	HOME	DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M578 LIGHT BV	HOME	DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
MACE	HOME	DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M728 LEV	06/77	P/DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M993 FOR MHC RECON VEH	02/22/91	PROB		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M9361 FOR	02/22/91	DEV		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
M551A1 ARMORED RECON	11/58	DEP		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
ASV																			
BLOCK 111 TANK	02/22/90	DEV		YES			YES	NO	YES		YES	NO	NO	YES	YES	YES	YES	YES	YES
LOSAT	07/90	DEV		YES			YES	NO	YES		YES	NO	NO	YES	YES	YES	YES	YES	YES
ACS	04/99/91	DEV		YES			NO	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
F11V	02/22/90	DEV		YES			YES	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
CPV	02/22/90	DEV		YES			YES	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
AFAS	02/22/90	DEV		YES			YES	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO
FARV-A	02/22/90	DEV		YES			YES	NO	YES		NO	NO	NO	NO	NO	NO	NO	NO	NO

* = UPDATE 1/87 D = DESIRED C = CREW ONLY M = MODULE/ENCLOSURE, ONLY, CREW HAS VFP
 MMP1 = MISSION WEEDS PRODUCT IMPROVEMENT PIP = PRODUCT IMPROVEMENT PROGRAM
 OTCH = OPERATIONAL TECHNICAL COMMAND MEMORANDUM OMB = QUALITATIVE MATERIAL REQUIREMENT

U.S. ARMY REPORT TO THE COMMITTEES ON APPROPRIATIONS
OF THE SENATE AND HOUSE OF REPRESENTATIVES ON THE ARMY'S NBC
REQUIREMENT AND PLANS TO MEET IT

I. INTRODUCTION.

In the Joint Appropriations Conference Report 101-938, October 24, 1990, the Army was tasked to "...review the requirement for NBC protection on armored systems and report to the Committees on Appropriations of the Senate and House of Representatives no later than June 15, 1991, on the Army's requirement and plans to meet it." The response herein reflects the Army's armored systems' NBC requirements, and the Army's current and future plans to meet them. For the purposes of this report, an "armored system" is any tracked or wheeled weapon system with light or heavy armor designed to protect the vehicle crew or the weapon system itself while the system is being operated in a combat environment.

Army doctrine integrates NBC protection with operational concepts to fight and win on the battlefield. This strategy was demonstrated by our willingness and ability to fight a chemical war, if it had been necessary, during Operation Desert Storm. Today, the Army's battlefield doctrine is evolving from AirLand Battle (ALB) to AirLand Operations wherein the four distinct operational phases of Detect, Fire, Maneuver, and Reconstitute are executed. The doctrine of AirLand Operations is aimed at rapidly destroying the enemy's forces, not retaining enemy terrain. Armored systems play a significant role in each of these phases, performing a number of critical combat tasks which result in combat effectiveness, survival, and successful mission completion. These tasks include Fire and Maneuver, Sustainment, Counterfire, and Combat Support. Armor battlefield readiness posture acknowledges the NBC threat and anticipates the presence of NBC environments. With more and more countries possessing biological and chemical weapons, the importance of readiness is underscored.

The Army's armor NBC protection requirements are driven by the operational need to fight in these environments. Requirements have changed to respond to perceived threats. Since 1984, requirements for materiel survivability have been added to armored systems NBC requirements to achieve a balance between personnel and equipment survivability. The U.S. Army Training and Doctrine Command (TRADOC) defines these requirements based on mission, doctrine, and operational concepts.

The elements of the NBC protective system requirements are embodied in protection, detection, decontamination, and NBC contamination survivability. In terms of functional configuration, armored systems are placed into two operational categories: open and closed. In open armored systems, combat tasks are performed with the crew and equipment exposed directly to the combat environment. Protection of the individual and NBC contamination

survivability of the equipment is paramount. In closed armored systems, combat tasks are performed in a crew compartment and the crew and equipment may not be directly exposed to the threat environment. However, even in closed systems, various exterior and interior regions involved in resupply, refueling, and field maintenance are directly exposed to NBC agents. This exposure necessitates consideration of NBC contamination survivability. Requirements for individual or crew (collective) protective filtration systems are driven by the concept of operation and mission of the specific armored system. Detection and decontamination capabilities may be required for either category.

For open systems, the crew NBC protection requirements are a combination of individual protective equipment (IPE) which includes mask/hood (individual or forced air respirator - ventilated facepiece), battledress overgarment (BDO), boots and gloves. Environmental control systems are an option for providing heat stress relief. For closed systems, individual protection can be accomplished by utilizing the IPE system approach for the open armored systems or by utilizing filtered air to overpressurize the entire crew compartment. This overpressure approach reduces or eliminates the dependency on IPE, permitting "shirt sleeve" operations, but requires tight controls on the vehicle air leakage. Ventilating facepieces may also be combined with this capability. This combination of overpressure and ventilated facepiece protection is called "hybrid" collective protection. Again, environmental control may be used for relief of heat stress caused by high workload rates or in systems requiring cooling of electronic equipment. This cooling may be of the crew compartment (macro-climate cooling) or of the individual crew members (micro-climate cooling).

Detectors are required for warning and identification of agent attack and to permit the prompt use of protective equipment and to allow combat units to perform evasive maneuvers to avoid contaminated areas, if required. Detectors are also used to minimize the adverse operational effects of prolonged use of protective equipment by indicating when the threat is no longer present. The option for mounting detection and warning devices on armor is designed and built into each armored vehicle. Deployment and use of a detector on an armored vehicle is determined by the field commander based on the perception of the threat, his operational concept and mission requirements.

Generally, essential decontamination equipment which may be used during combat operations is required for each armored system. Complete armored system decontamination is performed in rear areas by Army Chemical Corps assets.

Materiel survivability consists of the use of technology and hardware to ensure materiel hardness, decontaminability, and compatibility with operations in individual protective equipment.

Although smoke is not considered NBC protection, it is an element of the chemical mission area and can serve as a significant combat multiplier for selected armored systems.

For a detailed explanation of individual and collective protection, detection, decontamination, smoke and NBC contamination survivability, refer to Appendix A. Also in Appendix A is an explanation of how a method of providing NBC protection can be applied to an armored system's operational concept. A compendium describing current and future NBC hardware and technologies is provided at Appendix C.

The Army has organized this response to Congress by recapping NBC protection requirements and the plans to meet them within each of the specific Battlefield Functional Areas (BFA) of Close Combat Heavy/Light (CCH/L), Fire Support (FS), Air Defense (AD), Intelligence and Electronic Warfare (IEW), and Combat Support (CS). The armored systems in each of these areas are as follows:

- **Close Combat Heavy/Light**

- Main Battle Tanks (M60 Family, M1 Family, and Armored Systems Modernization (ASM) Block III Tank)
- Armored Personnel Carriers (M113 Series)
- Armored Fighting Vehicles (Bradley Series - M2 and M3, ASM Future Infantry Fighting Vehicle - FIFV)
- Armored Anti-Tank Systems (Improved TOW Vehicle-ITV, Line of Sight Anti-Tank - LOSAT)
- Armored Assault Vehicles (M55A1 Sheridan, Armored Gun System - AGS)

- **Fire Support**

- Coordination (Fire Support Team Vehicle - FISTV)
- Missile and rocket launcher (Multiple Launch Rocket System (MLRS) M270 Launcher)
- Artillery (M110A2 Howitzer, M109 series Howitzers, ASM Advanced Field Artillery System - AFAS)
- Resupply/Ammunition Carriers (Field Artillery Ammunition Supply Vehicle - FAASV, ASM Future Armored Resupply Vehicle - Ammunition - FARV-A)

- **Air Defense**

- Line of Sight-Forward-Heavy (LOS-F-H)
- Armored Short Range Air Defense (SHORAD) systems (Vulcan, Chapparral)

- **Intelligence and Electronic Warfare**

- Ground Based Common Sensor (GBCS)/Electronic Fighting Vehicle System (EFVS)

- **Combat Support**

- Armored Engineering Vehicles (M728 Combat Engineer Vehicle, M9 Armored Combat Earthmover, ASM Combat Mobility Vehicle - CMV)
- Armored Recovery Vehicles (M88 Family, M578)
- Armored Vehicle Launched Bridges (M60, M1 chassis)
- NBC Reconnaissance Vehicles (XM93 series)

The specific NBC protective system requirements for each vehicle are provided in Section II of this report. Status of development, product improvement and other program initiatives are provided in Section III. Summary data sheets for each specific armored system identified above are provided at Appendix B.

II. ARMORED SYSTEMS NBC REQUIREMENTS.

The battlefield requires diverse equipment systems to execute different missions and satisfy varied operational requirements. The Fire/Maneuver task is accomplished by light and heavy armored vehicles such as tanks, armored gun systems, and Infantry and Cavalry Fighting Vehicles (IFVs/CFVs) engaging the enemy and maneuvering force concentrations. Sustainment is the combination of anticipation, integration, continuity, responsiveness, and improvisation to the mission needs of the combined arms. It is supported by armored vehicles to arm, fuel, fix, move and sustain the soldier. Counterfire is accomplished by the field artillery, air defense, and air/ground battlefield systems. Functions include target acquisition, communication to delivery systems, and engagement. Combat Support tasks involve the battlefield systems for command and control (C²), communications, Intelligence and Electronic Warfare (IEW), mobility and countermobility, which afford the commander with timely command, control, communications and intelligence (C³I), logistics, resupply, and maneuverability. It is important to understand NBC requirements rationale in the context of battlefield functions necessary to execute the Army's fighting doctrine.

AirLand Operations is an evolutionary concept that builds upon the current AirLand Battle doctrine. It is based upon specific stages during conflict where forces disperse to detect the enemy and reduce detection by the enemy, mass to concentrate long range fires on the enemy and maneuver close combat assets, engage the enemy in intense and highly synchronized close combat to inflict decisive losses, re-disperse to prepare for future operations, and reconstitute either forward or rear to resupply and repair for future operations.

Long range fires, close combat, maneuver, and reconstitution are accomplished by main battle tanks, infantry and cavalry fighting vehicles, artillery, and combat support armored systems. All armored systems are designed to function, albeit with some probable degradation in performance, with the vehicle crews dressed in mission oriented protective posture (MOPP) ensembles. These ensembles consist of the soldier's individual protective equipment (mask and hood, BDOs, boots and gloves).

Armored systems NBC protection requirements are determined within the context of the specific Battlefield Functional Areas (BFA) of Close Combat-Heavy/Light (CCH/L), Fire Support (FS), Air Defense (AD), Intelligence and Electronic Warfare (IEW) and Combat Support (CS) to execute the fighting doctrine, as documented herein.

A. Close Combat Heavy/Light - This combat mission element rapidly maneuvers survivable light and heavy forces into

concentrated combat elements to effect highly lethal direct fires and casualties on the enemy. The Army addresses the need for these systems to operate in NBC environments in open or closed hatch configurations, in accordance with doctrinal operational concepts. Detection of NBC contamination affords CCH/L forces the ability to avoid contaminated terrain, if possible. If the mission requires, the forces fight through the area and decontaminate as soon as possible. The following addresses the NBC requirements for specific CCH/L armored systems.

1. Main Battle Tank (MBT) systems (M60, M1, Block III Tank) mass into specific concentrations for heavy force close combat engagement and direct fires. MBTs are the principal weapon systems of the heavy force during all types of combat operations that provide accurate, mobile, protected direct fire power and shock effect required for assault forces. They also provide lethal, close-in, direct, defensive fire power necessary to stop an attacking force. The changes in requirements for NBC protection reflect changes in doctrine, such as AirLand Battle (ALB) to AirLand Operations, and changes in NBC protection technology such as MOPP-only to collective protection equipment. Collective protection may combine overpressure systems with ventilated facepieces and environmental control units. This combination of overpressure and ventilated facepiece protection is referred to as "hybrid" collective protection. Overpressure systems reduce the probability of the interior of the tank becoming contaminated in the open mode. Collective protection is instrumental in permitting MOPP reduction resulting in enhanced mission sustainment. Additionally, micro-climate cooling of the individual crew members further reduces the risk of heat stress casualties. Tank commanders prefer "open-hatch" or open system operations to be able to perceive the battlefield and provide visual contact and signals between task force elements. During such conditions, the crew still maintains full chemical protection through the use of ventilated facepieces. Occasionally, such as when under direct fire, "buttoned-up" or closed system posture is required to fight through the area. The NBC requirement statement for each tank system reflects 1) the need for crews to observe, maneuver, perform, rearm and resupply, and 2) the availability of NBC hardware and technology at the time of fielding.

The M60 series main battle tank was designed in the 60's as the principal weapon system of the tank battalion. Its primary mission was to close with and destroy the enemy. It was designed to operate under all weather conditions and in NBC environments. The M60A1 and M60A3 both have requirements for ventilated facepiece. The M60A3 tank added the requirement for a decontamination capability.

The M1 series main battle tank is being fielded to replace the M60 series tanks. The M1 requirements have evolved from ventilated facepiece to hybrid collective protection and

micro-climate cooling. All variants in the M1 tank series have requirements for detection and decontamination capabilities.

The ASM Block-III tank will replace the Abrams main battle tank on a one-for-one basis. The Block-III tank will support the AirLand Operations employment concepts in the traditional role of armor. It is an offensive weapon system that can close with, destroy and break through enemy defenses, and exploit success in the enemy's rear. The operational employment concept for the Block-III tank will be closed-hatch. This change in doctrine from open to closed operations is foreseen based on improved battlefield sensors and augmented and improved vision devices. The NBC requirements for the Block III tank include many protection options. An NBC overpressure system with advanced filtration technology is required which will reduce the logistical burden of replacing NBC filters, along with an integrated micro-climate cooling system with ventilated facepiece. An integrated NBC detection system is required, capable of interior and exterior monitoring for chemical and ultimately biological agents. Stand off detection capability is required from 10 meters to at least one kilometer. Compliance with AR 70-71, NBC contamination survivability and incorporation of Chemical Agent Resistant Coating (CARC) is required for all painted surfaces.

2. Armored personnel transportation and reconnaissance systems include the M113 Armored Personnel Carrier (APC) combat vehicles. Battlefield operations during close combat demand rapid and frequent ingress/egress forcing open system conditions. Requirements statements for these systems dictate that crew members and members of the mechanized infantry squads who use the mobility of APCs to traverse the battlefield will rely upon individual protection.

3. Armored fighting systems include the Bradley M2 Infantry/M3 Cavalry Fighting Vehicle (IFV/CFV) and the ASM's Future Infantry Fighting Vehicle (FIFV) systems. Battlefield operations during close combat demand rapid and frequent ingress/egress forcing open system conditions. Requirements statements for these systems dictate that members of the mechanized infantry and cavalry squads will rely upon individual protection, except for the driver, commander, and gunner, who will use a ventilated facepiece system. The IFV/CFV also has requirements for a detection and decontamination capability. The A1 and A2 versions of the Bradley are CARC painted.

The ASM variant Future Infantry Fighting Vehicle (FIFV) will replace the Bradley Fighting Vehicles (BFV) and M113 carriers (squad carriers, commander's vehicle and executive officer's vehicle) in the infantry brigade. It is planned that the FIFV will replace the commander's and XO's BFV/M113s until the ASM Command Group Vehicle is fielded. The FIFV will be mounted on the heavy protection level chassis and will provide mobile protected

transport for the infantry squad to the critical required point of the battlefield. It will provide overwatching fires in support of the dismounted infantry and fires to destroy enemy IFVs/light armored vehicles, tanks, and attack helicopters. The FIFV will have a two-man crew and carry a dismount element.

Operational employment mandates open system mobility. The NBC requirements for the FIFV include many protection options. An advanced NBC overpressure system is required which will reduce the logistical burden of replacing NBC filters, along with an integrated micro-climate cooling system with ventilated facepiece. An integrated NBC detection system is required, capable of interior and exterior monitoring for chemical and biological agents. Stand off detection capability is required from 10 meters to at least one kilometer. A decontamination capability is also required. Compliance with AR 70-71, NBC contamination materiel survivability and incorporation of Chemical Agent Resistant Coating (CARC) is required for all painted surfaces.

4. Armored anti-tank systems are critical to the success of our armor combat operations. The armored system that is currently fielded to perform the anti-armor mission is the Improved TOW Vehicle (ITV). The ITV has a requirement for individual NBC protection only, and also has a detection and decontamination capability. The ITV will be replaced by the Line of Sight Anti-Tank (LOSAT) which integrates the launcher onto a modified Bradley (XM1071 LOSAT Carrier) chassis. LOSAT will integrate a hybrid collective protection system with micro-climate cooling. Decontamination and detection capabilities will be provided. Both the ITV and LOSAT are to be CARC painted.

5. Armored assault vehicles such as the M551A1 Sheridan and its replacement, the Armored Gun System (AGS), are generally employed in direct support of airborne and other infantry units as part of contingency and reinforcing missions worldwide. Sheridan crews are required to perform battlefield functions in individual protective gear. The AGS crews will be provided with a ventilated facepiece collective protection system. Both the Sheridan and the AGS have requirements for a decontamination capability and both vehicles are to be CARC painted.

B. Fire Support - The fire support mission includes those efforts directly related to the generation and application of long range indirect fires which support the close combat/maneuver forces and add depth to the battlefield. Detection and avoidance of NBC contamination and the ability to execute rapid decontamination procedures are essential to reduce the stress of MOPP on soldiers operating sophisticated weaponry. Open hatch and open crew operations are inherent for some fire support systems. For these current platforms, individual protection and ventilated facepiece are required for most applications.

1. Artillery fire coordination supported by the M981 Fire Support Team Vehicle (FISTV) supports the M1/M60/M113 force and requires NBC protection via individual protection, and ventilated facepiece. A detection and decontamination capability are also required.

2. Missile and rocket launchers, such as the Multiple Launch Rocket System (MLRS) M270 Launcher, qualify as closed systems which benefit from collective protection. The M270 is a Bradley chassis derivative with a requirement for an overpressure system for NBC and rocket fume protection. It also has NBC requirements for ventilated facepiece.

3. The M109 Howitzer series NBC requirements have evolved from individual protection only to ventilated facepiece. With the Howitzer Improvement Program (M109A6 Paladin), ventilated facepiece is required. Micro-climate cooling is also required to reduce the risk of heat stress casualties caused by the high work rate required for artillery missions. A decontamination capability is required for all M109s.

4. The M110A2 8 inch Howitzer is a completely open system and, therefore, requires individual protection only. It also has requirements for a decontamination capability.

5. The Field Artillery Ammunition Supply Vehicle (FAASV) system supports ammunition resupply of the M109 family. The M992 FAASV requires ventilated facepiece and individual protection. Detection and decontamination capability are also required.

6. The Advanced Field Artillery System will be mounted on the heavy protection level common component chassis to provide the platform to support the 155mm cannon recoil and ensure system survivability. This indirect fire weapon will replace the M109A6 Paladin Howitzer. The future indirect fire system consists of the Advanced Field Artillery System-Cannon (AFAS-C) and the Future Armored Resupply Vehicle-Ammunition (FARV-A). AFAS cannot function effectively without FARV-A. The AFAS-C will have a four-man crew. The system will be employed in autonomous and semi-autonomous operations. The FARV-A will be assigned as an integral system of the battalion/squadron support elements. It will operate between the combat trains and rearm points located in close proximity to the armored fighting system's battle positions. Once loaded, the FARV-A, by virtue of its communications and navigation systems, can move forward to a protected position near the fighting systems and execute rapid resupply. The FARV-A will transport ammunition and provide automated ammunition receiving and transferring capability to increase the speed of resupply operations. The FARV-A will have a two-man crew and be fielded on a one-for-one basis with AFAS, replacing FAASV in AFAS equipped artillery battalions.

The operational employment concept requires both open and closed hatch configurations. Therefore, both the AFAS-C and FARV-A require an advanced NBC overpressure system which will reduce the logistical burden of replacing NBC filters, along with integrated micro-climate cooling systems with ventilated facepiece. An integrated NBC detection system is required, capable of interior and exterior monitoring for chemical and biological agents. Stand-off detection capability is required from 10 meters to at least one kilometer. A decontamination capability is also required. Compliance with AR 70-71, NBC contamination materiel survivability and incorporation of Chemical Agent Resistant Coating (CARC) is required for all painted surfaces.

C. Air Defense (AD) - Air defense platforms kill or nullify enemy air threats, protect C³I nodes, and sustain the force. Targets of enemy air attacks, such as force concentrations, air bases, etc. are highly prized and armored air defense systems are frequently collocated with these targets. NBC combat doctrine for Air Defense, therefore, emphasizes detection and avoidance of contaminated areas, and warning and rapid decontamination as necessary. Certain crew positions in armored systems, such as the Vulcan gunner, and Chapparral crew operationally require exposure to the elements during the mission. Hence, individual protection is required. A closed system is required for selected air defense systems when the crew is "buttoned up" and drives through the contaminated areas with the supported force. The Line of Sight-Forward-Heavy (LOS-F-H) Air Defense Anti-Tank System (ADATS) development is an example.

1. The Forward Area AD (FAAD) Line of Sight-Forward-Heavy (LOS-F-H) objective system will be integrated onto a modified Bradley chassis (XM1069) and require NBC protection consisting of a hybrid collective protection system.

2. The Short Range AD (SHORAD) systems are the M163A1/A2 Vulcan and the M730A1/A2 Chapparral. The Vulcan is an open crew system with a requirement for crew operations wearing individual protection. The Chapparral requires ventilated facepiece.

D. Intelligence and Electronic Warfare - Battlefield intelligence information is necessary to produce a clear picture of the battlefield and enables the commander to disrupt the enemy's command and control systems by means of electronic warfare. The Electronic Fighting Vehicle System (EFVS) is being developed for integration into a Bradley MLRS-type chassis. The crew of six is split between a cab and the enclosure. Ventiladed facepieces are required for the crew members operating in the cab. The enclosure requires overpressure with integrated macro-climate cooling. Detection and decontamination capabilities are required.

E. Combat Support. Many armored systems provide commanders

with support and sustainment capability.

1. Combat engineering and mine warfare vehicles support the survivability and mobility of forces, and deny the enemy movement into key areas of defense. The overall mission is also enhanced by sustainment from logistics support, maintenance, and recovery vehicles. NBC systems required are individual protection and ventilated facepieces.

a. Armored Engineering Vehicles: The M9 Armored Combat Earthmover (ACE) has a requirement for ventilated facepieces and decontamination equipment. The M728 Combat Engineer Vehicle (CEV) also has a requirement for ventilated facepiece and decontamination equipment. The ACE, and CEV are CARC painted.

b. Armored Recovery Vehicles: The M88 (medium) and M578 (light) recovery vehicle crews are required to operate their respective armored systems wearing IPE. In addition, these vehicles have detection and decontamination capability requirements. The M88A1E1 requires ventilated facepiece, detection and decontamination capabilities.

c. Armored Vehicle Launched Bridges (AVLB): The M60A1 AVLB is based on a converted M60A2 chassis and has a requirement for ventilated facepiece and decontamination capability.

2. The Combat Mobility Vehicle (CMV), an ASM variant, will be mounted on the heavy protection level common component chassis and provide the combined arms team a capability to breach complex obstacles in stride. The CMV will replace the M728 CEV on a basis of two CMVs for each CEV. The CMV will have a two-man crew. The CMV integrates counter-mine and counter-obstacles capabilities into a single survivable vehicle that breaches complex obstacle systems and creates a lane for other vehicles to follow.

The operational employment concept remains open hatch and the NBC requirements include an overpressure system with ventilated facepieces (hybrid collective protection) and an advanced filtration technology which will reduce the logistical burden of replacing NBC filters. The CMV is also required to have an integrated micro-climate cooling system. An integrated NBC detection system is required which will be capable of interior and exterior monitoring for chemical and biological agents. Stand-off detection capability is required from 10 meters to at least one kilometer. A decontamination capability is required. Compliance with AR 70-71, NBC contamination survivability and incorporation of Chemical Agent Resistant Coating (CARC) is required for all painted surfaces.

3. The NBC reconnaissance vehicles, XM93 and XM93E1, are variants of the German FUCHS vehicle. The XM93 requires overpressure collective protection and macro-climate cooling. In addition, the XM93 has requirements for an M8A1 Chemical Agent Alarm, Chemical Agent Monitor (CAM), AN/VDR-2 radiation detector and an MM-1 mass spectrometer for agent vapor and liquid detection. The XM93E1 has added a requirement for ventilated facepiece system to make the collective protection a hybrid system. Micro-climate cooling for the crew is also a requirement. In addition to the XM93 suite of detectors, the XM-21 Remote Sensing Chemical Agent Alarm (RSCAP) will be added to the XM93E1 for a stand-off agent detection capability. Both vehicles have requirements for a decontamination capability and will be CARC painted.

III. PLANS TO MEET NBC REQUIREMENTS.

The current plans of the Army to meet the NBC requirements in Section II are described herein, consistent with the NBC protection definitions and the relationship to Army combat operations. These plans constitute an acquisition strategy to improve fielded armored system capabilities with enhanced NBC protection equipment integrated into the designs.

The current status for specific armored systems reflects tradeoffs that were exercised between cost, schedule, and NBC protection technology availability to meet operational and performance requirements of the user. The Army continues to review armored systems that presently do not meet new NBC Protection requirements (i.e. not painted with chemical agent resistant coating (CARC), and upgrade system capabilities within budget constraints and operational requirements. The following summaries are organized by battlefield functional area, as were requirements in Section II. Additional details for each armored system addressed in this report are available in Appendix B.

A. Close Combat Heavy/Light - Close Combat doctrine expresses the need for armored systems to operate in the presence of NBC contaminated environments in open hatch or open crew configurations, depending on the operations doctrine and situation. The overall strategy of this mission area is to continue fielding the Abrams tank, Bradley Fighting Vehicle, and the Tube-launched Optically-tracked, Wire-guided (TOW) antitank missile into the early 90's while product improving these systems toward advanced mobility, survivability, lethality, and supportability. During the same period, product improvements will be pursued for associated and fielded systems. To meet the threat of the early twenty-first century, the mission area strategy supports concept definition, research, and development in support of the Armored Systems Modernization (ASM).

1. While the M60 tank Required Operational Capability (ROC) had no NBC protection requirements, the A1 and A3 variants were upgraded to include a ventilated facepiece, CARC paint, and decontamination capability. The M1A1 tank represents the first of the preplanned block improvements in the Abrams tank program. In addition to the integration of the 120mm gun and improved armor, a hybrid NBC protection system with micro-climate cooling was added. The Block II M1A2 will also include this NBC protection suite. All M1 variants have a detection and decontamination capability. The M60A3 tank was phased out of the mission area by the M1 tank, which is being replaced by the improved M1A1.

2. The M113 Armored Personnel Carrier was introduced in 1960 to replace the aging M59. The crews of the M113 family of vehicles operate in individual protection equipment. Mounting provisions for detection and decontamination equipment are

available and the M113s are CARC painted.

3. The Bradley Infantry and Cavalry Fighting Vehicle fielded systems have progressed from individual protection only (M2A0/M3A0) to ventilated facepieces (A1s/A2s) with mounting provisions for detection and decontamination capability. The Mission Needs Statement for the M2/M3 required ventilated facepieces on all Bradley IFV/CFVs. Ventilating facepieces were introduced in the M2A1/M3A1 fighting vehicles and continued in the A2 variants. The M2A0 and M3A0 have not been upgraded with a ventilated facepiece system due to other program needs. However, the vehicle crews can satisfactorily complete their combat mission while wearing MOPP4 protective ensembles. The A1/A2 versions of the Bradley are CARC painted.

4. The Improved TOW Vehicle (ITV) will be replaced by the Line of Sight Anti-Tank (LOSAT) system which integrates the launcher onto a modified Bradley (M270 MLRS) chassis. LOSAT will integrate overpressure, ventilated facepiece and micro-climate cooling systems. Both the ITV and LOSAT are CARC painted.

5. The Sheridan has been in the Army inventory for over twenty-five years. Although the Sheridan's requirements document did not require collective protection, the M551A1 version of the Sheridan incorporated a ventilated facepiece system and provided a decontamination capability for operations in an NBC contaminated environment. The Sheridan is CARC painted.

6. The Armored Systems Modernization (ASM) program represents the future part of the Army plans for acquisition of armored systems. When ASM begins fielding, it will enhance armored battlefield operations and ultimately will replace all current armored systems platforms. In the heavy protection level common chassis portion of ASM, the baseline chassis variants for the Block III tank and the Future Infantry Fighting Vehicle (FIFV) are being developed to support CCH/L missions. LOSAT is on an ASM medium protection level Bradley chassis.

The ASM common chassis is integrating an advanced NBC collective protection overpressure system using an auxiliary power unit/environmental control unit (APU/ECU) integrated with a ventilated facepiece micro-climate cooling system and advanced NBC filters. Detection capability will include the XM22 Automatic Chemical Agent Detection Alarm (ACADA), a sample transfer system, and AN/VDR-2 Radiac Meter. The detection system will provide an inside/outside monitoring capability and will be integrated so that NBC warnings are automatically sent over the commander's communications network. Biological and standoff chemical detection capabilities are also to be integrated into the ASM family. The M13 Decontamination Apparatus, Portable (DAP) is used for decontamination, and the vehicles will be CARC painted. ASM's materiel survivability program offers the first opportunity for a

generation of armored systems to be designed for hardness, decontaminability, and compatibility from the onset.

The Armored Gun System is being developed under the supervision of PEO ASM. The AGS is an NDI effort that will be fielded in FY97 to provide a modern, light tank capability for contingency and reinforcing force missions. The AGS will have a ventilated facepiece system, will be CARC painted and will have an on-board decontamination capability. The AGS will not have the full complement of NBC protection and detection capabilities as is planned for the other ASM variants due to the AGS's stringent weight restrictions required for airborne unit deployment.

B. Fire Support - The fire support mission includes those efforts directly related to the generation and application of long range indirect fires and counterfires which support the close combat/maneuver forces and add depth to the battlefield. Close support fires are provided by cannon artillery howitzers and mortars, and supported by ammunition carriers. Counterfire is provided by the Multiple Launch Rocket System (MLRS) and also the 8 inch M110A2 cannon units. Deep fires are the responsibility of the MLRS variant missiles.

The armored systems acquisition strategy for fire support addresses the combat tasks of coordination (FISTV), close support Self-Propelled Howitzers (SPH) (M109 Series, FAASV, AFAS, FARV-A), and counterfire (MLRS, M110A2).

1. The M981 Fire Support Team Vehicle (FISTV) is an M113 derivative. It will be phased out of the inventory in favor of a BFVS chassis derivative, to be followed by an ASM variant. The current desired operational battlefield mix for fire support is to have the M1/M60/M113 force supported by the M981; the M1/M2 force supported by the BFVS derivative; and ultimately, the Advanced Fire Support Vehicle (ADV FSV) supporting the Armored Systems Modernization (ASM) force.

The NBC protection system for the M981 includes a ventilated facepiece for the vehicle crew, detection, and portable decontamination apparatus. The BFVS and ASM derivatives will offer the NBC protection systems of the M2A2/M3A2 and ASM common chassis, respectively, as a baseline.

2. The indirect fire support weapon for heavy forces is the M109A2/A3 155mm self-propelled howitzer (SPH). Block improvements have increased range and reliability. The M109A6 (Paladin) system represents the current version of the Howitzer Improvement Program (HIP) and includes a complete suite of NBC protection. The Paladin is an open system but has incorporated a ventilated facepiece and micro-climate cooling to relieve crew stress under the heavy workload conditions. Provisions have been made to mount an M13 Decontamination Apparatus. The vehicle is

painted with CARC paint.

Fielding of the ASM AFAS will initiate a phasing out of the M109 series howitzers, and will afford the common chassis NBC protection suite including overpressure, ventilated facepiece with micro-cooling. Decontamination capability and automatic detection and warning are also planned.

The self-propelled systems require accompanying ammunition carriers on the battlefield. The M548 ammunition carrier and the M992 FAASV will support the M109A2/A3, the modified M992 FAASV will support the M109A6 Paladin, and the ASM FARV-A will support AFAS. The M548, an M113 variant, has a decontamination capability. The crew operates in MOPP ensemble. The FAASV operates with frequent crew ingress/egress and offers a ventilated facepiece. It is compatible with crew operations in MOPP and also has detection and decontamination capability.

3. The principal counterfire weapons platforms in the Army are the M110A2 8 inch SPH and the M270 MLRS. The M110 SPH is an open vehicle designed in the 1950s. The crew members operate in MOPP. The M270 is a Bradley Fighting Vehicle derivative and has an overpressure system for both NBC and rocket fume protection and a ventilated facepiece for crew NBC protection. The MLRS also has detection capability and is CARC painted.

C. Air Defense - Air defense platforms kill or nullify enemy air threats and protect C³I nodes and the maneuver forces. The materiel acquisition strategy addresses Forward Area Air Defense (FAAD) and Short Range Air Defense (SHORAD) systems. In the armored systems context for this report, only the FAAD Line of Sight-Forward-Heavy (LOS-F-H) Air Defense Anti-Tank System (ADATS) and SHORAD Vulcan and Chaparral are addressed.

1. The objective LOS-F-H system will enter the inventory on a modified Bradley chassis (M1069) using the ADATS and will be integrated onto an ASM variant during a Block II upgrade. LOS-F-H employs a hybrid collective protection systems and micro-climatic cooling system. Detection and decontamination capabilities will be provided.

2. The M730A2 Chaparral has a canvas top which is removed to fire missiles. The NBC protection provided includes a ventilated facepiece within this M113 variant for the gunner assigned position and five positions located within the cab. The crew must egress to operate the carrier in MOPP4 for mission execution. A decontamination capability is also provided.

3. The Vulcan Air Defense System is an open crew system operated by crew in MOPP. The Vulcan system has an M13 Decontamination Apparatus.

D. Intelligence and Electronic Warfare - The Electronic Fighting Vehicle System (EFVS) is a component of both the Ground Based Common Sensor (GBCS) - Heavy and the Joint Surveillance Target Attack Radar System (J-STARS) programs. The enclosure which houses the IEW electronics is mounted on a Bradley Fighting Vehicle chassis. The electronic enclosure is equipped with an overpressure and environmental control system which allows the EFVS crew to operate in an NBC contaminated environment in a reduced individual protective posture. Crew members operating in the cab of the vehicle are provided with ventilated facepieces for NBC protection. The EFVS will have detection and decontamination capabilities. The system will be CARC painted.

E. Combat Mobility and Support - Many armored systems provide commanders with support and sustainment capability to conduct mobility, countermobility, combat sustainment, engineering, and topographic engineering operations within the deep, close, and rear operations. Current mobility will be improved by the introduction of the Combat Mobility Vehicle (CMV) ASM variant of the common chassis. The NBC Reconnaissance System (XM93 and XM93E1) will have the capability to detect NBC contamination locally and remotely through a variety of sensors. All of these systems operate under the doctrine of detecting NBC contamination and avoiding wherever possible.

1. Construction and Engineering Vehicles include the M9 Armored Combat Earthmover (ACE) and the M728 Combat Engineer Vehicle (CEV). The M728 CEV is equipped with a ventilated facepiece and decontamination equipment. The ACE also has a ventilated facepiece, micro-climatic cooling and decontamination capability. Both ACE and CEV are CARC painted.

2. Recovery vehicles include the M88 medium recovery vehicle and the M578 light recovery vehicle. The M578 was fielded in the 1960s and is equipped with ventilated facepiece and decontamination equipment. It is also CARC painted. The M88A1 replaced the M88 gasoline vehicle and is equipped with a ventilated facepiece and decontamination capability. Both are CARC painted.

3. The M60A1 AVLB is converted from a M60A2 CARC painted chassis and uses a ventilated facepiece. Decontamination equipment is aboard.

4. NBC Reconnaissance Vehicles: The XM93 and XM93E1 are variants of the German FUCHS vehicle. The XM93 is equipped with overpressure collective protection and macro-climate cooling systems. In addition, the XM93 has an M8A1 Chemical Agent Alarm, Chemical Agent Monitor (CAM), AN/VDR-2 radiation detector and an MM-1 mass spectrometer for agent vapor and liquid detection. The XM93E1 will add a ventilated facepiece system to make the collective protection a hybrid system. Micro-climate cooling for the crew will also be added. In addition to the XM93 suite of

detectors, the XM-21 Remote Sensing Chemical Agent Alarm will be added to the XM93E1 for a stand-off agent detection capability. The XM93E1 will have a remote chemical alarm system. Both vehicles will be equipped with decontamination equipment and will be CARC painted.

IV. SUMMARY AND CONCLUSIONS

A. Summary:

Armor NBC protection requirements are driven by the operational need to fight in any potential battlefield environment. These NBC requirements are embodied in protection, detection, decontamination and NBC contamination survivability. The Army constantly reviews requirements to respond to changing threats, evolving doctrine, and available technology.

Table 1 summarizes the requirements and armor program status of NBC protective systems. A brief explanation of the information contained in the table can be found on the table's facing page.

In summary, the current Army armored systems are able to fight on the NBC contaminated battlefield. The Army recognized the importance of NBC contamination survivability of equipment through the publication of AR 70-71 in 1984, requiring NBC contamination survivability of all mission essential materiel. Although most of the systems surveyed in this report predate this AR, the need for and the feasibility of achieving NBC contamination survivability is the subject of an ongoing Army effort. In the future, the ASM variants will enhance battlefield operations with improved NBC defense capabilities for the armored forces. Sustained mission effectiveness and materiel survivability with reduced logistical and maintenance burden are the major combat attributes of ASM's NBC defense capabilities for armored systems in AirLand Operations.

B. Conclusions:

This review shows the Army armor concept of battle and the integrated nature of the NBC systems to address this threat. Operational requirements are being satisfied. Armored systems have been and continue to be upgraded to enhance mission sustainment and effectiveness in the NBC environment. The armored systems modernization program represents the Army's future plans for the acquisition of armored platforms. As envisioned, the ASM common chassis and combat variants are moving toward reduced individual vulnerability and, therefore, closed compartment concepts. Hardware and technologies, including materiel survivability, to support these demanding future requirements are being aggressively developed.

EXPLANATION OF TABLE 1 COLUMN HEADERS AND ENTRIES

ARMORED SYSTEM

- Short form of Vehicle Nomenclature

PROGRAM

- Reqt Date : Mo/Da/Yr of Requirements Document
 - LC Phase : Life Cycle Phase (DEvelopment, DEpployment, PROduction, PROduction/DEployment, Low Rate Initial Production, Pre-planned Product Improvement)

ESSENTIAL REQUIREMENTS - Those Items Identified in the System's Requirement Document as "Must Have" by the User

- Protection: Individual Protection (IP) is Provided to all Armored Force Personnel
 • VFP : Ventilated Facepiece (Filtered Air Provided to a Respirator)
 • OP : Over Pressure (Filtered Air Provided to an Enclosure)
 • HYB : VFP and OP Applied Together

- Cooling : Micro-climate (Individual) Cooling (uC);
 Macro-climate (Compartment) Cooling

DETECTORS AND DECONTAMINATION

- RQD : User Requirement
 - ON VEH : Mounted Location/Hookup Identified

SMOKE

- RQD : User Requirement
 - ON VEH : Mounted Location/Hookup Identified

OTHER

- AR 70-71 RQD : Was AR 70-71 in effect at the time the requirements document was written?
 - CARC Painted : Does the Vehicle have Chemical Agent Resistant Coating?

APPENDIX A

NBC TERMS AND ARMORED OPERATIONAL CONCEPTS

I. INTRODUCTION

This appendix provides a description of NBC terms and concepts and how armored systems employ NBC protective measures to meet operational needs. It also provides the rationale for why specific NBC protective measures are incorporated into particular armored systems.

II. NBC TERMS AND EMPLOYMENT CONCEPTS

The elements of the NBC protective system are embodied in protection, detection, decontamination, and smoke. Protection of the individual is paramount.

For open systems, the crew protection requirements are a combination of individual protective equipment (IPE) which includes masks (individual or forced air respirators - ventilated facepiece), hoods, battledress overgarments, boots and gloves. Environmental control systems are an option for reducing the risk of heat stress casualties. For closed systems, individual protection can be accomplished by utilizing the IPE system approach for the open armored systems or by utilizing filtered air to overpressurize the entire crew compartment. This overpressure approach reduces dependence on IPE permitting "shirt sleeve" operations, but requires tight controls on the vehicle air leakage areas. Ventilating facepiece respirators may also be combined with this capability.

Detectors are required for warning and identification of agent attack and to permit the prompt use of protective equipment. Detectors are also used to alert vehicle crews of probable areas of NBC contamination thus allowing the soldiers the option of performing evasive maneuvers. In addition, detectors are used to minimize the adverse operational effects of prolonged use of protective equipment by indicating when the threat is no longer present.

Mission essential decontamination equipment is available on the battlefield at the individual and system level for basic soldier and hasty decontamination procedures. Deliberate decontamination is performed as far forward as possible by Army Chemical Corps assets.

A. Protection

Individual protective equipment (IPE) is the set of equipment issued to every soldier that provides protection to allow soldiers

to complete their mission on an NBC contaminated battlefield. IPE generally consists of a protective mask, hood, chemical protective overgarment (green chemical protective overgarment - CPOG or camouflaged Battle Dress overgarment - BDO) and protective boots and gloves. The wearing of IPE is directed by the unit commander and the combat doctrine provides the guidelines for the system referred to as Mission Oriented Protective Posture (MOPP). A designated MOPP level dictates what and how IPE items are worn and is dependent upon the chemical threat. All soldiers are trained to be proficient in the protective measures that must be taken before, during, and after an NBC attack. Wearing individual protective equipment causes physiological and psychological stress on the soldier. These stresses are exacerbated by operations at high work rates or elevated temperatures. In an effort to balance protection with the threat, temperature, and urgency of mission, MOPP levels are adjusted by the unit commander. As the potential for encountering contamination increases, the posture level increases from the basic MOPP Zero through four levels:

- **MOPP0:** BDO, boots, gloves available; mask/hood carried
- **MOPP1:** BDO worn; boots, mask/hood, gloves carried
- **MOPP2:** BDO, boots worn; mask/hood, gloves carried
- **MOPP3:** BDO, boots, mask/hood worn; gloves carried
- **MOPP4:** BDO, boots, mask/hood, gloves worn

In very hot weather, the BDO jacket and hood can be left open for ventilation for MOPP levels 1, 2, and 3.

Collective protection provides varying types of contamination-free working environments for selected personnel, and it can allow soldiers relief from continuous wear of MOPP gear. The effects of wearing MOPP gear for extended periods and the enemy's ability to employ NBC weapons anywhere on the battlefield dictate that collective protection be planned and used where feasible.

There are three basic types of collective protection equipment (CPE) approaches considered for armored vehicles - ventilated facepiece, overpressure, and hybrid. These can be supplemented with a cooling system to reduce heat stress on crew members.

In the ventilated facepiece (VFP) system, a gas-particulate filter unit (GPFU) supplies filtered, pressurized air through hoses to individual facepieces (masks). The GPFU is an electrically powered blower with replaceable air filter elements. It reduces breathing resistance through masks, and it aids in sweat evaporation. In addition, it can provide warm air to facepieces in cold weather. This system is useful for crew members in a vehicle which is continuously open. Although the individual soldier is exposed to the NBC environment, he can use the centralized GPFU attached to the vehicle as protection. The VFP system also lengthens the usage time for the protective mask filter, since the

mask filter is not exposed to chemical agents while connected to the VFP system.

An overpressure system is an enclosure of pressurized, purified air. Gas-particulate filters remove any NBC contamination from the air. The positive air pressure inside the vehicle precludes leakage of contaminated air into the enclosure. This system is only useful in vehicles that are continuously closed and the individual is not directly exposed to NBC contamination.

Overpressure and ventilated-facepiece systems combine into a hybrid system which possesses the advantages of both its subsystems. In this system, the gas-particulate filter unit can pressurize the closed vehicle and/or provide filtered air directly to crew masks. The vehicle crew can activate the ventilated facepiece system as needed, such as when the tactical situation requires open hatches or when the interior becomes contaminated. During open-hatch operations, the positive pressure reduces the amount of vapor contamination that enters. If contamination enters, the system helps purge the interior of toxic vapors.

Macro-climate and micro-climate cooling systems provide a means to reduce the heat stress on crew members caused by wearing MOPP gear in warm or high temperature environments. Macro-cooling systems condition the air around the soldier inside a crew compartment. This approach is also useful in cooling electronic equipment inside a compartment. This approach is only practical on closed systems and is compatible with overpressure-type collective protection systems. Micro-cooling systems cool a small portion of the environment around the soldier. Typically, this involves pumping a cool liquid or cool air through a vest worn by the soldier, absorbing body heat, and cooling the individual. Micro-cooling systems are appropriate for open systems and require less power and space on the vehicle.

As previously discussed, armored systems adopt an available type of NBC protection concept that is compatible with the vehicle configuration (open or closed) and its operational employment concept. Table A-1 depicts how a protection system supports a vehicle configuration and gives examples of armored vehicles that are fielded, or soon to be fielded, that reflect this match-up.

B. Detection

Detection devices have three basic functions in relation to armored systems: first, they are used to detect and identify NBC attacks or contaminated areas; second, they produce an audible/visual alarm, and third, they are used to determine the extent of remaining contamination after a decontamination operation. Chemical agent detection and warning allows combat units to

TABLE A-1. OPERATIONAL SYSTEMS CONCEPTS

TYPES OF PROTECTION AVAILABLE	CS/SC	OS/SC	OS/MC	OS/P	EXAMPLES
Overpressure (OP)	X				Vans and Shelters
Ventilated facepiece (VFP)		X			FISTV, Cbt Engr Veh, Recvry Veh
Hybrid (OP + VFP)	X	X			M1A1 Tank, M1A2 Tank, Fox NBC Veh
Individual Protective Equipment Only			X	X	M113A2 APC M110A2 SPH, M106 Mrtr Cr
Macro-Cooling	X				Fox NBC Vehicle
Micro-Cooling	X	X			M1A1 Tank, M1A2 Tank, M109A6 How

Definitions for the chart above

CS - Closed System: Hull/turret/body closed and relatively air tight.

OS - Open System: Hull/turret/body hatches or ramps open, or system not designed to be enclosed.

SC - Static Crew: Crew on board the system with fixed fighting/operating positions to control elements of the overall system (e.g., tank drivers, gunners and loaders).

MC - Mobile Crew: Crew on board the system without fixed travelling/operating positions relative to fighting positions (e.g., M577 Command Post Vehicle, M106A1 Mortar Carrier M109A2/A3 155mm Howitzer and M730A1/A2 Chaparral crews).

P - Passengers: Infantry squad in an armored personnel carrier

determine the required protective measures and to develop operational plans to mitigate the NBC threat. To minimize the adverse effects of protective measures, chemical detection, identification and warning can be used to avoid contaminated areas and, if avoidance is not possible, to determine the type of agent and extent of contamination so that protective gear and the collective protection systems are properly employed. After exposure to NBC contamination, detectors and monitors are used to indicate the scope of contamination on equipment and, after decontamination, the effectiveness of the decontamination operation. Detection and warning are achieved through periodic and continuous monitoring using various techniques. Detection is achieved through point detection, standoff detection, and automatic warning and reporting. Point detection is the detection of contaminants at the local position. Standoff detection is the detection of contaminants at a distance (one to five kilometers) from the local position. Automatic warning and report systems are set to automatically give a warning when a contaminant is encountered and to report the hazard automatically to adjacent and command/control units. Provisions for carrying or mounting this equipment is usually specified in the vehicle requirements documents. The M8A1 Chemical Agent Alarm and the Chemical Agent Monitor (CAM) are available for this use. In the field, the unit commander decides which vehicle(s) will mount the unit's alarm systems.

C. Decontamination

Decontamination is the removal of the contamination hazards on personnel and materiel. The levels of decontamination, in increasing order of complexity, are: basic soldier skills, hasty, and deliberate decontamination operations. Each progressive level requires an increase in time and effort, but offers increased degrees of contaminant removal. Basic soldier skills include skin decontamination (removal of contaminants from skin), personal wipedown (wipe off of contaminants from hood, mask, weapons, and gloves), and operator's spraydown (spraying of control surfaces that the soldier is likely to come into contact with). Operator spraydown is performed with a decontamination apparatus carried on board the vehicle. Provisions for carrying this equipment are usually specified in the vehicle's requirements document. The ABC M11 Decontaminating Apparatus or the M13 Decontaminating Apparatus, Portable (DAP) is available for this use and are supplied by the using unit. All soldiers learn the basic skills to decontaminate themselves and their handheld equipment. The next higher order of decontamination, hasty decontamination, is designed to provide soldiers a method to quickly remove gross contamination from their equipment while still proceeding with their mission. Hasty decontamination consists of exchanging the individual soldier's contaminated MOPP gear with clean MCPP gear, wiping down and brushing the soldier's

mask, hood and individual gear with decontaminants and washing down vehicles with power-driven decontamination equipment. Deliberate decontamination thoroughly removes contamination down to insignificant levels. Specially trained troops, usually a chemical unit located to the rear of the battlefield, support the deliberate decontamination operations.

D. Smoke

Smoke by itself is not lethal. However, it can be used to degrade the enemy's ability to acquire information on friendly units. This technique can be used to obscure the visual, infrared, and millimeter wave systems of the enemy. Defensive smoke capability is specified for selected vehicles. This capability is provided by on-board grenade launching systems and vehicle exhaust systems. Mechanical generators are placed on dedicated vehicles for the purpose of producing smoke to cover a large area.

E. NBC Contamination Survivability

NBC contamination survivability is the capability of a system and its crew to withstand an NBC-contaminated environment, including decontamination without losing the ability to accomplish the assigned mission. Characteristics of NBC contamination survivability are as follows:

a. **Hardness.** Capability of withstanding the materiel damaging effects of NBC contamination and the procedures and agents required to decontaminate the item.

b. **Compatibility.** Capability of being operated, maintained, and resupplied by persons wearing the full NBC protective ensemble, in all climatic categories for which the item is designed and for a period specified in the requirements document. Collective protection equipment (CPE) does not provide compatibility. However, for some systems the combat developer may elect to substitute CPE for compatibility. In doing so, he accepts the possibility of crew degradation if contamination enters the CPE and the crew is forced to don the individual protective ensemble.

c. **Decontaminability.** Capability of being rapidly decontaminated to reduce the hazard to a negligible level for unprotected persons who operate, maintain, and resupply the materiel (equipment). Decontaminability and hardness are distinct qualities. Decontaminability standards concern the residual hazards to personnel; hardness standards concern damage to materiel.

APPENDIX B

This appendix contains detailed individual summaries of the current NBC requirements and plans for each of the armored systems addressed in this report. The individual data sheets are collected into the following system categories:

- SUBAPPENDIX 1: M1 COMBAT TANK SYSTEMS
- SUBAPPENDIX 2: BRADLEY FIGHTING VEHICLE SYSTEM
- SUBAPPENDIX 3: M113 FAMILY VARIANTS
- SUBAPPENDIX 4: M60 MAIN BATTLE TANKS
- SUBAPPENDIX 5: ARMORED ARTILLERY VEHICLES
- SUBAPPENDIX 6: OTHER COMBAT SUPPORT VEHICLES
- SUBAPPENDIX 7: ASM COMMON CHASSIS

SUB-APPENDIX 1

M1 Abrams Main Battle Tank

Description:

The M1 Abrams Main Battle Tank is designed to close with and destroy enemy forces on the integrated battlefield using firepower, maneuver, and shock effect. Currently being fielded is the M1A1 Tank which has improved armor and a 120 mm smoothbore gun. The M1A2, currently under development, will have improved lethality, survivability, and fightability that is required to defeat the threat of the 1990s.

Battlefield Functional Area Variants:

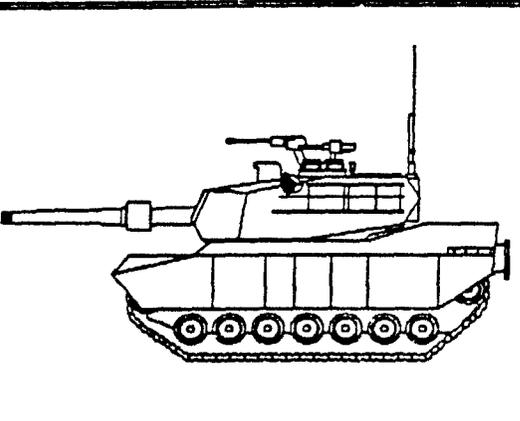
Close Combat Heavy/Light

M1 Abrams Tank
M1IP Abrams Tank
M1A1 Abrams Main Battle Tank
M1A2 Abrams Main Battle Tank

NBC Overview:

The M1A1 tank represents the first of the preplanned block improvements in the Abrams tank program. In addition to the integration of the 120mm gun and improved armor, an integrated NBC filtration system with environmental control (i.e. heating/cooling) which supplies air to the crew for breathing/heat stress relief and for vehicle overpressure. The Block II M1A2 will also include this NBC protection suite. The M60A3 tank was phased out of the mission area by the M1 tank, which is being replaced by the improved M1A1.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M1 Abrams Main Battle Tank (MBT)	
RESPONSIBLE PEO/FM: SFAE-ASM-AB/COL Caldwell	
TRADOC POC: TSM-AGS (ATZK-TF)/COL Colgan	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M1 Main Battle Tank (MBT) is used as the principal weapon of the tank battalions of the Army in the field during all types of combat operations, conducted under any condition from low intensity to general nuclear and non-nuclear situations. As part of an offensive force, the MBT is employed as the decisive element of the combined arms team, defeating the enemy force by fire and maneuver. In defensive operations the M1 is employed as part of a combined arms team to repulse enemy attacks by destroying his assault elements. There is an unfunded proposal to upgrade all M1 MBTs to M1A2 versions.

OPERATIONAL EMPLOYMENT CONCEPTS:

Situation dependent consideration must be given to mission, enemy, terrain, troops, and time available (METT-T). Tank commanders prefer "open hatch" or open system operations to be able to perceive the battlefield and provide visual contact and signals between task force elements. Occasionally, such as when under direct fire, "buttoned-up" or closed system posture is required to fight through the area.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The M1 has a ventilated facepiece system. Also it will provide for stowage of the most current chemical agent detection kit, M11 Decontamination Apparatus, and automatic chemical agent alarm system. The M1 has a dual smoke capability utilizing both an integral exhaust smoke generator and a smoke grenade launcher.

VEHICLE SUMMARY SHEET (Continued)

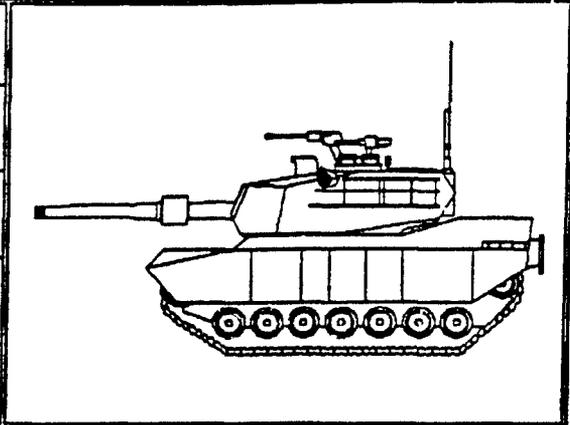
NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Ventilated Facepiece.
DETECTION	Systems Capability	M&A1 Chemical Agent Alarm.
DECONTAMINATION	Capability	ABC-M11 Decontamination Apparatus.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Pre AR 70-71.
	Decontaminability	Pre AR 70-71.
SMOKE	Type	Grenades, Vehicle Exhaust.

SUMMARY REMARKS:

The M1 is fully capable of performing its combat mission in an NBC environment. The levels of protection for the crew allow them to continue their missions in an NBC environment.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M1IP Abrams Main Battle Tank (MBT)	
RESPONSIBLE PEO/PM: SFAE-ASM-AB/COL Caldwell	
TRADOC POC: TSM-AGS (ATZK-TF)/COL Colgan	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM.

The M1IP Main Battle Tank (MBT) is used as the principal weapon of the tank battalions of the Army in the field during all types of combat operations, conducted under any condition from low intensity to general nuclear and non-nuclear situations. As part of an offensive force, the M1IP is employed as the decisive element of the combined arms team, defeating the enemy force by fire and maneuver. In defensive operations the M1IP is employed as part of a combined arms team to repulse enemy attacks by destroying his assault elements.

OPERATIONAL EMPLOYMENT CONCEPTS:

Situation dependent consideration must be given to mission, enemy, terrain, troops, and time available (METT-T). Tank commanders prefer "open hatch" or open system operations to be able to perceive the battlefield and provide visual contact and signals between task force elements. Occasionally, such as when under direct fire, "buttoned-up" or closed system posture is required to fight through the area.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The M1IP has a ventilated facepiece system. Also it will provide for stowage of the most current chemical agent detection kit, M11 Decontamination Apparatus, and automatic chemical agent alarm system. The M1IP has a dual smoke capability utilizing both an integral exhaust smoke generator and a smoke grenade launcher.

VEHICLE SUMMARY SHEET (Continued)

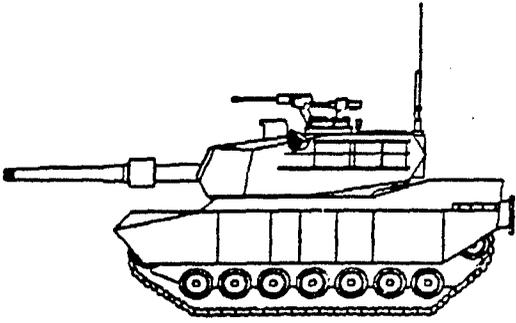
NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Ventilated Facepiece
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm.
DECONTAMINATION	Capability	ABC-M11 Decontamination Apparatus.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Pre AR 70-71.
	Decontaminability	Pre AR 70-71.
SMOKE	Type	Grenades, Vehicle exhaust.

SUMMARY REMARKS:

The M11P is fully capable of performing its combat mission in an NBC environment. The levels of protection for the crew allow them to continue their missions in an NBC environment.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M1A1 Abrams Main Battle Tank (MBT)	
RESPONSIBLE FEO/PM: SFAE-ASM-AB/COL Caldwell	
TRADOC POC: TSM-AGS (ATZK-TF)/COL Colgan	
ACQUISITION PHASE: Production	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM.

The M1A1 Main Battle Tank (MBT) is used as the principal weapon of the tank battalions of the Army in the field during all types of combat operations, conducted under any condition from low intensity to general nuclear and non-nuclear situations. As part of an offensive force, the MBT is employed as the decisive element of the combined arms team, defeating the enemy force by fire and maneuver. In defensive operations the MBT is employed as part of a combined arms team to repulse enemy attacks by destroying his assault elements.

OPERATIONAL EMPLOYMENT CONCEPTS:

Situation dependent consideration must be given to mission, enemy, terrain, troops, and time available (METT-T). Tank commanders prefer "open hatch" or open system operations to be able to perceive the battlefield and provide visual contact and signals between task force elements. Occasionally, such as when under direct fire, "buttoned-up" or closed system posture is required to fight through the area.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

A hybrid overpressure and ventilated facepiece system assures that the M1A1 is capable of preventing chemical agent ingress and crew compartment contamination allowing crew performance at reduced MOPP levels. The micro-climate cooling allows the crew to operate under high ambient temperatures for extended time. Incorporation of CARC paint improves vehicle decontaminability. Crew members must be able to successfully perform their mission in an NBC environment. The M1A1 provides for stowage of the current chemical agent detection kit, and automatic chemical agent alarm system. The M1A1 also has a dual smoke capability utilizing both an integral exhaust smoke generator and a smoke grenade launcher.

VEHICLE SUMMARY SHEET

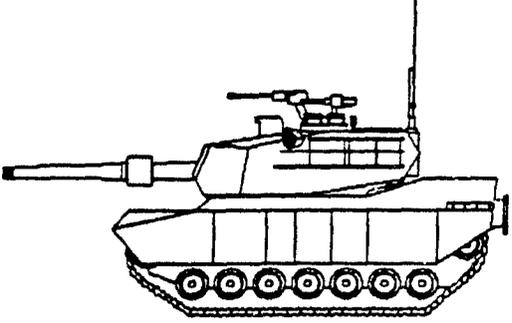
NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Hybrid with micro-climate cooling.
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm.
DECONTAMINATION	Capability	ABC-M11 Decontamination Apparatus.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Material/Component selected to resist agent/decontaminant.
	Compatibility	System designed and validated to be operable in MOPP gear.
	Decontaminability	CARC paint. Design considers ease of decontamination.
SMOKE	Type	Grenades, Vehicle Exhaust.

SUMMARY REMARKS:

The M1A1 is fully capable of performing its combat mission in an NBC environment.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M1A2 Abrams Main Battle Tank (MBT)	
RESPONSIBLE PEO/PM: SFAE-ASM-AB/COL Caldwell	
TRADOC POC: TSM-AGS (ATZK-TF)/COL Colgan	
ACQUISITION PHASE: Development	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M1A2 Main Battle Tank (MBT) will be used as the principal weapon of the tank battalions of the Army in the field during all types of combat operations, conducted under any condition from low intensity to general nuclear and non-nuclear situations. As part of an offensive force, the MBT is employed as the decisive element of the combined arms team, defeating the enemy force by fire and maneuver. In defensive operations the MBT is employed as part of a combined arms team to repulse enemy attacks by destroying his assault elements.

OPERATIONAL EMPLOYMENT CONCEPTS:

Situation dependent consideration must be given to mission, enemy, terrain, troops, and time available (METT-T). Tank commanders prefer "open hatch" or open system operations to be able to perceive the battlefield and provide visual contact and signals between task force elements. Occasionally, such as when under direct fire, "buttoned-up" or closed system posture is required to fight through the area.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The M1A2 NBC Protection System is the same as the M1A1's NBC System. A hybrid overpressure and ventilated facepiece system assures that the vehicle is capable of preventing chemical agent ingress and crew compartment contamination allowing crew performance at reduced MOPP levels. Micro-climate cooling allows the crew to operate under high ambient temperatures for extended time. Incorporation of CARC paint improves vehicle decontaminability. Crew members must be able to successfully perform their mission in an NBC environment. The M1A2 provides for stowage of the current chemical agent detection kit, and automatic chemical agent alarm system. The M1A2 will have a dual smoke capability utilizing both an integral exhaust smoke generator and a smoke grenade launcher.

VEHICLE SUMMARY SHEET

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Hybrid with micro-cooling.
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm.
DECONTAMINATION	Capability	ABC-M11 Decontamination Apparatus.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Material/Component selected to resist agent/decontaminant.
	Compatibility	System designed and validated to be operable in MOPP gear.
	Decontaminability	CARC paint. Design considers ease of decontamination.
SMOKE	Type	Grenades, Vehicle Exhaust.

SUMMARY REMARKS:

The M1A2 has not been through the Early User Test and Evaluation (EUTE) as of May 1, 1991.

SUB-APPENDIX 2

Bradley Fighting Vehicle Chassis

Description:

The BFVS, consisting of the M2 Infantry Fighting Vehicle and M3 Cavalry Fighting Vehicle, is designed to participate in mobile armored warfare. Both vehicles are supported by the same chassis which also supports the M270 Multiple Launch Rocket System (MLRS) and the Line of Sight-Forward-Heavy (LOS-F-H). The M2A0 and M3A0 have 25mm automatic cannons and vehicle mounted TOW systems. The M2A0 and M2A1 have firing ports which allow onboard personnel to destroy enemy forces without the need to dismount. In addition to the three man crews, the M2 vehicle carries a six man infantry squad, and the M3 vehicle carries a two man reconnaissance squad. The speed and mobility of these vehicles make it compatible with the M1 series Abrams Tank. The "A1" configurations incorporated several improvements including TOW-2 and vehicle restowage. The "A2" configurations incorporate a high survivability and restowage package and as a result, the horsepower was increased to accommodate the increased weight. The A1 and A2 variants also integrated NBC protection. The MLRS is a free flight artillery rocket system that greatly improves the conventional, indirect-fire capability of the field Army. The LOS-F-H provides low level air defense for heavy maneuver forces against attack by rotary and fixed wing aircraft.

Battlefield Functional Area Variants:

Close Combat Heavy/Light

M2 Series (IFV)	M3 Series (CFV)
M2	M3
M2A1	M3A1
M2A2	M3A2

Fire Support

M270 Multiple Launch Rocket System (MLRS)

Air Defense

Line of Sight-Forward Heavy (LOS-F-H)

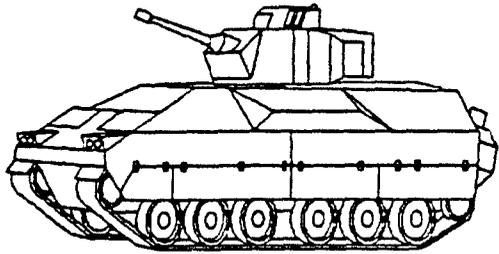
Combat Mobility and Support

Electronic Fighting Vehicle System (EFVS)

NBC Overview:

The M2A1, M2A2, M3A1, M3A2 Bradleys have ventilated facepiece systems for the commander, gunner, and driver consisting of M13 gas particulate filter unit which feeds air to the crew's M25A1 gas masks. They also stow M8A1 Chemical Agent Alarm, MOPP gear, and ABC-M11 decontamination apparatus. The dismounted infantrymen have their own suits and masks which allow them to leave the vehicle quickly. Two M257 smoke dischargers are mounted on the M2 and M3 vehicles and the engines are fitted with a vehicle exhaust smoke-generating system. The A1 and A2 versions of the IFV and CFV, and MLRS are CARC painted. The Electronic Fighting Vehicle System (EFVS) crew of six is split between a cab and the EFVS enclosure. The crew have ventilated facepieces. The enclosure incorporates an overpressure system with an integrated environmental control unit.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M2 Bradley Infantry Fighting Vehicle	
RESPONSIBLE PEO/PM: SFAE-ASM-BV/Gary Chamberlain	
TRADOC POC: ATSH-TSM-FVS/MAJ Helmer	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M2 provides the mechanized infantry with a full-tracked, lightly armored fighting vehicle. The M2 is employed on the battlefield with the Main Battle Tank to close on enemy forces to destroy them, either by mounted or dismounted means, and reach and clear the objective.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M2 is designed to fight buttoned-up or open hatch as necessary. Depending on the situation, bypassing contaminated areas is the most desirable but the vehicle must be capable of fighting through NBC contaminated areas.

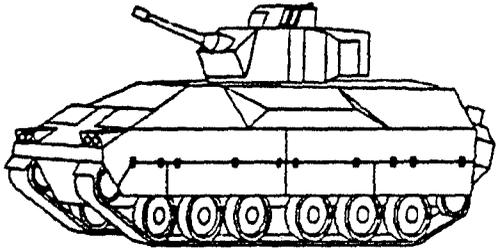
NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

Schedule and funding constraints precluded including the ventilated facepiece system requested by the user. Although possibilities and feasibility of upgrading through to the A2 configuration are being explored, there is currently no firm approval or funding in place to convert or upgrade A0 vehicles. The existing vehicle is capable of being operated in MOPP4 NBC protection ensembles.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	Yes.
	Collective	None.
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm.
DECONTAMINATION	Capability	ABC-M11 Decontamination Apparatus.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71
	Competibility	System is pre AR 70-71 validated to operate in MOPP gear.
	Decontaminability	Pre AR 70-71
SMOKE	Type	Grenades, Vehicle exhaust.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M2A1 Bradley Infantry Fighting Vehicle	
RESPONSIBLE PEO/PM: SFAE-ASM-BV/Gary Chamberlain	
TRADOC POC: ATSH-TSM-FVS/MAJ Helmer	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: M2A1s Being Converted to M2A2s by April 1997	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M2A1 provides the mechanized infantry with a full-tracked, lightly armored fighting vehicle. The M2A1 is employed on the battlefield with the Main Battle Tank to close on enemy forces to destroy them, either by mounted or dismounted means, and reach and clear the objective.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M2A1 is designed to fight buttoned-up or open hatch as necessary. Depending on the situation, bypassing contaminated areas is the most desirable but the vehicle must be capable of fighting through NBC contaminated areas.

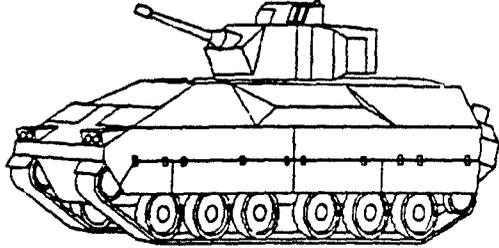
NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The Bradley Infantry and Cavalry Fighting Vehicle (IFV/CFV) fielded systems have progressed from individual protection only to ventilated facepieces with mounting provisions for detection and decontamination capability. A materiel change is being considered to require an overpressure system for all variants of the M2 and M3. No plan exists to implement this requirement. The M2A1 has storage capability for the M8A1 Chemical Agent Alarm, along with an ABC-M11 decontamination unit.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	Yes, for dismounted squad.
	Collective	Ventilated Facepieces for crew only.
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm.
DECONTAMINATION	Capability	ABC-M11 Decontamination Apparatus.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	System is pre AR 70-71 validated to operate in MOPP gear.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	Grenades. Vehicle exhaust.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M2A2 Bradley Infantry Fighting Vehicle	
RESPONSIBLE PEO/PM: SFAE-ASM-BV/Gary Chamberlain	
TRADOC POC: ATSH-TSM-FVS/MAJ Helmer	
ACQUISITION PHASE: Production/Deployment	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M2A2 provides the mechanized infantry with a full-tracked, lightly armored fighting vehicle. The M2A2 is employed on the battlefield with the Main Battle Tank to close on enemy forces to destroy them, either by mounted or dismounted means, and reach and clear the objective.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M2A2 is designed to fight buttoned-up or open hatch as necessary. Depending on the situation, bypassing contaminated areas is the most desirable but the vehicle must be capable of fighting through NBC contaminated areas.

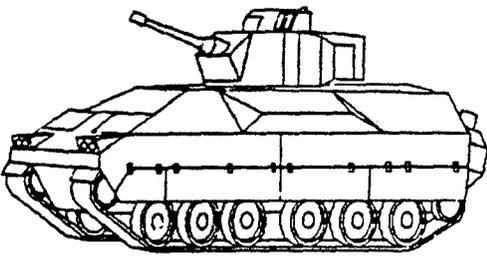
NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The Bradley Infantry and Cavalry Fighting Vehicle (IFV/CFV) fielded systems have progressed from individual protection only to ventilated facepieces with mounting provisions for detection and decontamination capability. A materiel change is being considered to require an overpressure system for all variants of the M2 and M3. No plan exists to implement this requirement. The M2A1 has storage capability for the M8A1 Chemical Agent Alarm, along with an ABC-M11 decontamination unit.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	Yes, for dismount squad.
	Collective	Ventilated Facepieces for crew only.
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm.
DECONTAMINATION	Capability	ABC-M11 Decontamination Apparatus.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	System is pre AR 70-71 validated to operate in MOPP gear.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	Grenades. Vehicle exhaust.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M3 Bradley Cavalry Fighting Vehicle	
RESPONSIBLE PEO/PM: SFAE-ASM-BV/Gary Chamberlain	
TRADOC POC: ATSH-TSM-FVS/MAJ Helmer	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M3 provides scout and armored cavalry units with a vehicle for their screening, reconnaissance, and security missions. The M3 is employed on the battlefield in conjunction with the Main Battle Tank and the M2 Infantry Fighting Vehicle to enable the force to close on enemy forces to destroy them, either by mounted or dismounted means, and reach and clear the objective.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M3 is designed to operate buttoned-up or open hatch as necessary. Depending on the situation, bypassing contaminated areas is the most desirable but the vehicle must be capable of fighting through NBC contaminated areas.

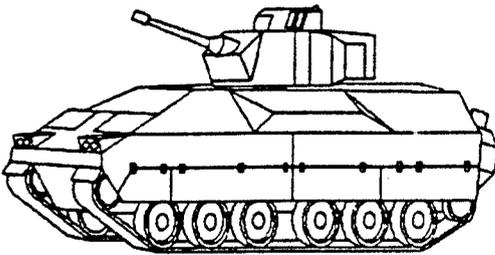
NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

Schedule and funding constraints precluded including the ventilated facepiece system requested by the user. However, the system is fully capable of being operated in MOPP4 NBC protection ensembles.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	Yes.
	Collective	None.
DETECTION	Systems Capability	MSA1 Chemical Agent Alarm.
DECONTAMINATION	Capability	ABC-M11 Decontamination Apparatus.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	System is pre AR 70-71 validated to operate in MOPP gear.
	Decontaminability	Pre AR 70-71.
SMOKE	Type	Grenades. Vehicle exhaust.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M3A1 Bradley Cavalry Fighting Vehicle	
RESPONSIBLE PEO/PM: SFAE-ASM-BV/Gary Chamberlain	
TRADOC POC: ATSH-TSM-FVS/MAJ Helmer	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: M3A1s Being Converted to M3A2s by July 1997	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M3A1 provides scout and armored cavalry units with a vehicle for their screening, reconnaissance, and security missions. The M3A1 is employed on the battlefield in conjunction with the Main Battle Tank and the M2 Infantry Fighting Vehicle to enable the force to close on enemy forces to destroy them, either by mounted or dismounted means, and reach and clear the objective.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M3A1 is designed to operate buttoned-up or open hatch as necessary. Depending on the situation, bypassing contaminated areas is the most desirable but the vehicle must be capable of fighting through NBC contaminated areas.

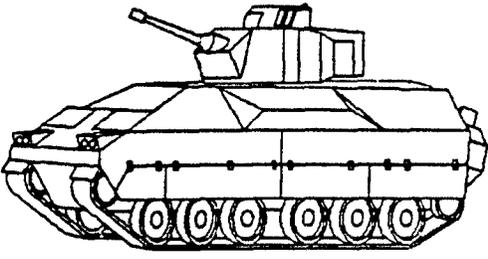
NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The M3A1 is equipped with a five man ventilated facepiece system that covers the full cavalry vehicle crew. It also has CARC paint, the ABC-M11 decontamination apparatus and a Radiac meter.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Ventilated Facepieces for the crew and scouts.
DETECTION	Systems Capability	M3A1 Chemical Agent Alarm. Radiac meter.
DECONTAMINATION	Capability	ABC-M11 Decontamination Apparatus.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	System is pre AR 70-71 and validated to operate in MOPP gear.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	Grenades. Vehicle exhaust.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M3A2 Bradley Cavalry Fighting Vehicle	
RESPONSIBLE PEO/PM: SFAE-ASM-BV/Gary Chamberlain	
TRADOC POC: ATSH-TSM-FVS/MAJ Helmer	
ACQUISITION PHASE: Production/ Deployment	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M3A2 provides scout and armored cavalry units with a vehicle for their screening, reconnaissance, and security missions. The M3A2 is employed on the battlefield in conjunction with the Main Battle Tank and the M2 Infantry Fighting Vehicle to enable forces to close on enemy forces to destroy them, either by mounted or dismounted means, and reach and clear the objective.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M3A2 is designed to operate buttoned-up or open hatch as necessary. Depending on the situation, bypassing contaminated areas is the most desirable but the vehicle must be capable of fighting through NBC contaminated areas.

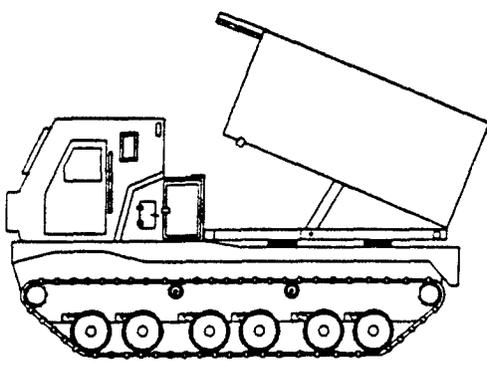
NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The M3A2 is equipped with a five man ventilated facepiece system that covers the full cavalry vehicle crew. It also has CARC paint, an M8A1 Chemical Agent Alarm, the ABC-M11 decontamination apparatus and a Radiac meter.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Ventilated Facepieces for the crew and scouts.
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm. Radiac meter.
DECONTAMINATION	Capability	ABC-M11 Decontamination Apparatus.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	System is pre AR 70-71 and validated to operate in MOPP gear.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	Grenades. Vehicle exhaust.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M270 Multiple Launch Rocket System (MLRS)	
RESPONSIBLE PEO/PM: SFAE-FS-S/Jim Steelman	
TRADOC POC: ATSF-TSM-RM/MAJ John Sorrell	
ACQUISITION PHASE: Production/Deployment	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M270 provides timely and accurate indirect fire support and counterbattery fire to maneuver forces. The MLRS consists of a 12-round launcher mounted on a highly mobile, tracked vehicle capable of firing rockets to ranges beyond 30 kilometers.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M270 is expected to have mobility comparable to the supported forces. The M270 is designed to be fully functional in a contaminated environment. The M270 MLRS qualifies as a closed system.

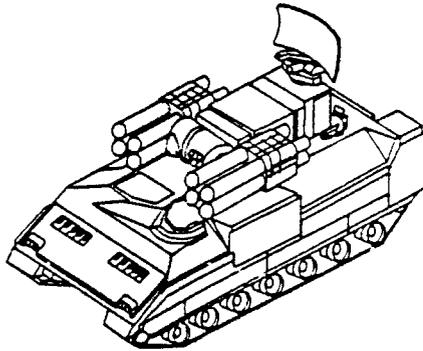
NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The MLRS is a Bradley Fighting Vehicle derivative and has an overpressure system for rocket fume protection and a ventilated facepiece for crew NBC protection. The MLRS has M8A1 Chemical Agent Alarm, CARC paint, and is compatible with MOPP operations.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
		Collective
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm.
DECONTAMINATION	Capability	None.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71. Material/Component designed to resist agent/decontaminant.
	Compatibility	System is pre AR 70-71 and verified to be operable in MOPP gear.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	System designed to withstand smoke effects.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: Line Of Sight-Forward Heavy (LOS-F-H)	
RESPONSIBLE PEO/PM: SFAE-AD-LO/John Joseph	
TRADOC POC: ATSA-TSM-F/LTC Moore	
ACQUISITION PHASE: Development	
PROJECTED FIRST UNIT EQUIPPED DATE: 1Q FY 96	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

In combination with other FAAD components, the LOS-F-H provides low level air defense for heavy maneuver forces against attack by rotary and fixed wing aircraft.

OPERATIONAL EMPLOYMENT CONCEPTS:

The LOS-F-H is a closed system which is capable of driving through contaminated areas.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The objective LOS-F-H system will enter the inventory on a modified Bradley chassis (XM1069) and will be integrated onto an ASM variant during a Block II upgrade. Initially, LOS-F-H will employ an integrated APU/ECU system, ventilated facepiece and micro-climate cooling. The objective system will be a hybrid and include a micro-climate cooling system. Capability for an M8A1 Chemical Agent Alarm and AN/VDR-2 RADIAC meter is included, along with ABC-M11 decontamination capability. LOS-F-H will be CARC painted.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Ventilated facepiece and micro-cooling; Objective system-hybrid.
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm. AN/VDR-2 Radiac meter.
DECONTAMINATION	Capability	ABC-M11 Decontamination Apparatus.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Not considered in design.
	Compatibility	System designed and validated to be operable in MOPP gear.
	Decontaminability	CARC Paint.
SMOKE	Type	Grenades.

SUMMARY REMARKS:

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: Electronic Fighting Vehicle System (EFVS/GBCS)	
RESPONSIBLE PEO/PM: PEO-IEW	
TRADOC POC: ATSI-TSM-G/James Gilbert	
ACQUISITION PHASE: Development	
PROJECTED FIRST UNIT EQUIPPED DATE: FY 97	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The EFVS is an enclosure for the Ground Based Common Sensor (GBCS) Heavy and the Joint Surveillance Target Attack Radar System (J-STARS) Ground Station Module. The enclosure is mounted on a Bradley Fighting Vehicle chassis.

OPERATIONAL EMPLOYMENT CONCEPTS:

The EFVS will deploy in the first 3 to 5 kilometers of the battlefield. The system is designed to operate in a contaminated environment with the hatches closed.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The electronic enclosure is equipped with an overpressure system which allows the EFVS crew to operate in a NBC contaminated environment wearing only MOPP2 gear (NBC overgarment and protective boots, only). Crew members operating in the cab of the vehicle are provided with ventilated facepieces for NBC protection. The EFVS carries a Chemical Agent Monitor (CAM) and the AN/VDR-2 Radiac meter. It also has the ABC-M11 Decontamination Apparatus and is CARC painted.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
		Collective
DETECTION	Systems Capability	Chemical Agent Monitor (CAM). AN/VDR-2 Radiac meter.
DECONTAMINATION	Capability	ABC-M11 Decontamination apparatus.
CONTAMINATION SURVIVABILITY (AR 70-71).	Hardness	Not considered in design.
	Compatibility	System designed and validated to be operable in MOPP4 gear.
	Decontaminability	CARC Paint. System designed for ease of decontamination.
SMOKE	Type	None.

SUMMARY REMARKS:

SUB-APPENDIX 3

M113 System

Description:

The M113 is an air-transportable, armored, multi-purpose vehicle family which provides a lightweight, armored personnel carrier for armor and infantry units capable of amphibious and air-drop operation, superior cross-country mobility and adaptable to multiple functions. The M113 was introduced during the 1960's.

Battlefield Functional Area Variants:

Close Combat Heavy/Light

M113A2 Armored Personnel Carrier
M113A3 Armored Personnel Carrier
M901A1 Improved TOW Vehicle

Air Defense

M730 Chaparral SAM Launcher
M163A1/A2 Vulcan Self-propelled Anti-aircraft Gun

Fire Support

M981 Fire Support Team Vehicle
M548 Cargo Carrier FT 6 Ton
XM1064 120 mm Mortar
M106A1/A2 107 mm Mortar Carrier

Combat Mobility and Support

M577A1/A2 Command Post
M1059 Carrier, Smoke Generator

NBC Overview:

The M113 Armored Personnel Carrier was introduced in 1960 to replace the aging M59. During the next 9 years, no requirements for NBC protection existed, but mounting provisions were developed for possible integration of ventilated facepieces. During FY-81 and FY-82 two Product Improvement Programs (PIP)s were introduced for vehicular adaptations to integrate the ventilated facepiece but were never funded and subsequently cancelled in August 1988. Except for the FISTV and the Chaparral, the M113 family relies on individual protection equipment.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M113A2 Armored Personnel Carrier (APC)	
RESPONSIBLE PEO/PM: AMSTA-UW/Joseph Godell	
TRADOC POC: ATSH-CDM-M/Copley	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M113A2 is a lightweight, armored personnel carrier for armor and infantry units capable of amphibious and air-drop operation, and superior cross-country mobility. The M113A2 is employed on the battlefield for delivering personnel to front lines for maneuver commanders.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M113A2 is designed to fight open hatched so soldiers can dismount. The M113A2 can operate in contaminated areas with on-board personnel in MOPP4.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

Overpressure will be looked at for future vehicles as well as other NBC initiatives. M8A1 Chemical Agent Alarm, M13 portable decontamination capability and CARC paint are incorporated.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	Yes.
	Collective	None.
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Pre AR 70-71.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	Grenades.

SUMMARY REMARKS:

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M113A3 Armored Personnel Carrier (APC)	
RESPONSIBLE PEO/PM: AMSTA-UW/Joseph Godell	
TRADOC POC: ATSH-CDM-M/Copley	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M113A3 is a lightweight, armored personnel carrier for armor and infantry units capable of amphibious and air-drop operation, and superior cross-country mobility. The M113A3 is employed on the battlefield for delivering personnel to front lines for maneuver commanders. The M113A3 incorporates the cooling and suspension improvements of the M113A3 but also has better performance and reliability. The M113A3 uses the Reliability Improvement of Selected Equipment (RISE) power train which includes a 275 hp turbocharged Detroit Diesel 6V-53T engine.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M113A3 is designed to fight open hatched so soldiers can dismount. The M113A3 can operate in contaminated areas with on-board personnel in MOPP4.

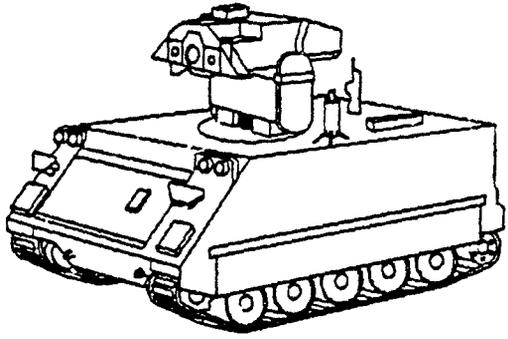
NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

Overpressure will be looked at for future vehicles as well as other NBC initiatives. An M8A1 Chemical Agent Alarm, M13 DAP portable decontamination capability and CARC paint are incorporated.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	Yes.
	Collective	None.
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Pre AR 70-71.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	Grenades.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M901A1 Improved TOW Vehicle	
RESPONSIBLE PEO/PM: AMSTA-UW/Joseph Godell	
TRADOC POC: ATSH-CDM-M/Copley	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M901A1 is a lightweight, armored personnel carrier for armor and infantry units capable of amphibious and air-drop operation, and superior cross-country mobility. The M901A1 is a modified M901 with a TOW mounted on top which normally fires at extended ranges to achieve standoff benefits.

OPERATIONAL EMPLOYMENT CONCEPTS:

Combat operation in the M901A1 requires frequent ingress/egress to reload the TOW launcher. Therefore, individual protection equipment is required. The M901A1 can operate in contaminated areas but on-board personnel must be in individual protective equipment.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

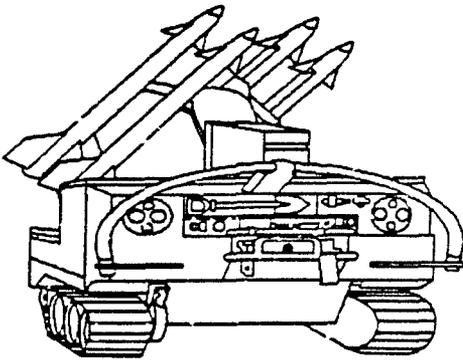
Ventilated facepieces are incompatible with rearm operation. Therefore, no improvements are envisioned. The ITV is CARC painted and has M8A1 Chemical Agent Alarm and M13 DAP portable decontamination capability.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	Yes.
	Collective	None.
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Pre AR 70-71.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	Grenades.

SUMMARY REMARKS:

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M730A1/A2 Chaparral SAM Launcher	
RESPONSIBLE PEO/PM: AMSTA-UW/Joseph Godell	
TRADOC POC: ATSA-CD/MAJ Eckberg	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M730 Chaparral is a short range, surface to air missile system that supports predominantly heavy forces.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M730A2 Chaparral provides closed system protection for the crew when on-board the vehicle. The crew, except for the gunner, must egress to operate the carrier in MOPP4 for mission execution.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

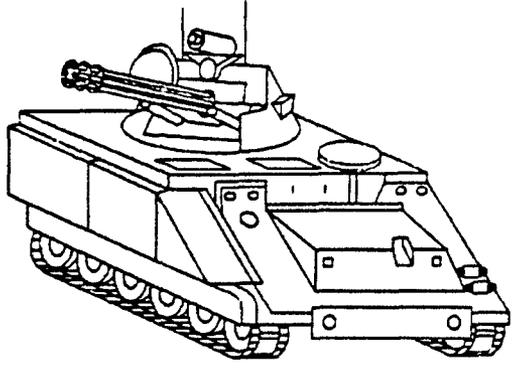
Block V PIP provided ventilated facepiece protection to the Chapparral gunner and is incorporated in the M48A2E1 and M48A3 (Chapparral carrier) models. Block VI PIP provides a collective NBC filter system to the crew while mounted on the M48A3 Chapparral carrier. Crew members are still exposed to the elements.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Ventilated facepiece for the gunner and five internal crew positions.
DETECTION	Systems Capability	None.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Pre AR 70-71.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	None.

SUMMARY REMARKS:

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M163A1/A2 Vulcan Self-propelled Anti-aircraft Gun	
RESPONSIBLE PEO/PM: AMSMC-ASA-A/Larry Niebuhr	
TRADOC POC: ATSA-CD/MAJ Eckborg	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: FY97	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M163 protects forward area combat elements and other critical assets from attack by hostile aircraft operating at low altitudes. The Vulcan systems is expected to be replaced by the Line of Sight-Forward-Heavy Air Defense system during FY 97.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M163 operate with an open hatch and will drive around contaminated areas, if possible. The gunner cannot seal himself inside system and operate the gun. He is exposed to the elements when performing his mission, therefore, individual protection equipment is required.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

NBC Protection is not currently in the VADS requirement documents. The M163 is being phased out of the inventory and the user community has terminated all PIP expenditures except those related to safety issues.

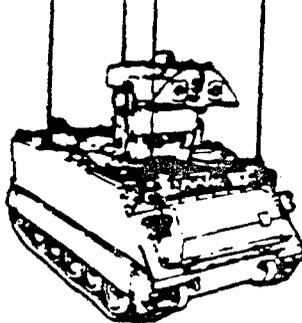
NBC PROTECTION CONCEPT

PROTECTION	Individual Only	Yes.
	Collective	None.
DETECTION	Systems Capability	None.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Competibility	Pre AR 70-71.
	Decontaminability	Pre AR 70-71.
SMOKE	Type	None.

SUMMARY REMARKS:

The Vulcan Air Defense Gun System was designed in the late 1960's as an open tub type weapon system. Individual protection was and is the only means by which the crew can protect themselves from the effects of NBC contamination.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M981 Fire Support Team Vehicle	
RESPONSIBLE PEO/PM: AMSTA-UW/Joseph Godell	
TRADOC POC: ATSF-TSM-TA/MAJ Daniel Alberico	
ACQUISITION PHASE:	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M981 provides forward observers a means to designate targets for guided munitions, plan fire support missions, and communicate with fire support forces.

OPERATIONAL EMPLOYMENT CONCEPTS:

The FISTV is expected to have mobility equal to that of the supported force in the performance of its fire support mission. The FISTV is designed to fully operate in an NBC environment as an open hatch system.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

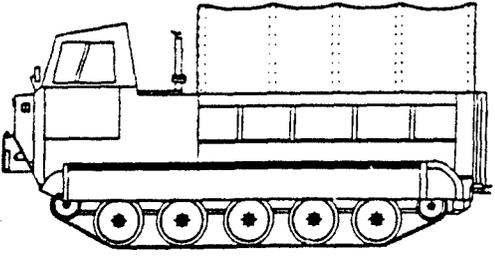
The M981's NBC protection system includes a ventilated facepiece, M8A1 Chemical Agent Alarm and M13 portable decontamination apparatus. It is CARC painted.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	Yes.
	Collective	Ventilated facepiece for crew, only.
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Pre AR 70-71.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	Grenades.

SUMMARY REMARKS:

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M548A1 Cargo Carrier FT 6 Ton	
RESPONSIBLE PEO/PM: AMSTA-UW/Joseph Godell	
TRADOC POC: ATSF-GN/Doug Converse	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M548A1 Cargo Carrier was initially designed for the US Army Signal Corps in 1960. The vehicle is used for a wide variety of roles including use as an ammunition resupply vehicle with self-propelled artillery units equipped with the M109 and M110 weapons.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M548A1 is expected to have mobility that will enable it to perform its logistical mission. It is designed to fully operate in a NBC environment under open hatch conditions.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

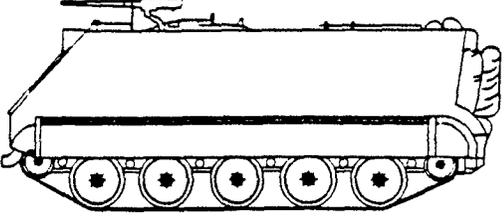
Ventilated facepieces are incompatible with open system operations. Therefore, no improvements are envisioned. The M548A1 is CARC painted and has M13 DAP portable decontamination capability.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	Yes.
	Collective	None.
DETECTION	Systems Capability	None.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Pre AR 70-71.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	None.

SUMMARY

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: XM1064 120mm Mortar	
RESPONSIBLE PEO/PM: AMSTA-UW/Joseph Godell	
TRADOC POC: ATSH-CDM-M/Copley	
ACQUISITION PHASE: Development	
PROJECTED FIRST UNIT EQUIPPED DATE: 4Q FY93	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The XM1064 will be employed on the battlefield for immediate response to the maneuver commanders. Usually employed one to two Km behind lead friendly forces. The XM 1064 will be replacing a portion of the M106A1/A2 107mm (4.2 inch) mortar systems.

OPERATIONAL EMPLOYMENT CONCEPTS:

The XM1064 is designed to fight open hatch. Depending on the battlefield situation, the mortar can be removed from the vehicle and deployed on the ground. The crew must operate in contaminated areas in MOPP.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

A turreted mortar is being addressed in the Mortar Master Plan as well as NBC initiatives. The XM1064 is CARC painted and has M8A1 Chemical Agent Alarm and M13 DAP portable decontamination capability.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	Yes.
	Collective	None.
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Pre AR 70-71.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	Grenades.

SUMMARY REMARKS:

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M106A1/A2 107 mm Mortar Carrier	
RESPONSIBLE PEO/PM: AMSTA-UW/Joseph Godell	
TRADOC POC: ATSH-CDM-M/Copley	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: 4Q FY 93 (Partial)	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM.

The M106 is employed on the battlefield for immediate response to the maneuver commanders. The M106 is usually employed one to two Km behind lead friendly forces. The M106 series mortars will be undergoing a partial conversion to the newer XM1064 120mm Mortar system. The balance of the M106A1/A2s will be in service indefinitely.

OPERATIONAL EMPLOYMENT CONCEPTS:

The XM1064 is designed to fight open hatch. Depending on the battlefield situation, the mortar can be removed from the vehicle and deployed on the ground. The crew must operate in MOPP contaminated areas.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

A turreted mortar is being addressed in the Mortar Master Plan as well as NBC initiatives. The XM1064 is CARC painted and has M8A1 Chemical Agent Alarm and M13 DAP portable decontamination capability.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	Yes.
	Collective	None.
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Pre AR 70-71.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	Grenades.

SUMMARY REMARKS:

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M577A1/A2 Command Post	
RESPONSIBLE PEO/PM: AMSTA-UW/Joseph Godell	
TRADOC POC: ATSH-CDM-M/Copley	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M577A1/A2 is a lightweight, armored personnel carrier for armor and infantry units capable of amphibious and air-drop operation, and superior cross-country mobility. The M577A1/A2 is employed on the battlefield for command and control of the battle.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M577A1/A2 is designed for command and control functions. The M577A1/A2 can operate in contaminated areas with on-board personnel in individual protective equipment.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

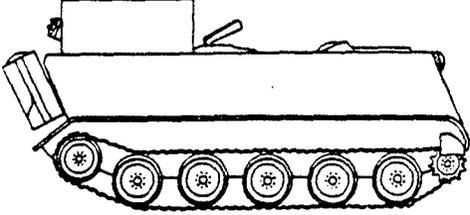
The M577A1/A2 is CARC painted and has M8A1 Chemical Agent Alarm and M13 DAP portable decontamination capability.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	Yes.
	Collective	None.
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Pre AR 70-71.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	None.

SUMMARY REMARKS:

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M1059 Carrier, Smoke Generator	
RESPONSIBLE PEO/PM: AMSTA-UW/Joseph Godell	
TRADOC POC: ATSH-CDM-M/Copley	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M1059 provides large area smoke for commanders throughout its theater of operation.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M1059 is to be used by soldiers in MOPPA.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The M1059 is CARC painted and has M8A1 Chemical Agent Alarm and M13 DAP portable decontamination capability.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	Yes.
	Collective	None.
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Pre AR 70-71.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	Mechanical Generator.

SUB-APPENDIX 4

M60 Main Battle Tanks

Description:

The M60 series Main Battle Tank (MBT) was the primary tank of the Army prior to the M1 Abrams Tank. Most M60A1 tanks have been converted to M60A3 tanks with diesel engines. The majority of M60A3 tanks are with the National Guard or the Army Reserve. All M60 and M60A2 tanks have been withdrawn from service.

Battlefield Functional Area Variants:

Close Combat Heavy/Light

M60A1 Main Battle Tank
M60A3 Main Battle Tank

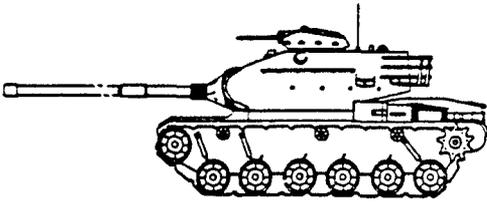
Combat Mobility and Support

M60A1 Armored Vehicle Launch Bridge (AVLB)

NBC Overview:

The primary NBC system for the M60 is a ventilated facepiece. The crew compartment is provided with a heater and a RADIAC NBC detector can be fitted if required.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M60A1 Main Battle Tank	
RESPONSIBLE PEO/PM: AMCPM-M113/M60 FOV/LTC Hamilton	
TRADOC POC:	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: Out of Active Army	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M60 Tank was designed as the principal weapon of the tank battalion. Its primary mission was to close with and destroy the enemy. It was designed to operate cross country in all environments, to include NBC environments. The M60 series tank are being phased out of the Active Army forces and are the primary MBTs for selected Army Reserve and Army National Guard units. The M60 series tanks are also the primary weapon system for the U.S. Marines.

OPERATIONAL EMPLOYMENT CONCEPTS:

Situation dependent consideration must be given to mission, enemy, terrain, troops and time available (METT-T).

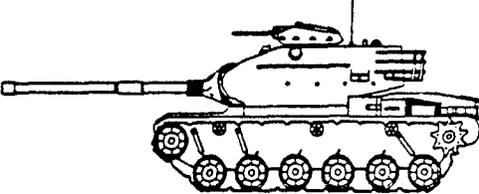
NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

Cost and space are the primary and predominate considerations that overpressure cannot be used. The M60A1 is equipped with a ventilated facepiece, ABC-M11 decontamination equipment, and is CARC painted.

NBC PROTECTION CONCEPT

PROTECTION	Individual	None.
	Collective	Ventilated Facepiece.
DETECTION	Systems Capability	None.
DECONTAMINATION	Capability	ABC-M11 Decontamination Apparatus.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Pre AR 70-71.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	Grenades, Vehicle Exhaust.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M60A3 Main Battle Tank	
RESPONSIBLE PEO/PM: AMCPM-M113/M60 FOV/LTC Hamilton	
TRADOC POC:	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: Out of Active Army	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M60 Tank was designed as the principal weapon of the tank battalion. It's primary mission was to close with and destroy the enemy. It was designed to operate cross country in all environments, to include NBC environments. The M60 series tank are being phased out of the Active Army forces and are the primary MBTs for selected Army Reserve and Army National Guard units. The M60 series tanks are also the primary weapons system for the U.S. Marines.

OPERATIONAL EMPLOYMENT CONCEPTS:

Situation dependent consideration must be given to mission, enemy, terrain, troops and time available (METT-T).

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

Cost and space are the primary and predominate considerations that overpressure was not used. Efforts to integrate an M8A1 Chemical Agent Alarm was terminated in 1984 by PM-M60 due to the M8A1 being unreliable. The M60A3 is equipped with a ventilated facepiece, ABC-M11 decontamination equipment, radiac meter and is CARC painted.

NBC PROTECTION CONCEPT

PROTECTION	Individual	None.
	Collective	Ventilated Facepiece.
DETECTION	Systems Capability	None.
DECONTAMINATION	Capability	ABC-M11 Decontamination Apparatus.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Pre AR 70-71.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	Grenades. Vehicle Exhaust.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M60 Armored Vehicle Launched Bridge (AVLB)	
RESPONSIBLE PEO/PM:	
TRADOC POC:	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM.

The AVLB does not have a modern requirements document, due to the age of the system. The document that established the requirements was prepared by the Chief of Engineer's Office and does not contain a tactical mission statement. The AVLB's role is to support the combined arms team in both the offense and defense by providing forward gap crossing capability, even under fire. The AVLB is used to enhance the mobility of forces in the combined arms team.

OPERATIONAL EMPLOYMENT CONCEPTS:

The AVLB requires the same NBC protection as the force it is supporting. It will be required to work in contaminated areas.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

Cost and space are the primary and predominant reasons that overpressure has not been included in the design. Funding has previously been requested and denied. The AVLB has a ventilated facepiece, ABC-M11 decontamination capability, and is CARC painted.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Ventilated Facepiece.
DETECTION	Systems Capability	None.
DECONTAMINATION	Capability	ABC-M11 Decontamination Apparatus.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Pre AR 70-71.
	Decontaminability	CARC paint. Pre AR 70-71.
SMOKE	Type	Vehicle exhaust.

SUMMARY REMARKS:

The operator can perform all tasks while in MCPP4 and the vehicle can be decontaminated.

SUB-APPENDIX 5

Armored Artillery Vehicles

Description:

The M109 self-propelled howitzer provides artillery support to maneuver elements of the combined arms team. The M109 has a crew of six which consists of commander, gunner, three ammunition members and the driver. The main armament is a 155 mm howitzer.

The M110A2 self-propelled howitzer is operated by a team of 12 (a five man crew on the howitzer and seven others in the M548 ammo carrier). It is armed with an 8 inch (203 mm) M202A1 cannon.

The M992 Field Artillery Ammunition Support Vehicle (FAASV) uses the M109 chassis and can carry approximately 100 155 mm projectiles, propelling charges, and fuzes.

The M1050 is a version of the FAASV for use with 8 inch (203 mm) howitzer ammunition. The M1050 is fitted with a stacker device.

Battlefield Functional Area Variants:

Fire Support

M109A2/A3 155 mm Howitzer

M109A4/A5 155 mm Howitzer

M109A6 155 mm Howitzer (Paladin)

M110A2 203 mm Self-propelled Howitzer

M992 Field Artillery Ammunition Support Vehicle (FAASV)

NBC Overview:

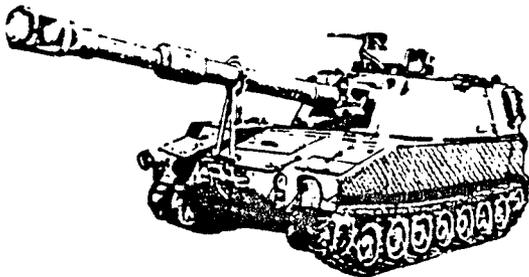
The M109A2/A3 do not provide for collective protection. The M109A4/A5 adopted a ventilated face piece system.

An NBC ventilated facepiece protection system is included on the FAASV. Additionally, the FAASV is fitted with chemical detection and alarm units and chemical decontamination units fitted on the chassis.

An NBC micro-climate cooling system and a ventilated facepiece system will be installed on the M109A6 Paladin.

The M110A2 relies on only individual protection because it is an open system.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M109A2/A3 155 mm Howitzer	
RESPONSIBLE PEO/PM: AMSMC-ASN-M/Sam Robbins	
TRADOC POC: ATSF-GN/Doug Converse	
ACQUISITION PHASE: P3I	
PROJECTED PHASE OUT DATE: Conversions to A4/A5 and A6s through FY99	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M109A2/A3 provides the primary indirect fire support to the maneuver brigades of the armored and mechanized infantry divisions. The M109A2/A3 is air transportable and is capable of firing both conventional and nuclear munitions. The current fleet of M109A2/A3s is being converted to M109A4/A5s and the M109A6 Paladins through 1999.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M109A2/A3 is expected to have the mobility comparable to the supported forces. The system is designed to be fully functional in a contaminated environment. The M109A2/A3 is an open hatch system.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

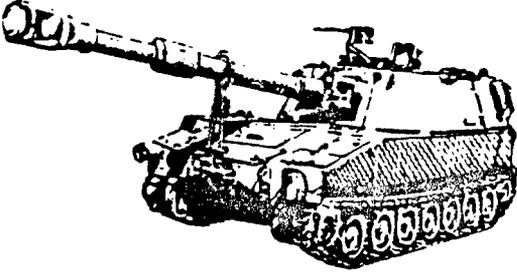
Approximately 824 M109A2/A3s will be converted into M109A6 Paladins as part of the Howitzer Improvement Program (HIP). The M109A2/A3 has a M13 decontamination capability and is CARC painted.

VEHICLE SUMMARY SHEET (Continued)

NBC PROTECTION CONCEPT

PROTECTION	Individual	Yes.
	Collective	None.
DETECTION	Systems Capability	None.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Validated to be operable in MOPP gear. Pre AR 70-71.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	None.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M109A4/A5 155 mm Howitzer	
RESPONSIBLE PEO/PM: AMSMC-ASN-M/Sam Robbins	
TRADOC POC: ATSF-CN/LTC Browers	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: 2010	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M109A4/A5 provides the primary indirect fire support to the maneuver brigades of the armored and mechanized infantry divisions. The M109A4/A5 replaces older versions of the M109 Howitzer in the Army Reserves and Army National Guard units.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M109A4/A5 is expected to have the mobility comparable to the supported forces. The system is designed to be fully functional in a contaminated environment. The M109A4/A5 is an open hatch system.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

Alternator size limitation and funding limitations precluded development of a micro-climate cooling system. Therefore, a ventilated facepiece system was the only improvement for the M109A4/A5. It carries the M13 decontamination apparatus and is CARC painted.

NBC PROTECTION CONCEPT

PROTECTION	Individual	No.
	Collective	Ventilated Facepiece.
DETECTION	Systems Capability	None.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Not considered in design.
	Compatibility	System validated for use in MOPP gear.
	Decontaminability	Yes. CARC Paint.
SMOKE	Type	None.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M109A6 Paladin 155 mm Self-propelled Howitzer	
RESPONSIBLE PEO/PM: SFAE-AR-HIP/ Stephen Wall	
TRADOC POC: ATSF-CN/LTC Browers	
ACQUISITION PHASE: Production	
PROJECTED FIRST UNIT EQUIPPED DATE: 3Q FY93	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M109A6 provides the primary indirect fire support to the maneuver brigades of the armored and mechanized infantry divisions.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M109A6 is expected to have the mobility comparable to the supported forces. The system is designed to be fully functional in a contaminated environment. The M109A6 is an open hatch system.

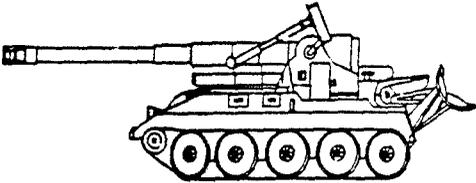
NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The M109A6 (Paladin) system represents the current version of the Howitzer Improvement Program (HIP) and includes a complete suite of NBC protection. The Paladin is an open system but has incorporated a ventilated facepiece and micro-climate cooling to relieve crew stress. The Paladin is an improvement of the M109A3 Howitzer, which itself is an improvement upon the M109 Howitzer of the early 1960's. Paladin carries the M13 decontamination apparatus and is CARC painted.

NBC PROTECTION CONCEPT

PROTECTION	Individual	None.
	Collective	Ventilated facepieces with micro-climate cooling.
DETECTION	Systems Capability	None.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Upgraded material/components designed to resist agents and decontaminants.
	Compatibility	System validated to be operable in MOPP gear.
	Decontaminability	CARC Paint. System upgraded design considers ease of decontamination.
SMOKE	Type	None.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M110A2 Self-propelled Howitzer	
RESPONSIBLE PEO/PM: AMSMC-ASA-H/Jim Varcho	
TRADOC POC: ATSF-CN/Steve Johnson	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: 2008	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M110A2 provides counter-fire support for the maneuver elements of the armored and mechanized infantry divisions.

OPERATIONAL EMPLOYMENT CONCEPTS:

The system is an open vehicle. The M110A2 is expected to have mobility comparable to the supported forces. The system is designed to be fully functional in a contaminated environment with personnel in individual protection equipment. The M110A2 only has a driver compartment. Other crew members are transported externally, with four riding on the howitzer and seven riding in/on the M548 Ammunition Support Vehicle.

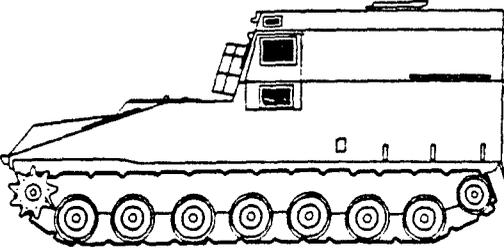
NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

PIP/MC 1-79-05-1008 required an NBC collective protection system with ventilated facepieces for the M110A2 but was not funded. The M110A2 carries the M13 decontamination apparatus and is CARC painted.

NBC PROTECTION CONCEPT

PROTECTION	Individual	Yes.
	Collective	None.
DETECTION	Systems Capability	None.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Pre AR 70-71.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	None.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M992 Field Artillery Ammunition Support Vehicle (FAASV)	
RESPONSIBLE PEO/PM: AMSTA-WS/W. Waak	
TRADOC POC: ATSF-CN/Famk Donatucci	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The FAASV delivers ammunition forward to self-propelled artillery units.

OPERATIONAL EMPLOYMENT CONCEPTS:

The FAASV is expected to have mobility that will enable it to perform its logistic mission. It is designed to fully operate in an NBC environment and operate with open hatches.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The FAASV has a material change in development to add the integrated micro-cooling (coolvest) system. The PIP and the funding have not been approved at this time. An overpressure system is not compatible with the vehicle's mission. FAASV is equipped with a ventilated facepiece, a M8A1 Chemical Agent Alarm, and an M13 decontamination apparatus. The M992 is CARC painted.

NBC PROTECTION CONCEPT

PROTECTION	Individual	Yes, for non crew members.
	Collective	Ventilated Facepiece, for vehicle crew, only.
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	System verified to be operable in MOPP gear. Pre AR 70-71.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	None.

SUB-APPENDIX 6

Armored Support Vehicles

Description:

The M88 series recovery vehicles are designed to recover large tracked vehicles on the battlefield. The M88A1 is capable of towing up to 60 ton loads. The M88A1E1 is designed to recover the M1A1 Abrams Main Battle Tank. All M88's have been converted to the M88A1.

The M578 Light Armored Recovery Vehicle is capable of lifting a maximum of 30,000 lbs and towing a maximum of 60,000 lbs.

Combat Engineering Vehicles include the M9 Armored Combat Earthmover (ACE) and the M728 Combat Engineer Vehicle (CEV). The M9 Armored Combat Earthmover (ACE) is intended to operate in forward areas and due to its high road speed can be placed up with the lead tanks in a convoy, closer to where it is needed. The M9 ACE is a general all-purpose engineer vehicle and can carry out tasks in three critical areas, mobility, countermobility, and survivability.

The Fox NBC Reconnaissance Vehicle is a highly mobile, amphibious, wheeled vehicle tailored to meet the operational requirements for NBC reconnaissance on the battlefield. The Fox will ultimately be able to detect, identify, and quantify a wide variety of contaminants. It will automatically integrate this information with data received from the on-board navigation and weather systems and provide accurate and timely NBC data to commanders through digital burst radio communications. The Fox will detect contaminants locally through point detectors and remotely through standoff detectors.

Variants:

Combat Mobility and Support

- M578 Light Recovery Vehicle
- M88A1 Medium Recovery Vehicle
- M88A1E1 Medium Recovery Vehicle
- M728 Combat Engineer Vehicle (CEV)
- M9 Armored Combat Earthmover (ACE)
- XM93 Fox NBC Reconnaissance Vehicle
- XM93E1 Fox NBC Reconnaissance Vehicle

Close Combat Heavy/Light

- M551A1 Sheridan

NBC Overview:

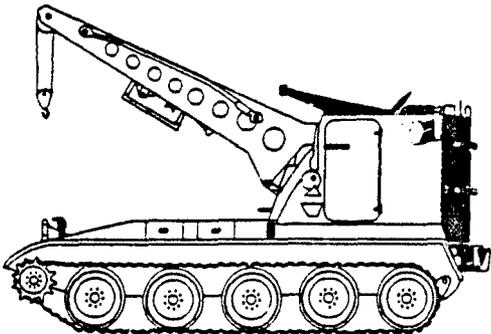
The M88A1 and M578 have incorporated a ventilated facepiece system.

The M9 ACE has a ventilated facepiece system and smoke obscurants. Retrofit for micro-climate cooling will begin in 1993.

The M728 CEV is equipped with a ventilated facepiece and decontamination equipment.

The XM93E1 Fox uses basic collective protection equipment from the German FUCHS vehicle. It was modified to include ventilated facepieces and micro-climate cooling.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M578 Light Recovery Vehicle	
RESPONSIBLE PEO/PM: AMSMC-ASA-H/Michael Mulvihill	
TRADOC POC: ATCD-SL/Ireland	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M578 provides recovery capability for armor, mechanized infantry, and self-propelled artillery forces.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M578 is employed with maneuver forces and operates in same battle area as combat arms units.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

M578 was fielded in the 1960's and the last significant design change was a product improvement in 1973. NBC protection is limited to what could be "added on." An M13 DAP will be stowed on the M578 in the future. It is equipped with a ventilated facepiece, ABC-M11 decontamination capability and is CARC painted.

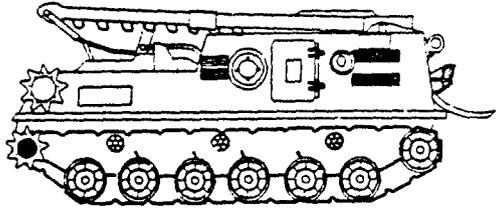
NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Ventilated Facepiece.
DETECTION	Systems Capability	None.
DECONTAMINATION	Capability	ABC-M11 Decontamination Apparatus. M13 DAP (future).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Pre AR 70-71.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	None.

SUMMARY REMARKS:

The M578 is being replaced with the M88A1.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M88A1 Medium Recovery Vehicle	
RESPONSIBLE PEO/PM: AMSTA-FRM/Joe Gibbs	
TRADOC POC: ATCD-SL/Ireland	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M88A1 is a full tracked, armored vehicle designed for hoisting, winching, and towing operations to effect battlefield recovery and evacuation of tanks and other tracked combat vehicles.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M88A1 is employed with maneuver forces and operates in same battle area as combat arms units.

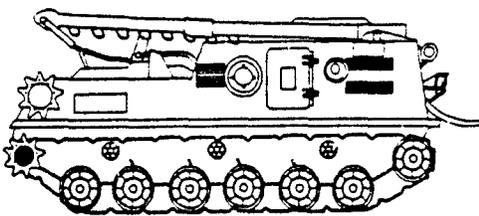
NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

Cost and space are the primary and predominant reasons that overpressure has not been included in the design. Funding has previously been requested and denied. It is equipped with a ventilated facepiece, ABC-M11 decontamination apparatus, and M13 portable decontamination capability. The M88A1 is CARC painted.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Ventilated Facepiece.
DETECTION	Systems Capability	None.
DECONTAMINATION	Capability	ABC-M11 Decontamination Apparatus, M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Pre AR 70-71.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	Grenades, Vehicle exhaust.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M88A1E1 Improved Recovery Vehicle	
RESPONSIBLE PEO/PM: AMSTA-Z-IRV/MAJ Schumacher	
TRADOC POC: Ordnance Center and School	
ACQUISITION PHASE: Development	
PROJECTED FIRST UNIT EQUIPPED DATE: 1Q FY93	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M88A1E1 is a full tracked, armored vehicle designed for hoisting, winching, and towing operations to effect battlefield recovery and evacuation of tanks and other tracked combat vehicles.

OPERATIONAL EMPLOYMENT CONCEPTS:

The M88A1E1 is employed with maneuver forces and operates in same battle area as combat arms units.

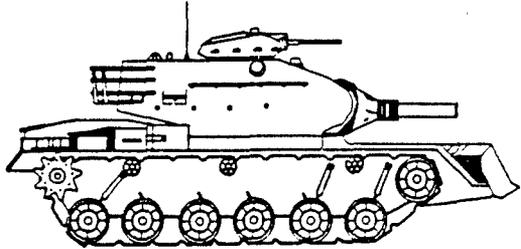
NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

Trade-off studies are being conducted to incorporate overpressure and micro-climate cooling based on operational doctrine in MOPP4 gear, NBC design requirements for overall decontamination problems found during concept studies, and bringing contamination into the vehicle after off-vehicle operations. It is equipped with a ventilated facepiece, M8A1 Chemical Agent Alarm and M13 decontamination capability. The M88A1E1 is CARC painted.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
		Collective
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	System is pre AR 70-71 and validated to be operable in MOPP4 gear.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	Grenades, Vehicle exhaust.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M728 Combat Engineer Vehicle	
RESPONSIBLE PEO/PM: AMSTA-FRM/Michael Forminski	
TRADOC POC: Engineer School	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE: Through 2004	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The CEV does not have a modern requirements document, due to the age of the system. The document that established the requirements was prepared by the Chief of Ordnance's Office and does not contain a tactical mission statement. The CEV's role is to support the Combined Arms Team in both the offense and the defense by providing forward obstacle breaching capability, even under fire. This system is programmed to be replaced by the ASM Combat Mobility Vehicle (CMV).

OPERATIONAL EMPLOYMENT CONCEPTS:

The CEV will be required to sustain the same conditions as the supported force. It will have to operate in contaminated zones.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

It is equipped with a ventilated facepiece and ABC-M11 and M13 decontamination capability. The M728 is CARC painted.

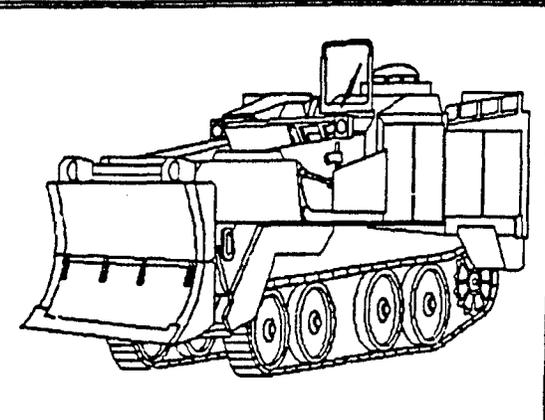
NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Ventilated Facepiece.
DETECTION	Systems Capability	None.
DECONTAMINATION	Capability	ABC-M11 Decontamination Apparatus. M13 Decontamination Apparatus, Portable (DAP) (recently released).
CONTAMINATION SURVIVABILITY (AR 70-71).	Hardness	Pre AR 70-71
	Compatibility	Pre AR 70-71.
	Decontaminability	CARC paint. Pre AR 70-71.
SMOKE	Type	Grenades, Vehicle exhaust.

SUMMARY REMARKS:

The operator can perform all tasks while in MOPP4 gear and the vehicle's can be decontaminated.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M9 Armored Combat Earthmover (ACE)	
RESPONSIBLE PEO/PM: AMCPM-M9/LTC Smith	
TRADOC POC: Engineer School	
ACQUISITION PHASE: Production/Deployment	
PROJECTED PHASE OUT DATE: Indefinite	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The M9 Armored Combat Earthmover (ACE) is intended to operate in forward areas and due to its high road speed can be placed up with the lead tanks in a convoy, closer to where it is needed. The M9 is a general all-purpose engineer vehicle and can carry out tasks in three critical areas, mobility, countermobility, and survivability. Mobility tasks include filling craters and ditches, assisting fighting vehicles (winching or towing), removing road blocks, trees, rubble, and other battlefield obstacles, preparing access/egress for fording sites and river crossings, preparing and maintaining combat routes and preparing and maintaining assault airfields. Countermobility tasks include the construction of anti-armor obstacles, demolishing fords and bridge by-passes, participating in the digging of tank ditches, destroying landing fields and airfields, participating in the preparation of strong points and hauling obstacle materials. Survivability tasks include the digging of hull defilade positions for armor, construction of defensive positions for command and control operations, construction of earth berms for protection, hauling material for protective shelters, clearing fields of fire and digging slots for vehicle mounter TOWs and other battlefield weapons.

OPERATIONAL EMPLOYMENT CONCEPTS:

The ACE will be required to support forces forward and will have to have the same NBC protection as the supported force. During dozing operation, the operator can perform with hatches closed; however, hatches open is preferred, even under contaminated conditions. The ACE must be able to perform its mission in contaminated areas.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

In 1983, TACOM NBC office conducted a study to select a micro-climate cooling system. A cool air micro-climate cooling system was selected for the driver. It was determined that overpressure is not practical due to 1200 CFM leakage. Future protection and contamination survivability considerations are currently planned. Only FY 91 and FY 93 are funded. A contamination susceptibility design study will be put in the future PIP. The M9 features a ventilated facepiece, M13 DAP and CARC paint.

VEHICLE SUMMARY SHEET (Continued)

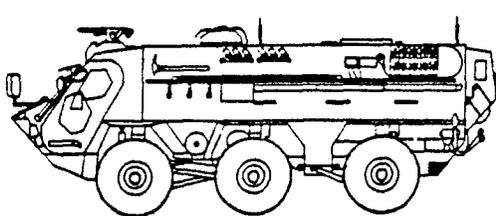
NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Ventilated Facepiece.
DETECTION	Systems Capability	None.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	The system is pre AR 70-71 and validated to be operable in MOPP4 gear.
	Decontaminability	CARC Paint. Pre AR 70-71.
SMOKE	Type	Grenades.

SUMMARY REMARKS:

The M9 ACE can operate in a contaminated environment as the operator can work in MOPP4 and the vehicle can be decontaminated.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: XM93 Fox NBC Reconnaissance System	
RESPONSIBLE PEO/PM: AMCPM-NN-R	
TRADOC POC: ATCD-GB/John Champion	
ACQUISITION PHASE: Production	
PROJECTED FUE USAEUR: October 1992	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The XM93 will provide NBC reconnaissance for commanders throughout its theater of operation.

OPERATIONAL EMPLOYMENT CONCEPTS:

The XM93 operates as a closed system.

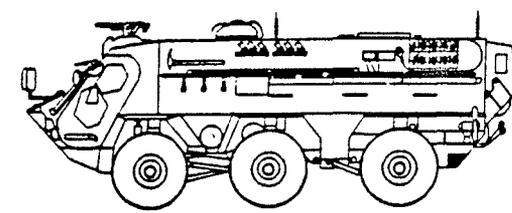
NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The XM93 FOX is a variant of the German Fuchs vehicle which is equipped with an NBC filtration and macro-cooling system. It is CARC painted and equipped with the M13 decontamination apparatus. The XM93 has a suite of detectors including the M8A1 Chemical Agent Monitor (CAM), AN/VDR-2 Radiac meter, and MM1 mass spectrometer liquid and vapor detector. Due to the obvious hazard presented to the FOX, an integrated NBC collective protection system including overpressure and macro-climate cooling is provided for crew members.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Positive pressure, German NBC filtration macro-cooling.
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm, AN/VDR-2 Radiac meter, ASG1 nuclear detector, MM1 liquid and vapor detector, Chemical Agent Monitor
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	German design.
	Competibility	German design.
	Decontaminability	CARC Paint, German design.
SMOKE	Type	Grenades.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: XM93E1 Fox NBC Reconnaissance System	
RESPONSIBLE PEO/PM: AMCPM-NN-R	
TRADOC POC: ATCD-GB/John Champion	
ACQUISITION PHASE: Development	
PROJECTED TC DATE: March 1994	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The XM93E1 will provide NBC reconnaissance for commanders throughout its theater of operation.

OPERATIONAL EMPLOYMENT CONCEPTS:

The XM93E1 will be operated as a closed system as it goes through any NBC contamination it surveys.

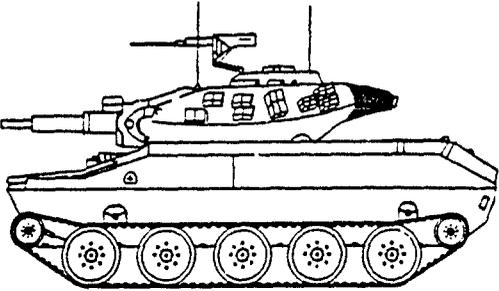
NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The XM93E1 FOX is a variant of the German Fuchs vehicle which is equipped with an NBC filtration and macro-cooling/hybrid system as in the XM93, but adds micro-climate cooling. It is CARC painted and equipped with the M13 decontamination apparatus. The XM93 will add the XM21 Remote Sensing Chemical Agent Alarm (RSCAAL) to a suite of detectors including the M8A1 Chemical Agent Monitor (CAM), AN/VDR-2 Radiac meter, and MM1 mass spectrometer liquid and vapor detector. Due to the obvious hazard presented to the FOX, an integrated NBC collective protection system including hybrid protection and micro- and macro-climate cooling is provided for crew members.

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
		Collective
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm, AN/VDR-2 Radiac meter, MM1 Mass Spectrometer, Chemical Agent Monitor, XM21 RSCAAL.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71).	Hardness	Material/Component designed to resist agent/decontaminant
	Compatibility	Designed for MOPP gear, operability not evaluated/validated.
	Decontaminability	CARC Paint. Design accounts for decontamination.
SMOKE	Type	Grenades.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: M551A1 Armored Reconnaissance/Airborne Assault Vehicle (Sheridan).	
RESPONSIBLE PEO/PM: AMSTA-UCC/Larry Cavanaugh	
TRADOC POC: ATSB-TSM-AGS/LTC SELF	
ACQUISITION PHASE: Deployment	
PROJECTED PHASE OUT DATE:	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The Sheridan is generally employed in direct support of airborne and other infantry units as part of contingency and reinforcing force missions worldwide. It is generally employed in air drop and forced entry operations where deployability is a key factor in accomplishing the mission within a minimum amount of time, thereby reducing the vulnerability of the inserted force. Initial employment is often at night. In the early phases of the action, the Sheridan destroys bunkers, vehicles, enemy emplacements and/or buildings to secure the position. It establishes positions to support the infantry in defending the position, expanding the airhead and conducting offensive operations. Sheridan units is primarily employed in support of infantry operations.

OPERATIONAL EMPLOYMENT CONCEPTS:

Situation dependent consideration must be given to mission enemy, terrain, and time available (METT-T).

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The M551A1 features a ventilated facepiece, ABC-M11 decontamination capability and CARC paint.

NEC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Ventilated Facepiece.
DETECTION	Systems Capability	None.
DECONTAMINATION	Capability	ABC-M11 decontamination apparatus.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Pre AR 70-71.
	Compatibility	Pre AR 70-71.
	Decontaminability	CARC paint. Pre AR 70-71.
SMOKE	Type	Engine generated smoke capability, Grenades.

SUMMARY REMARKS: The only protection is that which is provided by the crew's MOPP gear.

SUB-APPENDIX 7

Armored System Modernization

Description:

The armored system modernization (ASM) program is the master plan to modernize the Army's combined arms combat systems. It will provide the ground component of the future Army with significantly increased lethality, mobility, and survivability. The ASM program optimizes commonality, enabling the Army to simultaneously field six armored systems: the Block III tank, the Advanced Field Artillery System (AFAS), the Combat Mobility Vehicle (CMV), and the Future Infantry Fighting Vehicle (FIFV) on the common heavy protection level chassis; and the Line-of-Sight Antitank (LOSAT) and the Future Armored Resupply Vehicle-Ammunition (FARV-A) on the Bradley-based medium protection chassis. By optimizing commonality and pursuing next generation technology, the ASM program will field a force that is more combat effective, more logistically supportable, and more cost effective to produce and maintain.

Heavy Protection Level Systems:

The Block III Tank will provide protection and lethality to defeat the projected threat for the year 2005. It will fulfill the need for a primary offensive weapons system that can close with, destroy, and break through enemy defenses. The Block III tank will be a replacement for the M1 series of tanks.

The Future Infantry Fighting Vehicle (FIFV) will provide infantry with a highly survivable, mobile, and lethal replacement for the M2 Bradley, and will defeat the threat beyond the year 2000.

The Combat Mobility Vehicle (CMV) is an advanced armored vehicle capable of creating cleared lanes, in stride with offensive forces, through complex obstacle systems and areas mined by threat forces.

The Advanced Field Artillery System (AFAS) will provide fire support by performing operations autonomously and be able to self-locate, self-orient, and fire within 30 seconds. The AFAS will use a 155 mm weapon. The AFAS will be a replacement for the M109 series of self propelled howitzers.

Medium Protection Level Systems:

The Line Of Sight Antitank (LOSAT) weapon system will use Kinetic Energy Missiles (KEM) to destroy armored vehicles. The LOSAT will be a replacement for the M901 improved TOW vehicle.

The Future Armored Resupply Vehicle - Ammunition (FARV-A) is an armored, rapid rearm system that can sustain supported forces and survive in the forward battle area.

Armored Gun System:

The Armored Gun System (AGS) is being developed under the supervision of PEO ASM as a strategically deployable, lightly armored direct fire weapons system to support light infantry forces. It will mount a 105mm gun that will destroy bunkers, unarmored and lightly armored vehicles and/or buildings. It will move rapidly to key points within the perimeter to assist the infantry in clearing strong points, or to repel counterattacks. The AGS will be acquired using a non-developmental item (NDI) integration strategy which will replace the aging M551A1 Sheridan in the 82d Airborne Division and be fielded to other light infantry forces where the capability currently does not exist.

Battlefield Functional Area Variants:

Close Combat - Heavy/Light:

Block III Tank
Line of Sight Anti-Tank (LOSAT)
Future Infantry Fighting Vehicle (FIFV)
Armored Gun System (AGS)

Combat Mobility and Support

Combat Mobility Vehicle (CMV)

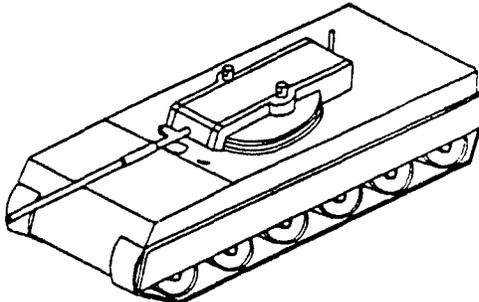
Fire Support

Future Armored Resupply Vehicle - Ammunition (FARV-A)
Advanced Field Artillery System (AFAS)

NBC Overview:

The ASM will be required to operate in all combat environments. There is an urgent need to provide defensive systems to protect the future armored force from threat NBC agents, avoid technology surprise, and support advanced development efforts. The ASM program provides the first integrated NBC survivability architecture for armored vehicles by addressing collective protection, power, environmental control, chemical detection and warning, NBC contamination survivability, and smoke system protection. The NBC system will interface with vehicle electronics and will be maximized through early design interface.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: Common Chassis/Block III Tank	
RESPONSIBLE PEO/PM: SFAE-ASM-BT/Roger Berent	
TRADOC POC: ATSB-CDM/CPT Jenkins	
ACQUISITION PHASE: Development	
PROJECTED FIRST UNIT EQUIPPED DATE: FY02	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The Block III Tank (BLK III) will support the Airland Battle Operations operational concept in the traditional role of armor. It will be an offensive weapon system that can close with, destroy, and break through enemy defenses, and exploit success in the enemy's rear. The BLK III will have a three man crew and will replace the Abrams Main Battle Tank on a one-for-one basis. A principal weapon system of the heavy force during all types of combat operation, the BLK III will provide accurate, mobile, protected direct fire power and shock effect required for assault forces. The BLK III will also provide lethal, close-in, direct fire defensive power necessary to stop an attacking force.

OPERATIONAL EMPLOYMENT CONCEPTS:

Situation dependent consideration must be given to mission, enemy, terrain, troops, and time available (METT-T).

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The Block III tank will have a total integrated NBC hybrid protection (overpressure and ventilated facepiece) with micro-climate cooling system which is capable of providing the uncontaminated ventilation needs of the crew and occupants for up to 96 hours. The NBC system must be capable of providing protection from all known and projected threats for extended periods without filter replacement. All NBC survivability measures must be capable of operating at full capability, under all battlefield conditions of the vehicle operating modes.

The Block III tank will have an integrated NBC detection system capable of monitoring interior and exterior nuclear, biological, and chemical contamination. Exterior stand-off vapor detection capability shall be capable of scanning 360 degrees in azimuth and 60 degrees in elevation, be able to detect negligible risk levels of contamination up to 1 km in range, and shall provide ranging as well as audible and visual warnings. The Block III tank will be NBC contamination in accordance with AR 70-71.

VEHICLE SUMMARY SHEET (continued)

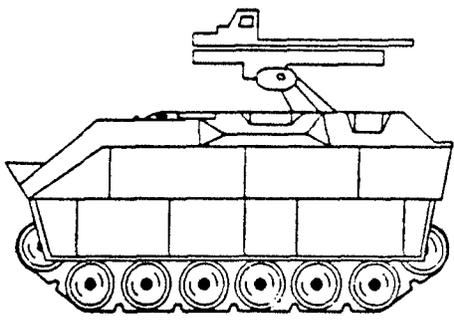
NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Hybrid system with micro-cooling and advanced NBC filtration.
DETECTION	Systems Capability	XM22 ACADA. AN/VDR-2 RADIAC meter.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP) or equivalent.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Material/component designed to resist agent/decontaminant.
	Compatibility	System is designed and will be validated for operation in MOPP gear.
	Decontaminability	CARC Paint. Design considers ease of decontamination.
SMOKE	Type	Grenades. Multispectral capability.

SUMMARY REMARKS:

System development will ensure fielding of a system which can perform its combat mission in an NBC environment.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: Line Of Sight Anti-Tank (LOSAT)	
RESPONSIBLE PEO/PM: SFAE-ASM-LS/Charles Supko	
TRADOC POC: ATSH-TSM-ATM/MAJ Tatum	
ACQUISITION PHASE: Development	
PROJECTED FIRST UNIT EQUIPPED DATE: FY97	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The LOSAT weapons system is being developed to provide maneuver elements with a highly mobile, all weather, day/night, direct fire, long range dedicated armor killer. This system will be operated close to the Forward Line Of Troops (FLOT) to attack threat main battle tanks and destroy threat armor during offensive and defensive operations. Secondary missions include self-defense capability against threat helicopters.

OPERATIONAL EMPLOYMENT CONCEPTS:

Situation dependent consideration must be given to mission, enemy, terrain, troops, and time available METT-T.

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

LOSAT will have a hybrid nuclear, biological, and chemical protection system (an NBC overpressure system and ventilated facepiece), an integrated micro-climate cooling system, an automatic NBC protection and warning system, and an integrated environmental control unit. The design will facilitate NBC decontamination and permit the use of standard army decontaminants.

VEHICLE SUMMARY SHEET (Continued)

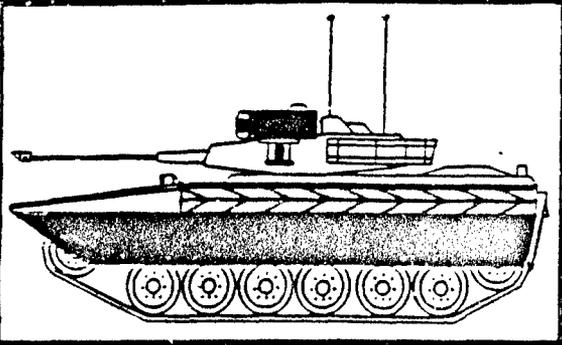
NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Hybrid with micro-cooling.
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm, XM22 ACADA.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP), or ABC-M11 Decontamination Apparatus.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Material/component designed to resist agent/decontaminant.
	Compatibility	System will be designed and validated to be operable in MOPP gear.
	Decontaminability	CARC Paint. System design will consider ease of decontamination.
SMOKE	Type	Self screening.

SUMMARY REMARKS:

LOSAT system will not be fielded before F / '97 but user requirements currently state that the system must allow for sustained operations in MOPP4 without injury in all climates.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: Future Infantry Fighting Vehicle (FIFV)	
RESPONSIBLE PEO/PM: SFAE-ASM-FV/MAJ Bob Hoover	
TRADOC POC: ATSH-CD-CS/Moon	
ACQUISITION PHASE: Development	
PROJECTED FIRST UNIT EQUIPPED DATE: FY04	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The FIFV will be mounted on the heavy protection level chassis and will provide mobile protected transport for the infantry squad to the critical required point of the battlefield. It will provide overwatching fires in support of the dismounted infantry and fires to destroy enemy IFVs/light armored vehicles, tanks, and attack helicopters. The FIFV will have a two man crew and carry a dismount element. It will replace the BFVs and M113 carriers (squad carriers, Commander's vehicle, and XO vehicle) in the Infantry Brigade, the FIFV will replace the Commander's and XO's BFV/M113 until the ASM Command Group Vehicle is fielded.

OPERATIONAL EMPLOYMENT CONCEPTS:

Situation dependent consideration must be given to mission, enemy, terrain, troops, and time available (METT-T).

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The FIFV will have a hybrid NBC protection system (overpressure system with ventilated facepiece) and a micro-climate cooling system. An integrated NBC detection system capable of interior and exterior monitoring for chemical and biological agents will be installed. Exterior detectors (stand-off vapors) should be able to detect from 10 meters to at least 1km. The detectors should be capable of continuous operation without maintenance or resupply for 48-72 hours.

The FIFV will be contamination/decontamination survivable in accordance with AR 70-71. All material used in the production of models will incorporate the latest technology in corrosion control and be compatible with NBC decontamination procedures. The FIFV will be painted in CARC paint.

VEHICLE SUMMARY SHEETS (Continued)

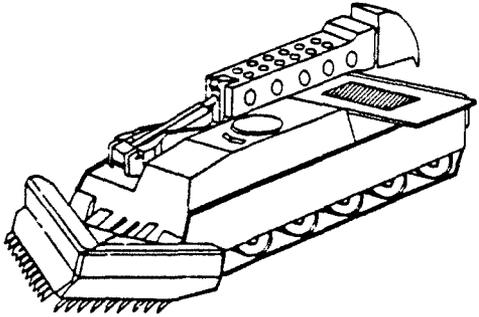
NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Specific system to be determined.
DETECTION	Systems Capability	Specific system to be determined.
DECONTAMINATION	Capability	Specific system to be determined.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Material/Component will be designed to resist agents/decontaminants.
	Compatibility	System will be designed and validated to be operable in MOPP gear.
	Decontaminability	Design will consider ease of decontamination.
SMOKE	Type	Grenades, Vehicle Exhaust, Mechanical Generators.

SUMMARY REMARKS:

System development will ensure fielding of a system which can perform its combat mission in an NBC environment.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: Combat Mobility Vehicle (CMV)	
RESPONSIBLE PEO/PM: SFAE-ASM-CMV/Brian Bonkosky	
TRADOC POC: ATSB-CDM/CPT Jenkins	
ACQUISITION PHASE:	
PROJECTED FIRST UNIT EQUIPPED DATE: FY03	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The CMV will be mounted on the heavy protection level chassis and will provide the combined arms team a capability to breach complex obstacles in stride. The CMV integrates countermine and counter obstacle capabilities into a single survivable vehicle that breaches complex systems and creates a lane for other vehicles to follow. The CMV will have a two man crew and will replace the M728 Combat Engineer Vehicle (CEV) on a basis of two CMVs for each CEV.

OPERATIONAL EMPLOYMENT CONCEPTS:

Situation dependent consideration must be given to mission, enemy, terrain, troops, and time available (METT-T).

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The CMV will have a hybrid nuclear, biological, and chemical protection system (an NBC overpressure system and ventilated facepiece), an integrated micro-climate cooling system, an automatic NBC protection and warning system, and an integrated environmental control unit. An integrated NBC detection system capable of interior and exterior monitoring for chemical and biological agents will be installed. Exterior detectors (stand-off vapors) should be able to detect from 10 meters to at least 1km. The detectors should be capable of continuous operation without maintenance or resupply for 48-72 hours.

The CMV will be contamination/decontamination survivable in accordance with AR 70-71. All material used in the production of models will incorporate the latest technology in corrosion control and be compatible with NBC decontamination procedures. The CMV will be painted in CARC paint.

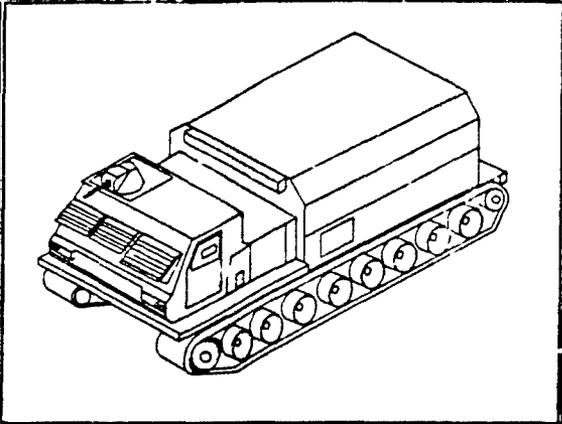
NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Hybrid system with micro-cooling and advanced NBC filtration.
DETECTION	Systems Capability	XM22 ACADA, AN/VDR-2 RADIAC meter.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Material/component designed to resist agent/decontaminant.
	Compatibility	System is designed and will be validated for operation in MOFP gear.
	Decontaminability	CARC Paint. Design considers ease of decontamination.
SMOKE	Type	Grenades.

SUMMARY REMARKS:

System development of the CMV will ensure fielding of a system which can perform its combat mission in an NBC environment.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: Future Armored Resupply Vehicle - Ammunition (FARV-A)	
RESPONSIBLE PEO/PM: AFAE-ASM-FR/Charles Moore	
TRADOC POC: ATCL-V/Russakoff	
ACQUISITION PHASE:	
PROJECTED FIRST UNIT EQUIPPED DATE: FY03	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The FARV concept requires a vehicle capable of carrying fuel, ammunition, and other essential supplies to rearm/refuel a fighting vehicle. This concept may require a two vehicle solution (Future Armored Resupply Vehicle-Ammunition (FARV-A) which will carry primarily fuel and a limited amount of other supplies). The FARV-A will be assigned as an integral system of the battalion/squadron support elements. It will operate between the combat trains and rearm points located in close proximity to the armored fighting system's battle positions. Once loaded, the FARV-A, by virtue of its communications and navigation systems, can move forward to a protected position near the fighting systems and execute rapid resupply. The FARV-A will transport ammunition and provide automated ammunition receiving and transferring capability to increase the speed of resupply operations. The FARV-A will have a two man crew and will replace the FAASV on a one-for-one basis in AFAS-C equipped artillery battalions. It will replace selected HEMTT and 5 ton trucks in armor, mechanized infantry, armored cavalry, and air defense artillery battalions/squadrons.

OPERATIONAL EMPLOYMENT CONCEPTS:

Situation dependent consideration must be given to mission, enemy, terrain, troops, and time available (METT-T).

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The FARV-A will have a hybrid nuclear, biological, and chemical protection system (an NBC overpressure system and ventilated facepiece), an integrated micro-climate cooling system, an automatic NBC protection and warning system, and an integrated environmental control unit. An integrated NBC detection system capable of interior and exterior monitoring for chemical and biological agents will be installed. Exterior detectors (stand-off vapors) should be able to detect from 10 meters to at least 1km. The detectors should be capable of continuous operation without maintenance or resupply for 48-72 hours.

The FARV-A will be contamination/decontamination survivable in accordance with AR 70-71. All material used in the production of models will incorporate the latest technology in corrosion control and be compatible with NBC decontamination procedures.

VEHICLE SUMMARY SHEET (Continued)

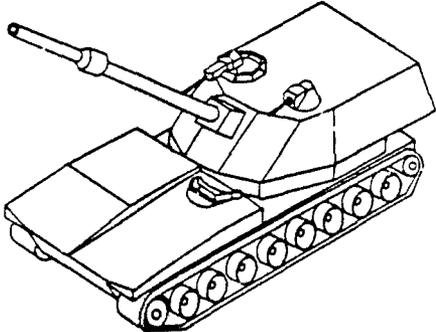
NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Hybrid system with micro-cooling and advanced NBC filtration.
DETECTION	Systems Capability	XM22 ACADA AN/VDR-2 RADIAC meter.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Material/component designed to resist agent/decontaminant.
	Compatibility	System is designed and will be validated for operation in MCPP gear.
	Decontaminability	CARC Paint. Design considers ease of decontamination.
SMOKE	Type	Grenades.

SUMMARY REMARKS:

System development will ensure fielding of a system which can perform its combat mission in an NBC environment.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: Advanced Field Artillery System (AFAS)	
RESPONSIBLE PEO/PM: SFAE-ASM-AF/MAJ Thomas Moriarty	
TRADOC POC: ATSF-TSM CN/Gross	
ACQUISITION PHASE: Development	
PROJECTED FIRST UNIT EQUIPPED DATE: FY03	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM.

The Advanced Field Artillery System (AFAS) will be mounted on the heavy protection level common component chassis to provide the platform to support the 155mm cannon recoil and ensure necessary system survivability. The AFAS will have a modified protection package that will provide it modified medium protection. The AFAS consist of the Advanced Field Artillery System Cannon and the Future Armored Resupply Vehicle Ammunition (FARV-A). The AFAS-C and FARV-V will be fielded with 24 weapons platforms and 24 ammunition resupply vehicles per Field Artillery battalion. The system will be employed in autonomous and semi-autonomous operation. AFAS will have a four man crew.

OPERATIONAL EMPLOYMENT CONCEPTS:

Situation dependent consideration must be given to mission, enemy, terrain, troops, and time available (METT-T).

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

AFAS will have a hybrid NBC protection system (overpressure system and ventilated facepiece) and an integrated micro-cooling system. An integrated NBC detection system capable of interior and exterior monitoring for chemical and biological agents will be installed. Exterior detectors (stand-off vapors) should be able to detect from 10 meters to at least 1km. The detectors should be capable of continuous operation without maintenance or resupply for 48-72 hours.

AFAS will be contamination/decontamination survivable in accordance with AR 70-71. All material used in the production of models will incorporate the latest technology in corrosion control and be compatible with NBC decontamination procedures.

VEHICLE SUMMARY SHEET (Continued)

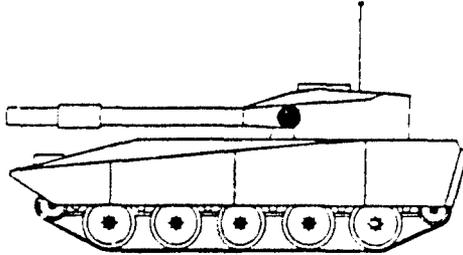
NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Hybrid system with micro-cooling and advanced NBC filtration.
DETECTION	Systems Capability	XM22 ACADA. AN/VDR-2 RADIAC meter.
DECONTAMINATION	Capability	M13 Decontamination Apparatus, Portable (DAP).
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Material/component designed to resist agent/decontaminant.
	Compatibility	System is designed and will be validated for operation in MOPP gear.
	Decontaminability	CARC Paint. Design considers ease of decontamination.
SMOKE	Type	Grenades.

SUMMARY REMARKS:

System development of AFAS will ensure fielding of a system which can perform its combat mission in an NBC environment.

VEHICLE SUMMARY SHEET

SYSTEM NOMENCLATURE: Armored Gun System (AGS)	
RESPONSIBLE PEO/PM: SFAE-ASM-AG/Phillip Meengs	
TRADOC POC: ATSB-TSM-AGS/LTC Self	
ACQUISITION PHASE: Development	
PROJECTED FIRST UNIT EQUIPPED DATE: FY95	

TACTICAL MISSION STATEMENT FOR THIS ARMORED SYSTEM:

The AGS will normally be employed in direct support of airborne and other infantry units as part of contingency and reinforcing force missions worldwide. It will be employed in air drop and forced entry operations where deployability is a key factor in accomplishing the mission within a minimum amount of time, thereby reducing the vulnerability of the inserted force. Initial employment will often be at night. In the early phases of the action, AGS will destroy bunkers, vehicles, weapon emplacements and/or buildings to secure the position. It would then move rapidly to key points within the perimeter to assist the infantry in clearing strong points, or to repel hasty counterattacks. Once the area is secure, the AGS would establish positions to support the infantry in defending the position, expanding the airhead and conducting offensive operations. AGS units will, primarily, be employed in support of infantry elements.

OPERATIONAL EMPLOYMENT CONCEPTS:

Situation dependent consideration must be given to mission, enemy, terrain, troops, and time available (METT-T).

NBC PROTECTION PROGRAM - REMARKS (INCLUDING FUTURE NBC PROTECTION ENHANCEMENT INITIATIVES):

The AGS will conform to NBC contamination and survivability standards and will accommodate the full range of operator and maintenance personnel wearing the full range of protective overgarments. The AGS will have a ventilated facepiece collective protection system. The individual protection with ventilated facepiece was specified due to weight considerations. Overpressure and micro-climate cooling are desired capabilities. The AGS will have an ABC-M11 decontamination apparatus. It will be CARC painted.

VEHICLE SUMMARY SHEET (continued)

NBC PROTECTION CONCEPT

PROTECTION	Individual Only	No.
	Collective	Ventilated Facepieces.
DETECTION	Systems Capability	M8A1 Chemical Agent Alarm.
DECONTAMINATION	Capability	ABC-M11 Decontamination Apparatus.
CONTAMINATION SURVIVABILITY (AR 70-71)	Hardness	Material/component designed to resist agent/decontaminant.
	Compatibility	System will be designed to be operable in MOPP gear.
	Decontaminability	CARC Paint. Design will consider ease of decontamination.
SMOKE	Type	Grenades.

SUMMARY REMARKS:

System development of the AGS will ensure fielding of a system which can perform its combat mission in an NBC environment.

APPENDIX C

Description of Current NBC Systems and Potential Future Technologies for Application to Armored Systems

I. INTRODUCTION

This appendix is a compendium of hardware descriptions for the current NBC hardware available for integration into armored systems. The objectives of providing this information is to impart to the reader a basic understanding of NBC hardware and technologies and to identify the availability of each item. The information is organized to follow the general sequence of the discussions of NBC system options in the report: 1) protection, 2) detection, 3) decontamination, and 4) smoke. Each subsection is structured to first provide concept definition, and close with current and future hardware descriptions for NBC technologies that have potential for application to satisfy the evolving armored systems NBC protection needs. The charts presented on pages C-13 through C-15 identify the availability status of each NBC system described.

A. PROTECTION

1. Descriptions of Current Protection Hardware:

a. NBC Filters: All fielded collective protection systems use impregnated activated carbon (whetlerite) to remove chemical contaminants from the air stream. Nuclear and biological contaminants, i.e. particulates, are removed by mechanical particulate separators and High Efficiency Particulate (HEPA) filter paper. Whetlerite carbon filtration technology along with HEPA particulate filter paper have been the only NBC filtration methods in use since the 1950's. They continue to be the technologies used now for NBC protection. Whetlerite carbon and HEPA particulate filter paper are arranged into many different configurations to suit different operational parameters. Some filters split the carbon and HEPA sections into separate beds while other filters consist of combined elements. A list of the current filters that can be utilized in building collective protection systems is shown in Table C-2.

b. Ventilated Facepiece Systems (M8 and M13): The ventilated facepiece uses an M8 (12 cfm of air) or M13 (20 cfm of air) gas particulate filter unit (GPFU) that supplies NBC filtered air, via hoses, to the M25A1 individual protective masks worn by vehicle crew members. The flexible air duct hose has sufficient length to permit normal performance of duties while in the vehicle. It supplies 3 to 4.5 cubic feet per minute of filter air directly into the soldier's mask. The surplus air to the mask has a cooling

effect in high ambient temperatures. An in-line heater, M3, can be utilized to heat the air provided to the mask if desired.

c. M1A1 Main Battle Tank NBC System: The M1A1 Main Battle Tank is equipped with an integrated environmental control/NBC system. This system provides up to a total of 200 cfm of NBC filtered/environmentally conditioned air to pressurize the interior to preclude the entry of NBC contaminants during closed hatch operations. Eighty cfm of this air is routed to the four crew members (20 cfm per crew member) for use in their micro-cooling air vest and M25A1 protective mask. The system takes high pressure/high temperature bleed air from the M1A1 main turbine engine. The air is then environmentally conditioned in an air cycle environmental control unit and sent through two 100 cfm NBC filters into the M1A1 air distribution network. An M13 ventilated facepiece system is also provided as a backup system in case the primary system malfunctions.

2. Descriptions of Future Protection Technologies Potentially Applicable to Armor Systems:

a. High Pressure NBC Filter: The V-22 aircraft will be outfitted with a high pressure NBC gas-particulate filter integrated with the aircraft environmental control unit. The NBC filter will filter all air entering the aircraft crew compartment. This technology could be applicable to armored systems equipped with a high pressure air source.

b. New Reactive Adsorbents (NRADS): Different impregnants or impregnant combinations are being investigated for use on the carbon used in existing filters. This new material would have the following advantages over activated carbon:

- increased capacity of the carbon for certain agents,
- replacement of the carcinogenic chromium on the carbon,
- reduced amount of ammonia offgassing from the carbon.

These advantages will greatly extend operational life, reduce logistics, and increase effectiveness. This will be used as an upgrade of the current generation of carbon based, single pass air filtration systems.

c. Advanced Collective Protection (CP) Technology: Since CP systems generally are designed for specific applications, the Army's technology program is used to develop the advanced filtration technology data base that verifies the potential of these technologies. The technology is then transferred to system developers for integration, or to interface documents that are

TABLE C-1: Charcoal Filters For Vehicle Collective Protection Systems

Fltr. Model No.	Description	Specification Drawing	Intended Use	Applicable Particulate Filter
M12A1	Gas - 12 CFM	MIL-F-14512C C5-19-2267	HOSP FILTER M17A1, 3 MAN TANK FILTER M8A2, ARMORED AMBULANCE FILTER M14	M13
M18	Gas - 10 CFM	MIL-F-51193B D5-19-2350	M13A1 FILTER UNIT	M19
M23	Gas - 150 CFM	MIL-F-51222A D5-19-1221	WITH M10 CPE*FOR HAWK AND M51 SHELTER SYSTEM	M24
M48	Gas Particulate Filter - 100 CFM	EA-F-1284 5-19-7436	COMBAT VEHICLES MCPE* M1A1 TANK	Combined /w Gas Filter
	Gas Particulate Filter Set - 200 CFM	SET MIL-F-51527 GAS MIL-F-51525 Part MIL-F-51526	USE IN M56, XM59 & XM62 FILTER UNITS FOR MCPE & M56E1 FOR SCPE*	EA-F-1125

- * CPE - Collective Protection Equipment
- MCPE - Modular Collective Protection Equipment
- SCPE - Simplified Collective Protection Equipment

developed to allow the Government to develop specific systems. There are currently two technologies that are being investigated for use in future Armored Systems Modernization (ASM) efforts. They are described below:

- Pressure Swing Adsorption/Desorption (PSA): This system uses pressure as the controlling adsorption/desorption variable for two or more parallel filtration media. The process is based on the principle that a vapor can be adsorbed on a filtration media at high pressure and desorbed from the media, or removed, when the pressure on the media is reduced. This process uses a filtration media of carbon or a zeolite to separate contaminants from contaminated air allowing breathable air to continue to the effluent end of one filter bed. A fraction of the purified air is then used at a reduced pressure to backflush the second filter bed to purge agent contamination thereby regenerating the filtration media in the second filter bed. By switching the flow control valves, the beds are cycled through adsorption/desorption modes, thereby, providing a continuous flow of filtered air. An air cycle environmental control unit recovers a portion of the compressive energy and provides thermal conditioning of the air. The technology program is aimed at determining characteristics of PSA adsorption with agents/simulants and verifying performance models with full scale testing. The advantages of this system are the small bed size allowed by rapid cycle pressure swings and greatly extended bed life. A disadvantage of this system is the reliance on a large number of mechanical parts which require maintenance. Similar systems are presently being used in commercial and military application for the separation of nitrogen and oxygen.

- Catalytic Oxidation: The current catalytic oxidation concept is based upon contaminated air being heated to a high temperature (750 °F) and pressurized to two times normal atmospheric pressure. The air is then passed through a catalytic reactor where the contaminants are decomposed or oxidized into other species. These species are either retained in the catalytic reactor or are removed by a subsequent post treatment process (i.e., reaction, adsorption, or absorption). The recuperator recovers a portion of the energy of the heated air and an air cycle environmental control unit provides cooling and further energy recovery. The technology program addresses fundamental kinetic characteristics of catalysts with agents/simulants and provides a predictive model of catalytic reactor performance. The advantages of this system are that the heat required can be generated from a turbine engine and the mechanical reliability of this system is high due to the small number of mechanical parts. A disadvantage of this system is that toxic or harmful products from the catalytic reactor must still be treated. The catalytic oxidation system provides the armored system designer/integrator with an advancement over the current automotive catalyst technology.

B. DETECTION

1. Descriptions of Current Detection Hardware:

a. VGH ABC-M8 Chemical Agent Detector Paper: The M8 chemical agent detector paper is used to categorize liquid agents. The paper contains three agent-sensitive dyes which produces a specific color when exposed to a specific agent. A color chart on the inside of the M8 booklet enables direct comparison for agent identification. False positives are possible with the M8 paper. The M8 paper detects and identifies liquid nerve and blister agents. The M8 paper can be used to sample for liquid chemical agents on vehicle surfaces or surrounding terrain.

b. M9 Chemical Agent Detector Paper: The M9 chemical agent detector paper is used to indicate the presence of liquid agents. The M9 paper will read the same color for both nerve and blister agents. The paper contains a suspension of an agent-sensitive dye, which will turn red or reddish-brown in those places exposed to liquid agent. False positives to petroleum products and decontamination solution DS2 are possible. M9 paper is designed to be attached to clothing or equipment. The M9 paper can be stuck to the exterior of the vehicle prior to combat action and used to detect any subsequent vehicle exposure to liquid chemical agent.

c. M256A1 Chemical Agent Detector Kit: The M256A1 chemical agent detector kit is a portable and expendable item capable of detecting both liquid (with M8 paper) and vapor concentrations of chemical agents. The sampler/detector in this kit will detect and identify low vapor concentrations of nerve, blister, and blood agents following a 10 minute exposure to the chemical agent vapors. The kit consists of 12 individually packaged samplers/detectors, a set of instruction cards, and a packet of ABC-M8 VGH chemical agent detector papers. The M256A1 kit can be used to manually sample air inside or outside the vehicle to determine if chemical agent vapor concentrations are low enough to allow protective masks to be removed. The M256A1 is authorized to individual units by common table of allowances (CTA).

d. M8A1 (M43A1 Chemical Agent Detector and M42 Alarm): The M8A1 system consists of the M43A1, for chemical agent detection, and the M42 alarm. The M43A1 is a nerve (G and V) agent alarm which operates on the ion cluster spectroscopy principle. A radioisotope ionizes air that is drawn into the detector. These ion clusters pass through a baffled diffusion cell which serves as the selective element. Nerve agent ion clusters preferentially pass through the diffusion cell and reach the counter electrode. When the counter electrode current surpasses a certain threshold, the alarm sounds. This detector detects only nerve agents. The M43A1 can be mounted on the exterior of several

combat vehicles, with the M42 alarm mounted inside the vehicle (connected by wire). The detector is designed to operate when the vehicle is stopped. The detector's concept of use is somewhat inconsistent with the combat vehicles' concept of use, which in some cases may have led to the M43A1 not always being used. The M43A1 is not recommended for sampling air within a closed vehicle, because it experiences a high background current (and hence a high rate of false alarms) in this environment. Additionally, the exhaust air from the detector would have to be vented to the exterior of the vehicle if the detector were used inside the vehicle. This would remove the very remote possibility of radioisotopic contamination of the interior of the vehicle due to the radioactive source in the detector. The M8A1 is authorized to individual units on their table of organization and equipment (TOE), for use as directed by the commander.

e. Chemical Agent Monitor (CAM): The CAM is a handheld, battery powered monitoring system, which operates on the principle of ion mobility spectrometry and is capable of detecting both nerve and blister agents. The CAM provides a visual display of contamination concentration in a bar form on a liquid crystal display. It is used primarily to monitor the exterior of the vehicle for agent contamination, to monitor personnel before reentry into the vehicle, and to monitor surrounding terrain for contamination. When sampling the exterior air, the CAM can be used to determine proper MOPP status for exiting from a vehicle. When sampling the interior air, the CAM can be used to determine when a crew may unmask in a vehicle, after having had a hatch open in a contaminated environment, e.g., for rearming. Authorization for the CAM is included in the unit's TOE.

f. IM93/UD Dosimeter: The IM93/UD is an instrument used to read the total gamma dose accumulated. It is a tubular device, about the size of a fountain pen. The user reads the accumulated gamma total dose simply by looking through the lens while pointing the instrument toward the sun or another bright-light source.

g. AN/PDR-27S Radiac: The AN/PDR-27S is a portable, watertight, battery-powered radiation detector and indicator that indicates the ambient radiation environment. The instrument detects and measures the beta and gamma radiation together or gamma radiation alone.

h. IM-174B/PD Radiac: The IM-174B/PD is a miniature, ion chamber gamma radiation survey meter that indicates the ambient radiation environment. It is capable of measuring in the range from 1 to 500 rad/hr.

i. AN/VDR-2 RADIAC: The AN/VDR-2 measures gamma dose rates from 0.01 mrad/hr to 10,000 rad/hr and beta dose rates from 0.01 mrad/hr to 4 rad/hr. The unit functions simultaneously as a

dose rate meter and dose meter with independent adjustable alarms that can be set at any level over the entire range. It can measure up to 1000 rad accumulated dose. Dosage is independently stored in non-destructive memory for display on command and may be retained when the unit is turned off. This instrument indicates the ambient radiation environment.

2. Descriptions of Future Detection Technologies Potentially Applicable to Armored Systems:

a. Chemical Agent Detector Network (CADNET, XM23 & XM24): The CADNET interfaces current and future chemical agent detectors such as the M43A1 to a radio-frequency transmitter/receiver set and to the SINCGARS field radio. This allows a chemical agent alarm to be automatically forwarded to the employing unit, adjacent units and higher command. The CADNET identifies the origin of the alarm. Type classification is scheduled for FY93.

b. Automatic Chemical Agent Alarm (ACADA, XM22): The XM22 will be an advanced, man-portable, point sampling, chemical agent vapor alarm system. It will have improved sensitivity and specificity over the M8A1, and will detect and identify all nerve agents, mustard, and Lewisite. It can also be used to detect chemical agents on surfaces and in collective protection shelters. The ACADA is being designed and tested to sample exterior air for chemical agent vapors while mounted on the exterior of moving combat vehicles. When used in conjunction with Multipurpose Integrated Chemical Agent Alarm (MICAD) or the Armored Systems Modernization (ASM) sample transfer system, the ACADA is located inside a vehicle and samples the air both exterior and interior to the vehicle (exhausting to the outside). However, the ACADA development program is not testing the ACADA in this latter role; this is to be done in the MICAD and ASM development programs. Type classification is scheduled for FY94.

c. Multipurpose Integrated Chemical Agent Alarm (MICAD): The MICAD digitally transmits chemical agent alarm information to adjacent units and/or command centers. It interfaces with the Maneuver Control System and the ACADA and will be compatible with other future chemical and biological agent detectors. It can perform both exterior and interior air sampling, transfer the sampled air and activate the vehicle collective protection measures. This system is being developed specifically for use with the current fleet of Army vehicles. The MICAD components and the associated detector(s) will be mounted inside the vehicle in most cases. Type classification is scheduled for FY96.

d. Remote Sensing Chemical Agent Alarm (RSCAAL, XM21): This alarm uses a passive infrared sensor and on-board, real-time computer analysis of interferograms to detect nerve and blister

agent vapors. It will automatically detect chemical agents at ranges up to 5 km when used for reconnaissance (mounted on an NBC Reconnaissance System) or in the surveillance mode (tripod mounted). It is not capable of being used on the move. Type classification is scheduled for FY91.

e. Laser Standoff Chemical Agent Detector (LSCAD): This detector is an infrared laser based spectrophotometer used for standoff detection of chemical agents. It provides the added capability of detecting chemical agent aerosols and detecting surface contaminants. This system will also be capable of detecting chemical agents from a moving platform. Type classification is scheduled for FY03.

f. Bio-Chemical Detector (BCD): The BDC will be a continuous, automatic air sampling device capable of detecting specific CB agents. It will have the capability of being hand-carried or vehicle mounted and permit "on the move" detection. Visual and audible alarm, display of agent class, and concentration level will be available locally and for transmission to a battlefield information network. It will also have the capability to indicate an all-clear condition. The system will serve as a tactical, interior/exterior alarm on ground and airborne vehicles and shelters. It will be modular to allow for continual upgrading. Type classification is scheduled for FY99.

g. Chemical-Biological Mass Spectrometer (CBMS): The CBMS is being designed to automatically and continuously detect, identify and quantify all known chemical and biological threat agents from stationary and vehicular applications. The CBMS will consist of a biological aerosol sampling probe, a ground sampling probe, and a mass analyzer chassis which houses a mass analyzer, pumps, and computer and control electronics. Biological aerosol sampling probe permits CBMS detection of biological aerosols, and chemical aerosols and vapors. The ground sampling probe permits CBMS detection of airborne chemical agents and liquid droplets on surfaces. Identified CBMS applications include the Nuclear, Biological and Chemical Reconnaissance Systems (NBCRS), fixed sites, biological area defense and sampling identification. Type classification is scheduled for FY99.

C. DECONTAMINATION

1. Description of Current Hardware:

a. ABC-M11 Decontaminating Apparatus, Portable, DS2: The ABC-M11, portable decontaminating apparatus consists of a steel cylinder with an aluminum spray head assembly screwed to the top and a nitrogen-filled cylinder which serves as a propellant for the decontamination solution. The ABC-M11 comes equipped with a mounting bracket. The nitrogen cylinders are issued with the M11, but the user must requisition the decontaminating agent, 1 1/3 quarts of DS2, and fill the container as needed. The filled

apparatus is pressurized immediately prior to use by raising the handle into position. The flow of DS2 is controlled by a thumb lever. The item weights 3.0 lbs empty (6.6 lbs filled) and is 5.5 in (D) X 14.25 in (H). The ABC-M11 is primarily used to decontaminate vehicles or crew-served weapons to the minimum extent necessary permitting their continued operation. It is typically carried in the mounting bracket attached to the vehicle. Decontamination is accomplished by spraying the decontamination agent on the contaminated equipment or vehicle. One filling will cover an area approximately 135 sq ft.

b. M13 Decontaminating Apparatus, Portable, DS2: The M13 has been designed to hold and dispense a larger quantity of DS2 (14 liters) than the M11. It consists of a prefilled container, a hose, a manual pump, two wand sections, and an attachable brush. All accessories are stored in the accessory container when not in use, which is part of the packaged item. The decontaminant is pumped via a hand pumping action to dispense the DS2. Spent containers may be discarded and replaced with a new filled container. The brush is also discarded and replaced after use. The item weights 54 lbs filled and its dimensions are approximately 20 in (H), X 14 in (L) x 7 in (W). The M13 is to be mounted on the equipment that it is intended to decontaminate. Mounting to a vehicle is by use of a standard fuel/water can mounting bracket. Decontamination is accomplished by hand pumping the DS2 from the container through the wand/brush assembly onto the surface of the vehicle or crew-served equipment to be decontaminated. One M13 DS2 container will decontaminate approximately 1200 square feet of surface area.

c. Decontamination Kit Personal, M258A1: The M258A1 consists of three "Decon 1" towelette wipes and three "Decon 2" towelette wipes which are individually sealed in easily opened, impermeable foil packets. The "Decon 1" packet has a top tab for immediate identification at night. The "Decon 2" packet contains a glass ampoule enclosed in a plastic mesh bag to prevent injury when the ampoules are broken. The six wipes in the M258A1 are contained in a waterproof plastic case with a metal snap hook for attachment to clothing or personal equipment. The M258A1 is used by the individual soldier for emergency decontamination of his skin and partial decontamination of his personal equipment.

d. Decontamination Kit, Individual Equipment M280 (DKIE): The decontamination kit, individual equipment M280 (DKIE) is used for partial decontamination of the soldier's equipment: CB protective boots, gloves, mask/hood and the personal weapon. The DKIE contains 20 individual systems--each consisting of an individual container, foil packet I, and foil packet II. Foil packet I contains a pad prewetted with hydroxyethane, phenol, sodium hydroxide, ammonia and water. Foil packet II contains a towelette impregnated with chloramine B; four crushable glass ampoules containing ethanol, zinc chloride and water; and a mesh bag

to hold the ampules. The system is used to remove and decontaminate blister and nerve agents from limited personal equipment. Due to operational constraints, only 10,000 M280s were produced and no more will be procured. This item will be replaced by the XM295 described later.

e. Decontaminating Kit, Skin, M291: The M291 contains six individual skin decontaminating packets for the emergency personal decontamination of skin. Each packet contains a non-woven fiber polybacked applicator pad impregnated with 2.8 grams of Ambergard XE-55 resin. Applicator pads have strap handles for ease of use. Individual pads are hermetically packaged in polyester-foil laminate material which is notched on each corner for easy opening. The six packets are carried in a flexible, wallet-like carrying pouch constructed of non-woven fabric. The M291 (6 packets) weighs 1.6 ounces and measures (folded) 4.4 x 4.7 x 1.4 inches. The M291 is to be used by the individual soldier in place of the M258A1. It may also be useful in decontamination of limited areas of equipment which cannot withstand exposure to DS2. However, the use of the M291 may leave a black residue on the equipment.

f. M17 Lightweight Decontamination System: The M17 is a portable, lightweight, compact, engine-driven pump and multifuel-fired water heating system. The system is capable of drawing water from any source and delivering it at moderate pressure (up to 100 psi) and controlled temperatures (120 °C). The system weighs 370 pounds and is 3.3 X 2 X 3 feet in size. An accessory kit weighing 165 pounds, is 3.5 X 2 X 1 feet in size and contains hoses, spray wands, personnel shower hardware and a siphon injector. The system also includes a 1500 or 3000 gallon capacity rubberized fabric, self-supporting, collapsible water tank. The M17 is used in hasty and deliberate decontamination for the removal of contaminants or decontaminants from vehicles, aircraft and other equipment. Because of its relatively small and lightweight size, it could be hauled by a trailer or carried on board large vehicles.

2. Description of Future Technologies:

a. Decontamination Kit, Individual Equipment, XM295: The XM295 will likely consist of four individual wipedown mitts within a soft, protective packet which is designed to fit comfortably within a pocket of the Battle Dress Overgarment (BDO). Each individual wipedown mitt in the kit is comprised of adsorbent resin contained within a non-woven polyester material and a polyethylene film backing. This technology is adapted from the development of the M291 Skin Decontaminating Kit and will be used to replace the M280 Decontamination Kit. In use, resin from the mitt is allowed to flow freely through the non-woven polyester pad. Decontamination is accomplished through sorption of contamination

by both the non-woven polyester pad and by the resin. The XM295 is to be used to decontaminate soldier's individual equipment. It may also be useful in decontamination of limited areas of equipment which cannot withstand exposure to DS2. Use of the XM295 may leave a residue on the equipment. Type classification is scheduled for FY94.

b. Decontaminating Agent, Multipurpose (DAM): The DAM is being developed to replace DS2 as the Army's primary decontaminant. It will be less corrosive than DS2 but will be as effective in the decontamination of chemical and biological agents. This new decontaminant will be a water based material and is expected to be applied through a water stream via a mixing or siphon device. The material will be used for exterior decontamination of vehicles in accordance with hasty or deliberate decontamination doctrine. Type classification is scheduled for FY00.

D. SMOKE

1. Description of Current Hardware:

a. Vehicle Engine Exhaust Smoke System (VEESS): VEES is a reinforcing and sustaining visual smoke screening system. Using the engine fuel pump, diesel fuel is pumped at a rate of approximately one gallon per minute into the right or left side of the hot engine exhaust system. The VEES is driver activated. The VEES is intended to be complimentary to the rapid smoke system (grenades).

b. Under Armor Form Fitting Tank: This system is a vehicle engine exhaust system that works the same as the VEES already mentioned except that instead of diesel fuel being pumped from the vehicle fuel tank into the engine exhaust, fog oil is pumped from a separate tank that is located under the vehicle. This system is used when the vehicle is being run off of JP8 fuel. At this time, JP8 cannot be used to produce smoke.

c. Smoke Generator set (SGS), M157: The M157 SGS consists of two M54 smoke generators, a remote control panel, fog oil tank, fog oil pump assembly and a air compressor unit. The M157 uses MOGAS to produce heat which vaporizes the fog oil. The vaporized fog oil is released into the air where it recondenses to produce large clouds of white smoke. There are two applications; the M157 and the M113A2 APC which produces the M1059 Smoke Generator Carrier for mechanized forces and the M157 mounted on a M1037 HMMWV used by motorized forces.

d. Smoke Grenade Launcher, M239/M250: The M239 is composed of two mirror image six-tube dischargers, two canvas covers, two smoke grenades stowage boxes and a push button firing

switch. The M250 is comprised of two mirror, image six-tube dischargers and two canvas covers. L8 Red Phosphorous (visual) and M76 (infrared) screening Grenades can be fired in one salvo of 12 grenades or two salvos of 6 grenades to rapidly create a defensive smoke screen.

e. Smoke Grenade Launcher, M243/M257/M259: The M243 is composed of two four tube discharges, eight rubber caps, two smoke grenade storage boxes and an arming and firing switch. The M257 is comprised of two four-tube dischargers and eight rubber caps. The M259 is comprised of two four-tube dischargers, eight rubber caps and an arming and firing switch. L8 and M76 grenades can be fired in one salvo of 8 grenades to rapidly create a defensive smoke screen.

f. Grenade, L8: The L8 provides a self-screening smoke capability for armored vehicles to screen vehicles from direct fire and conceal vehicles caught in the open. The grenade is filled with a Red Phosphorus and butyl rubber mix. The grenade is launched from existing (M239/M25 and M243/M257/M259) and developmental launchers when electrical current activates the electrical squib type fuse which ignites the propellant charge. The grenade bursts to produce an immediate smoke cloud.

g. Grenade, M76: The M76 provides armored vehicles rapid smoke self protection against missile and projectile sensor and guidance threats. The M76 supplements the L8 by providing protection in the infrared. The grenade is fired from existing and developmental launchers. The M76 is activated the same as the L8.

3. Description of Future Technologies:

a. Discharger, Grenade, Smoke, XM6: The XM6 is a 2X2 tube design. Two pairs of vertically mounted parallel tubes are set at a 13.5 degree angle on the discharger base. The discharger tubes are designed to fire multiple salvos of visual, infrared and millimeter wave grenades up to 360 degrees around the vehicle and overhead. The system will be operable with the vehicle's automatic/discriminatory firing.

b. Grenade, Millimeter Screening, XM81: The XM81 is designed to be launched from standard and developmental smoke grenade launchers. Body structure, safe and arm mechanism and firing train are similar to the M76 Grenade. Originally, the XM81 Grenade was designed to block the millimeter wave of the electromagnetic spectrum, however, in FY90, the program was redirected to include IR.

c. Light Vehicle Obscuration System (LVOS): The concept for LVOS pyrotechniques grenades for rapid smoke protection for light vehicles. Current rapid smoke self-protection grenades (i.e. the M76) have a fragment hazard associated with them which

prevents their use on unarmed vehicles. The type of grenades envisioned for the LVOS would generate smoke by burning within its container thus eliminating any fragment hazard. Although intended for Scout and TOW High Mobility Multipurpose Wheeled Vehicles (HMMWVs), this type of system could be installed on any tactical vehicle which requires smoke protection but cannot use standard self-protection grenades (L8A3, M76, etc.).

TABLE C-2: CURRENT HARDWARE AND FUTURE TECHNOLOGIES FOR NBC PROTECTION

SYSTEM	TYPE CLASSIFICATION DATES FOR SYSTEM									
	Available Now	'92	'93	'94	'95	'96	'97	'98	'99	'00
INDIVIDUAL PROTECTION										
Battle Dress Overgarment	X									
M25A1 Tank Crewmen Mask	X									
FUTURE - M42 Tank Crewmen Mask		X**								
COLLECTIVE PROTECTION										
NBC Filters	X									
M8/M13 Ventilated Facepiece System	X									
M1A1 Main Battle Tank NBC System	X									
FUTURE - High Pressure NBC Gas-Particulate Filter			X							
FUTURE - New Impregnated Carbon (NRADS)									X***	
FUTURE - Pressure Swing Adsorption/Desorption (PSA)									X***	
FUTURE - Catalytic Oxidation									X***	
DETECTION										
VGH ABC-M8 Chemical Agent Detector Paper	X									
M9 Chemical Agent Detector Paper	X									
256A1 Chemical Agent Detector Kit	X									
M8A1 (M43A1 Chemical Agent Detector and M42 Alarm)	X									
Chemical Agent Monitor (CAM)	X									

* Availability is usually two years after type classification (TC). All systems TC in '91 are available immediately.
 ** TC action FY97, available to the field in FY91. *** Technology verified and available for application to armored systems.

TABLE C-2 cont.: CURRENT AND FUTURE TECHNOLOGIES FOR NBC PROTECTION

SYSTEM	TYPE CLASSIFICATION DATES FOR SYSTEM									
	Available Now	'92	'93	'94	'95	'96	'97	'98	'99	'00
DETECTION (continued)										
IM93/UD Dosimeter	X									
AN/POR-275 Radiac	X									
IM-174B/PO Radiac	X									
AN/VOR-2 Radiac	X									
<i>FUTURE</i> - Chemical Agent Detector Network (ICADNET, XM23 & XM24)				X						
<i>FUTURE</i> - Automatic Chemical Agent Alarm (ACADA, XM22)				X						
<i>FUTURE</i> - Multipurpose Integrated Chemical Agent Alarm (MICAD)							X			
<i>FUTURE</i> - Remote Sensing Chemical Agent Alarm (RSCAAL, XM21)									X	
<i>FUTURE</i> - Biological Chemical Detector									X	
<i>FUTURE</i> - Chemical-Biological Mass Spectrometer									X	
<i>FUTURE</i> - Laser Stand-off Detector										X
DECONTAMINATION										
ASC-M11 Decontaminating Apparatus										X
M13 Decontaminating Apparatus										X

* Availability is usually two years after type classification (TC). All systems TC in '91 available immediately.

TABLE C-2 cont.: CURRENT AND FUTURE TECHNOLOGIES FOR NBC PROTECTION

SYSTEM	TYPE CLASSIFICATION* DATES FOR SYSTEM									
	Available Now	'92	'93	'94	'95	'96	'97	'98	'99	'00
DECONTAMINATION (continued)										
M258A1 Personal Decontamination Kit										
M290 Individual Equipment Decontamination Kit	X									
M291 Skun Decontamination Kit	X									
M17 Lightweight Decontamination System	X									
XM295 Individual Decontamination Kit				X						
FUTURE - Decontaminating Agent, Multipurpose										
										X
SMOKE										
Smoke Grenade Launcher, M239/M250	X									
Smoke Grenades Launcher, M243/M257/M259	X									
Grenade, L8	X									
Grenade, M76	X									
Under Armor Form Fitting Tank	X									
M157 Smoke Generator Set	X									
Vehicle Engine Exhaust Smoke System (VEESS)	X									
FUTURE - Discharger, Grenade, Smoke, XM6								X		
FUTURE - Grenade, Millimeter Screening, XM81									X	
FUTURE - Light Vehicle Obscuration System										X

* Availability is usually two years after type classification (TC). All systems TC in '91 available immediately.

APPENDIX D

GLOSSARY OF TERMS

ABC	Atomic, Biological, and Chemical
ACADA	Automatic Chemical Agent Detection Alarm
ACE	Armored Combat Earthmover
AD	Air Defense
ADATS	Air Defense Anti-Tank System
ADV-FSV	Advanced Fire Support Vehicle
AFAS	Advanced Field Artillery System
AFAS-C	Advanced Field Artillery System-Cannon
ALB	AirLand Battle
APC	Armored Personnel Carrier
APU	Auxilliary Power Unit
AR	Army Regulation
ASM	Armored Systems Modernization
AVLB	Armored Vehicle Launched Bridge
BDO	Battledress Overgarment
BFA	Battlefield Functional Areas
BFV	Bradley Fighting Vehicle
C	Celcius (Measure of Temperature)
C ²	Command and Control
C ³ I	Command, Control, Communications & Intelligence
CADNET	Chemical Agent Detector Network
CAM	Chemical Agent Monitor
CARC	Chemical Agent Resistant Coating
CCH/L	Close Combat Heavy/Light
CEV	Combat Engineer Vehicle
CFM	Cubic Feet Per Minute
CFV	Cavalry Fighting Vehicle
cGy	Centi-Gray (0.01 Gray, equals 1 Rad)
CMV	Combat Mobility Vehicle
CP	Collective Protection
CPE	Collective Protection Equipment
CPOG	Chemical Protective Overgarment (OD Green)
CS	Closed System
CS	Combat Support
DAM	Decontaminating Agent, Multipurpose
DAP	Decontamination Apparatus, Portable
DKIE	Decontaminating Kit, Individual Equipment
DS2	Decontaminating Solution 2
ECU	Environmental Control Unit
EFVS	Electronic Fighting Vehicle System
F	Fahrenheit (Measure of Temperature)
FAAD	Forward Area Air Defense
FAASV	Field Artillery Ammunition Supply Vehicle
FARV-A	Future Armored Resupply Vehicle-Ammunition
FIFV	Future Infantry Fighting Vehicle
FISTV	Fire Support Team Vehicle
FS	Fire Support

FY	Fiscal Year
GBCS	Ground Based Common Sensor
GPFU	Gas-Particulate Filter Unit
HEMTT	Heavy Equipment Mobility Transport Truck
HEPA	High Efficiency Particulate Assembly
HIP	Howitzer Improvement Program
HMMWV	High Mobility Multipurpose Wheeled Vehicle
HYB	Hybrid Collective Protection
IEW	Intelligence and Electronic Warfare
IFV	Infantry Fighting Vehicle
IPE	Individual Protective Equipment
IR	Infrared
ITV	Improved TOW Vehicle
J-STARS	Joint Surveillance Target Attack Radar System
KM	Kilometer
LC	Life Cycle
LOS-F-H	Line of Sight-Forward-Heavy
LOSAT	Line of Sight Anti-Tank
LSCAD	Laser Standoff Chemical Agent Detector
LVOS	Light Vehicle Obscuration System
MBT	Main Battle Tank
MC	Macro-Climate Cooling
MC	Mobile Crew
MCPE	Modular Collective Protection Equipment
METT-T	Mission, Enemy, Terrain, Troops, and Time
MICAD	Multipurpose Integrated Chemical Agent Alarm
MLRS	Multiple Launch Rocket System
MOPP	Mission Oriented Protective Posture
NBC	Nuclear, Biological, and Chemical
NRADS	New Reactive Adsorbents
OP	Overpressure
OS	Open System
P	Passengers
PIP	Product Improvement Program
PSA	Pressure Swing Adsorption/Desorption
RQD	Required
REQT	Requirement
RSCAAL	Remote Sensing Chemical Agent Alarm
SC	Static Crew
SCPE	Simplified Collective Protection Equipment
SGS	Smoke Generator Set
SHORAD	Short Range Air Defense
SPH	Self-Propelled Howitzer
TC	Type Classification
TOW	Tube-Launched Optically-Tracked Wire-Guided
TRADOC	Training and Doctrine Command
UC	Micro-Climate Cooling
VEESS	Vehicle Engine Exhaust Smoke System
VFP	Ventilated Facepiece
VGH	V-Agent, G-Agent, H-Agent