MNBC

Medical Nuclear Biological Chemical Defense Team

Limited Military Utility Assessment

Final Report - May 2004

Det 1 AFOTEC

MNBC Defense Team LMUA Final Report

May 2004

Prepared By:

Philip E. Goff
Major, USAF
Test Director

Approved By:

Joseph J. Bonin
Colonel, USAF
Commander, Detachment 1 AFOTEC

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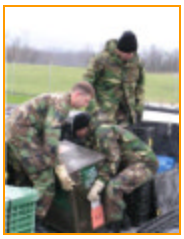
Executive Summary 1		Air Combat Command and the Air Force Medical Evaluation Support Activity sponsored the Medical Nuclear Biological Chemical Defense Team limited military utility assessment, which took place at the Expeditionary Medical Support Experimental, Exercise, and Technology Insertion test site at Fort Detrick, MD. The assessment was conducted in two parts: Part I took place 11–14 November 2003 and Part II took place 8–12 December 2003.
Introduction 5		The Detachment 1 Air Force Operational Test and Evaluation Center mission was to assess the deployment, employment, and operational form, fit, and function of the Medical Nuclear Biological Chemical Defense Team allowance standard equipment package. The allowance standard has been modified to include state-of-the-art nuclear, biological, and chemical equipment and equipment infrastructure upgrades and improvements.
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Executive Summary

Overview

This Final Report provides the results of a limited military utility assessment (LMUA) of the Medical Nuclear Biological, and Chemical (MNBC) Defense Team allowance standard (AS) equipment package.

The United States Air Force (USAF) Air Combat Command (ACC) sponsored this assessment, which was conducted by Detachment 1 (Det 1) Air Force Operational Test and Evaluation Center (AFOTEC) and supported by the Air Force Medical Evaluation Support Activity (AFMESA). The LMUA was conducted in two parts at the AFMESA Expeditionary Medical Support (EMEDS) Experimental, Exercise, and Technology Insertion (XTI) test site at Fort Detrick, MD. Part I was conducted 11–14 November 2003; Part II was conducted 8–12 December 2003.

The purpose of this event was to determine the deployment, employment, and operational form, fit, and function (F3) of the MNBC Defense Team AS equipment package for use in the deployed operational environment. The AS includes commercial off-the-shelf (COTS) nuclear, biological, and chemical (NBC) sampling, identification, and measurement equipment and infrastructure equipment, such as the small shelter system (SSS) and other team equipment used to support operations in the deployed environment.

Execution

Det 1 AFOTEC conducted this assessment using one MNBC Defense Team from Langley Air Force Base (AFB), VA, and two MNBC Defense Teams from Whiteman AFB, MO. Each team was made up of one bioenvironmental engineer (BEE) and two BEE technicians. In addition, a biological augmentation team (BAT), made up of two personnel from Langley AFB, provided notional BAT support and interoperability input. The BAT can be collocated with the MNBC Defense Team as part of an integrated medical NBC defense capability package.

Notional operational NBC scenarios were used to validate the MNBC Defense Team AS equipment package to determine the effectiveness and suitability of additional COTS NBC technologies that have been included in the new AS equipment package, to identify the optimum equipment package required to support the MNBC Defense Team mission, and to refine the tactics, techniques, and procedures (TTP) and concept of operations (CONOPS) for their use. The scenarios included four NBC events used to employ the MNBC Defense Team AS equipment package and one deployment pack-out and palletization event.

Vendor personnel, ACC representatives, and a Det 1 AFOTEC communications specialist provided training during Part I of the assessment.

Results

The following are the key results of the MNBC Defense Team LMUA:

- All operators indicated that the current NBC equipment is sufficient to address the CONOPS mandated mission of the MNBC Defense Team.
- The Motorola 5000 communications system adequately supports MNBC Defense Team operations, and operators considered the current AS allocation of five handheld radios to be sufficient to support team operations. The long "rubber duck" antennas used with the radios were considered to be problematic when the operators were wearing mission-oriented protective posture (MOPP) gear.
- The MNBC Defense Team work center (the SSS and shelter extension manufactured by Alaska Industries) provided sufficient space to accommodate compatibility for the MNBC Defense Team and the BAT. A suggested footprint was identified, but the most effective and efficient work center equipment configuration may be mission or deployment dependent.
- The infrastructure equipment (field office equipment, computers, printers, office supplies) was adequate to support the mandated 30-day mission capability of the MNBC Defense Team; however, numerous changes to the AS were suggested to improve the efficiency of work center operations.
- Most of the AS consumables are sufficient to sustain 30-day mission capability; however, the operators identified several key consumable items in the AS that were of insufficient quantities.
- No training issues were noted regarding the SSS, the shelter components, or the Motorola 5000 communications system.
- A complete AS equipment package was successfully repacked and palletized using two standard 463L pallets.
- Ease of setup is an issue with some MNBC Defense Team equipment. Three of four operators cited the HAPSITE as being difficult to set up. (HAPSITE is used to collect and analyze volatile organic compounds in air, water, and soil.)
- Operation of the NBC equipment was considered easy overall, and relatively easy while wearing MOPP 4; however, some performance difficulties were identified, particularly during night operations.

Conclusions

The assessment-rating summary provided in Table 1 reflects operator satisfaction with the adequacy, sufficiency, and performance of the MNBC Defense Team AS equipment package. Table 1 contains operator ratings for each characteristic based on operator comments and questionnaire responses.

The MNBC Defense Team AS is sufficient to perform the MNBC Defense Team mission, although numerous suggestions were made to improve the AS and equipment contained therein.

The MNBC Defense Team AS equipment package is adequate to address the spectrum of chemical, biological, and radiological threats as required in the MNBC Defense Team CONOPS and current medical doctrine. However, equipment performance can be affected by extreme environmental conditions (see Annex D).

Table 1. Summary Ratings: *Assessment ratings are provided in the table below.*

Capability Summary	
System Characteristic	**Rating**
Adequacy of the Motorola 5000 communications system	◉
Adequacy of infrastructure equipment	◉
Adequacy of NBC equipment	◉
Compatibility with the BAT	◉
Ease of setup	◉
Ease of use	◒
Palletization requirements	◉
Reliability	◒
Power	◒

Legend		
	◉	Excellent demonstration of capability/characteristic
	◒	Good demonstration of capability/ characteristic
	○	Marginal demonstration of capability/characteristic
	●	Unsatisfactory demonstration of capability/characteristic

The CONOPS states that expeditionary combat support (ECS) will be provided for the MNBC Defense Team in the deployed environment. ECS will provide power for the MNBC work center. However, the power generation capability of the 10-kilowatt (kW) generator, currently included in the team AS to supply backup power, does not generate adequate power to support the co-location of MNBC Defense Team and BAT operations when deployed in a bare-base or far-forward environment, absent ECS support. Additionally, the 10 kW generator will not support operation of the environmental control unit (ECU). Annex D provides a list of environmental limitations specific to several critical pieces of NBC equipment. Assessors also determined that, under test conditions, the Honda 1.5 kW generators could not provide sufficient power to simultaneously operate the RADeCO Grab Air Samplers and the Dycor XMX Bio-aerosol Collectors.

Recommendations

Operators provided extensive feedback regarding the mission requirements of the MNBC Defense Team CONOPS and the AS equipment allocation. The following is a summary of the key recommendations provided in this report:

- Maintain five of the Motorola 5000 handheld radios in the AS, and consider the use of smaller rubber duck antennas.
- Determine whether the current CONOPS adequately addresses the need for a vehicle to support MNBC Defense Team operations.
- Modify the equipage in the MNBC Defense Team AS equipment package to improve utility and usability. A complete list of equipage modifications is set forth in the Recommendations section of this report.
- Identify and implement a viable training methodology that will develop and maintain sufficient operator proficiency with the NBC equipment and the SSS, collective protection (CP) liner, and related components.
- Include pertinent operator and training manuals with the NBC equipment.
- Conduct a suitable assessment of the TVA technology in an appropriate operational environment to validate the utility of this equipment. The TVA 1000B could not be operated due to the lack of hydrogen gas, which is used with this piece of equipment. In addition, the model used during the assessment was the wrong model and is not included in the AS.
- Identify and implement procedures and methods to properly dispose of hazardous or infectious waste.
- Identify procedures for effective SSS access and egress to the MNBC Defense Team work center when deployed in a contaminated environment.
- Conduct a risk/benefit analysis to determine the impact of temperature extremes on the NBC equipment (see Annex D).
- Identify emergency power and portable power generators that will meet current power requirements.
- Validate the BAT AS to identify and resolve communications, equipment, and supply requirements to support interoperability with the MNBC Defense Team.
- Ensure that the appropriate action is taken to configure the HAPSITE laptop computer in accordance with base/medical communications procedures and interoperability requirements.

Introduction

Purpose and Background

ACC requested that AFMESA coordinate an assessment of the effectiveness and suitability of the new MNBC Defense Team employment concept. Det 1 AFOTEC conducted this LMUA of a CONOPS and a new AS for the MNBC Defense Team. The Det 1 AFOTEC mission was to assess deployment, employment, and operational F3 of the MNBC Defense Team AS equipment package for use in the deployed operational environment.

The MNBC Defense Team LMUA was a two-part assessment conducted at the AFMESA EMEDS-XTI assessment site at Fort Detrick, MD. Part I of the assessment took place 11–14 November 2003 and consisted of training and a pack-out and palletization exercise using a modified MNBC Defense Team AS. Part II of the assessment took place 8–12 December 2003. Part II included completion of training and familiarization activities, followed by initiation of operational activities. AFMESA, ACC, and Det 1 AFOTEC identified five operational scenarios, which were used to direct MNBC Defense Team operations.

Rapid deployment requirements of USAF medical personnel include insertion into operational environments that potentially involve NBC threats. These deployments include both combat operations in far-forward operational theaters and deployed support for homeland security-related NBC events. The USAF NBC mission in the modern deployed operational environment demands state-of-the-art NBC technologies, equipment, and training to support passive NBC defensive capabilities, improved casualty prevention and survivability, improved situational awareness, and timely crisis management.

To improve USAF NBC defense capabilities and requirements, Headquarters ACC developed the MNBC Defense Team CONOPS to provide enhanced, state-of-the-art defensive NBC contingency asset support for base locations and deployed settings in NBC threat environments.

Prior to October 2002, the Bioenvironmental Nuclear, Biological, and Chemical (BNBC) team existed as an extension of the Civil Engineering Readiness (CEX) NBC reconnaissance team. The BNBC team performed initial detection for NBC agents on deployed airbases. After the new MNBC Defense Team CONOPS was approved in October 2002, the mission of the MNBC Defense Team changed from initial detection to performing a health risk assessment for NBC threats and incidents.

Headquarters ACC Bioenvironmental Engineering (SGPB) assessed the existing BNBC AS for suitability to support this new mission. The key detectors (Improved Chemical Agent Monitors [ICAM], the M272 kit, and the M256 kit) on the BNBC AS did not provide reliable hazard information (i.e.,

there were numerous different types of false positives for the ICAM). The system also produced false negatives at concentrations that would result in severe physiological effects. ACC determined that this equipment set did not meet the new MNBC Defense Team mission requirements. In accordance with the requirements identified in the Counter Chemical Warfare CONOPS, the MNBC team must be able to provide the commander with a reliable health risk assessment to support suitable and appropriate passive defense responses to address the identified NBC threat.

In the summer of 2002, the Air Staff tasked the Air Force Institute for Environment, Safety and Health Risk Analysis (AFIERA) to perform a market survey of government off-the-shelf/COTS materiel solutions to fill the immediate capability gap. AFIERA evaluated each piece of equipment, performed technical studies, and made recommendations to HQ ACC and the Air Force Surgeon General's office. Since then, several studies have been conducted on the HAPSITE and HAZMAT ID, including Soldier and Biological Chemical Command (SBCCOM) testing/calibration, live agent testing in the Czech Republic, and other calibration/validation studies.

The new equipment set recommended by AFIERA has been endorsed by the MNBC Pilot Unit at Whiteman AFB and ACC/SGPB as viable solutions to meet the requirements outlined in the CONOPS. ACC intends to use the results of this assessment to support configuration and AS equipment package decisions for deployment and employment of the MNBC Defense Team.

Technology Description

The MNBC Defense Team provides increased survivability through enhanced NBC force protection and casualty mitigation and prevention. In accordance with the current CONOPS, the MNBC Defense Team is designed to interface with the BAT, the Preventive and Aerospace Medicine (PAM) Team, and other wartime NBC assets as part of an integrated, base-level medical NBC defense package.

Each MNBC Defense Team consists of three USAF BEE personnel, including one BEE and two BEE technicians. Each three-person MNBC Defense Team is tasked to perform medical NBC surveillance and provide NBC defensive capability at deployed locations. The team members perform contamination avoidance through base-wide surveillance and NBC agent collection, identification, and quantification. Using this information, the MNBC Defense Team also provides NBC health risk assessments to optimize combat operations and to support homeland security critical incident response management in NBC threat environments.

The MNBC Defense Team is assigned an equipment package (Unit Type Code [UTC] FFGL7). This UTC consists of sampling, analysis, and monitoring equipment for chemical, biological, and radiological hazards, and related support equipment (see Figure 1). When deployed, the MNBC Defense

Team is equipped for a 30-day mission capability. The current AS equipment package has been selected as the most effective way to address the full NBC threat spectrum, to provide comprehensive NBC defense capability, and to provide timely, comprehensive health risk assessments to the commander or crisis manager.

ACC modified the original MNBC Defense Team AS to include additional COTS NBC and infrastructure equipment. Annex B of this report contains a list of the AS equipment package used during this LMUA. ACC provided the AS and will use the results of this report to finalize the MNBC Defense Team AS.

Figure 1. CP Liner: *The SSS used during the MNBC Defense Team LMUA included CP liners fitted to the work center and the vestibule.*

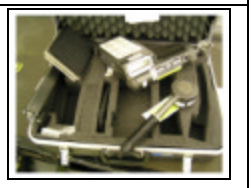
The MNBC Defense Team AS includes the following infrastructure equipment and associated supplies:

- Equipment and supplies to support collection, preservation, analysis, packaging, and shipment of air, water, soil, and other environmental samples
- One 32.5-foot by 20-foot SSS and an 8-foot by 20-foot extension used to support BAT operations
- Five programmable, encryptable Motorola 5000 communications systems with one base station
- Two network-capable notebook computers with compact disc/rewriteable (CD/RW) capability and loaded with HAPSITE sampling and identification software
- One portable, all-in-one printer
- One Global Positioning System (GPS) navigation device

During this assessment, one CP assemblage, which was used to provide NBC protection to the MNBC Defense Team and BAT work center (UTC FFCPA), was employed; however, the effectiveness and suitability of the CP liner was not evaluated. AFMESA reviewed the SSS components listed on the AS and verified that it was complete and is interoperable with the FFCPA. Although the CP liner is not part of the current MNBC Defense Team AS, it is considered part of the MNBC Defense Team force module. The ACC project leader stated that the MNBC Defense Team will be deployed with the allowance standard and an FFCPA. The FFCPA was included in this assessment to add realism, and to identify functionality and space issues created by the use of the FFCPA.

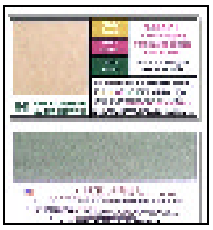
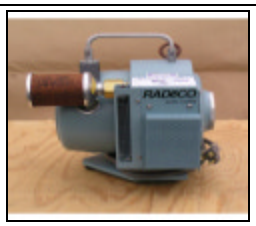
MNBC Defense Team AS equipment used to support NBC monitoring, sampling, collection, and analysis are identified in Table 2.

Table 2. Technology Descriptions: *This table describes the NBC equipment that is part of the MNBC Defense Team AS.*

NBC Equipment Description	Photo
One Drager Civil Defense Simultest (CDS) Kit that detects and identifies hazardous gas and vapors.	
One Drager Chip Management System (CMS) that uses gas-specific chips to identify and quantify hazardous gases and vapors in ambient air.	
One Dycor XMX Bio-aerosol Collector/Concentrator that provides liquid samples for biological assay, analysis, or immunoassay.	
Two types of Electronic Personal Dosimeters (EPD) are included in the AS. Six MK2 EPDs and two neutron EPDs are used to measure individual exposure to high-energy photon (gamma) and beta radiation, X-rays, and neutrons.	
Four ADM-300A Multifunction Radiac Meters that are capable of locating, identifying, and measuring alpha and beta particles and gamma and X-rays using individual probes.	
One SAM 935 Portable Surveillance and Measurement System that detects and identifies nuclides and mixed isotopes.	
One HAZCAT Chemical Identification System that uses reagents to confirm the presence, but not the concentration levels, of specific chemical substances using field chemical analysis.	

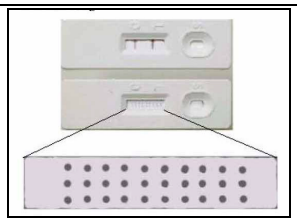
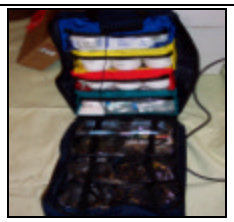
Continued

Table 2. Technology Descriptions (Continued): *This table describes the NBC equipment that is part of the MNBC Defense Team AS.*

NBC Equipment Description	Photo
M8 and M9 Chemical Agent Detector Paper are dye-impregnated papers that change color when exposed to liquid chemical agents or aerosols. • M8 paper comes in 4-inch by 2 ½-inch, 25-sheet booklets and is capable of detecting G-series and V-type nerve agents and H-type blister agents. The agents are identified by distinctive color changes in the paper. • M9 paper is rolled into 2-inch wide by 30-foot long rolls and is capable of detecting G-series and V-type nerve agents, H-type and L-type blister agents, but does NOT distinguish the identity of the agent.	
One M272 Chemical Agent Water Testing Kit is a reagent test kit used to determine whether water has been contaminated with G-series and V-type nerve agents, A-type blood agents, or H- and L-type blister agents. Color changes in the test tickets indicate the type and degree of contamination.	
One HAPSITE Portable Gas Chromatograph (GC)/Mass Spectrometer (MS) and HAPSITE Headspace Sampling System (HSS) that collect and analyze volatile organic compounds in air, water, and soil.	
Four portable RADeCO Grab Air Samplers that identify airborne chemical particulates and compounds.	
One TVA 1000B that uses flame ionization and photo ionization detection techniques to sample and measure gas concentrations.	
One HAZMAT ID analyzer that measures chemical interaction with infrared light and produces an infrared fingerprint. The fingerprint is analyzed to identify the chemical using an onboard chemical database library. The HAZMAT ID also has a limited capability to determine the presence of biological materials.	

Continued

Table 2. Technology Descriptions (Concluded): *This table describes the NBC equipment that is part of the MNBC Defense Team AS.*

NBC Equipment Description	Photo
One Victoreen 451P Advanced Survey Meter that is used to measure gamma and x-ray radiation.	
One handheld immunochromatographic assay (HHA) that is a one-time use, antibody-based test strip used to presumptively screen for various biological agents.	
One Quicksilver Sampling Kit that test water samples for the presence of chemical and biological agents.	

ACC included the HAPSITE in the AS due to the capability of this equipment to field confirm over 120,000 volatile/semi-volatile compounds, to include most chemical warfare agents. The HAPSITE has a detection limit of 3-4 orders of magnitude less than conventional detectors for most chemical warfare agents (e.g., the M22 and ICAM). HAPSITE accessories also enable analysis of various hazards in water and soil.

ACC included the HAZMAT ID in the AS due to the capability of this equipment to identify over 18,000 solids, liquids, dusty agents, and biological materials, excluding salts, metals, and simple structured molecules. No currently fielded system performs these functions at operational exposure levels.

The HAZCAT kit provides the MNBC Defense Team with the ability to identify most solids and liquids, including salts, metals and organic compounds. Use of the HAZCAT is intended to complement the capabilities of the HAZMAT ID.

The XMX is used to collect high volume air samples and impinge the respirable sample in a liquid. This process ensures the viability of biological samples, which is a capability not provided by currently fielded samplers. As a complement to the XMX, the RADeCO air sampler collects high volume air samples on a dry filter. The XMX and RADeCO air samplers are used to

enable the MNBC Defense Team to collect the full spectrum of airborne NBC threats.

The suite of NBC equipment included in the MNBC Defense Team AS is designed by ACC to reduce the confirmation time required and to reduce overall false positive and false negative results experienced with currently fielded equipment. HQ ACC/SGPB has previously examined the HAPSITE and HAZMAT ID and determined that each piece of equipment has fail-safe mechanisms that preclude operation of the equipment when environmental factors, such as temperature extremes, are reached. The fail-safe mechanisms are designed to increase the reliability of the HAPSITE and HAZMAT ID over such instruments as the ICAM, M22, M256, and M272, which have no such fail-safe mechanisms.

The equipment package is designed to provide an operational MNBC Defense Team work center, which can also support the BAT when collocated with the MNBC Defense Team. The equipment assemblage is shipped on two standard 463L pallets. One of the goals of this assessment was to determine the optimal number of pallets required to ship the MNBC Defense Team AS equipment package.

CONOPS Mission Mandate

The mission of the MNBC Defense Team is to perform base-wide airborne and environmental NBC sample collection and analysis to support comprehensive, timely human health risk assessments. The MNBC Defense Team performs presumptive and confirmatory sampling of suspected NBC contamination and assists with soil, air, water, food, and environmental sample collection. The MNBC Defense Team provides biological samples, which are suitable for field confirmation, to BAT personnel. MNBC personnel are uniquely trained to handle, package, analyze, and ship NBC-related samples, and will assist the PAM Team in collecting food and water samples in NBC threat environments. The MNBC Defense Team is also tasked to assist with critical incident response support for Homeland Security-related incidents.

The MNBC Defense Team CONOPS states that the team may be trained to operate Department of Defense HHA instrumentation and, with appropriate training, will be tasked to provide assistance to the BAT with sample collection. The MNBC Defense Team can also be asked by CEX to take custody of and transport biological agent screening samples to facilitate follow-up testing when definitive or confirmatory analysis is required.

The MNBC health risk assessment tasks include collection, collation, and analysis of NBC tactical reconnaissance data, identification and qualification of threat agents, exposure assessment, risk communication for the commander, and assessments of patient encounter data provided by medical personnel. The MNBC Defense Team provides health risk assessments that quantify and qualify NBC exposure data to determine short- and long-term health risks to personnel in contaminated operating environments (see Figure 2). The MNBC Defense Team also works with CEX and other NBC organizations to coordinate pre- and post-attack NBC health risks and provide advice to the commander related to MOPP declarations.

Figure 2. MNBC Defense Team: *The MNBC Defense Team prepares to conduct operations and initiate surveillance and collection activities.*

The MNBC Defense Team also captures epidemiological data in the appropriate Global Expeditionary Medical System database and provides this data to the PAM Team.

Objectives and General Assessment Approach

The objective of this LMUA event was to assess deployment, employment, and operational F3 of the MNBC Defense Team AS equipment package for use in the deployed operational environment.

The primary goals of this assessment included:

- Determine whether the MNBC Defense Team equipment package is adequate to enable collection, analysis, and reporting capabilities identified in the CONOPS.
- Determine the optimal configuration for packaging and deploying the MNBC Defense Team AS equipment package using standard 463L pallets.
- Assess the ability of the MNBC Defense Team to use advanced detection equipment in MOPP gear and in various environmental conditions (e.g., nighttime operations).

A secondary goal of this assessment was to determine the effectiveness and suitability of collocation and deployment of the MNBC Defense Team with the BAT in a single SSS and shelter extension with the FFCPA.

The LMUA events also generated data to identify and refine training and maintenance requirements for the MNBC Defense Team.

The assessment approach for this LMUA was designed to assess deployment and employment concepts of the MNBC Defense Team using

scenarios that were scripted to replicate a defensive NBC operational environment. The operational scenarios required MNBC Defense Team personnel to establish and operate the MNBC Defense Team work center, set up the infrastructure equipment package, and operate the NBC equipment, including the COTS NBC equipment added to the MNBC Defense Team AS equipment package.

Three MNBC Defense Teams that were selected to participate in this LMUA. Each team alternated exercising their equipment and demonstrating procedures in the operational scenarios, including the pack-out and palletization portion of the assessment. Subject matter experts (SME), representing participating USAF organizations, also provided subjective assessment and feedback; however, the SMEs did not directly participate in the assessment scenarios.

The Det 1 AFOTEC assessment team developed three critical operational issues (COI) and supporting objectives for this LMUA (see Table 3). More detailed measures are provided in the Execution section of this report.

Table 3. MNBC COIs: *The Det 1 AFOTEC team identified 3 COIs and 12 objectives for the assessment of the MNBC Defense Team AS equipment package.*

COI 1: Is the MNBC equipment package adequate to support MNBC Defense Team operations in the deployed environment?
Objective 1-1: Assess whether the allowance standard equipment package provides adequate infrastructure to support an MNBC Defense Team operational work center.
Objective 1-2: Assess the adequacy of the supply allowance to support 30-day mission capability of the MNBC Defense Team.
Objective 1-3: Assess the adequacy of the Motorola 5000 communications system to meet the communications requirements of the MNBC Defense Team.
Objective 1-4: Assess the ability of the MNBC Defense Team to effectively utilize the advanced NBC collection and analysis equipment to support the operational health service support mission of the MNBC Defense Team.
COI 2: Is the MNBC equipment package suitable to support the requirements of the MNBC Defense Team health service support mission?
Objective 2-1: Identify training issues or shortfalls that impact operator proficiency.
Objective 2-2: Assess the ease of setup of the MNBC sampling, analysis, and monitoring equipment by the three-person MNBC Defense Team.
Objective 2-3: Assess the ease-of-use of the MNBC sampling, analysis, and monitoring equipment.
Objective 2-4: Identify reliability and logistics supportability issues of the MNBC Defense Team allowance standard.
Objective 2-5: Assess the compatibility of the MNBC Defense Team equipment configuration in the SSS when collocated with the BAT.
Objective 2-6: Identify design and operational safety issues.
COI 3: Is the MNBC equipment allocation package the optimum configuration for support of the MNBC mission?
Objective 3-1: Validate the optimum equipment allowance standard suitable to support MNBC Defense Team operations.
Objective 3-2: Determine the optimal packaging/palletization of the MNBC equipment package.

Location

Det 1 AFOTEC conducted the MNBC Defense Team LMUA at the AFMESA EMEDS-XTI test site at Fort Detrick, MD. The LMUA was conducted in two parts. Part I was conducted 11–4 November 2003, and consisted of training and a pack-out and palletization exercise. Part II of the assessment, which took place 8–12 December 2003, validated the MNBC equipment package, determined the effectiveness and suitability of the operational concept of the MNBC Defense Team, identified the optimum set of components required to support the MNBC mission, and helped refine TTPs and the CONOPS.

Scenarios

Det 1 AFOTEC, ACC, and AFMESA developed a realistic set of NBC operational scenarios that were used to support the LMUA. The scenarios included a variety of deployment, employment, and operational activities that were designed to require MNBC Defense Team personnel to comprehensively demonstrate the adequacy and sufficiency of the infrastructure and NBC equipment. The operators were encouraged to identify potential improvements or modifications to the AS, to demonstrate the adequacy of the MNBC Defense Team Work Center configuration, to validate interoperability with the BAT, and to demonstrate the operational limitations of the NBC equipment.

The scenarios were initiated with a notional MNBC Defense Team/BAT deployment to a base site (see Figure 3). During this scenario, MNBC and BAT personnel completed equipment setup, checkout, and calibration, and initiated reporting activities designed to validate the MNBC Defense Team reporting methodology. The remaining scenarios involved a series of controlled operational scenarios using the MNBC Defense Team NBC equipment. The LMUA was concluded with a redeployment scenario that included pack out and palletization of the MNBC Defense Team AS equipment package. In all, the five scenarios used to support this assessment included:

Figure 3. Assessment Scenario #1: *The assessment was initiated using a timed scenario to unpack and set up the MNBC Defense Team AS.*

- An MNBC Defense Team deployment and employment scenario
- A chemical attack
- A radiological and biological attack, which included night operations
- A terrorist attack using weapons of mass destruction (WMD)
- Redeployment of the MNBC Defense Team

The scenarios are described in detail in Annex C of

this report. These scenario descriptions include scenario objectives, tasks, and activities that were performed to measure the successful completion of the scenario by MNBC Defense Team personnel.

Although actual samples were taken and run on the NBC equipment, no actual agents or simulants were used during this assessment. The actual capability and effectiveness of the NBC equipment were not assessed. Referee inject cards (RIC) and confidence checkers were used, where appropriate, during each operational scenario to simulate the presence of chemical and biological agents. The HAZMAT ID was programmed to identify antifreeze, which served as a substitute for VX, and the HAPSITE was preloaded with a chromatogram and spectra that were representative of VX.

Assessment Schedule

Table 4 reflects the overall schedule for the MNBC LMUA, including Parts I and II, from delivery of the assessment execution document (AED) through distribution of the Final Report.

Table 4. Assessment Schedule: *This LMUA took place in November and December 2003.*

Date	Activity
5 November 2003	Completed and distributed the AED
10 November 2003	Deployed to Fort Detrick, MD (Part I)
11–14 November 2003	Collected pack-out and palletization assessment data
15 November 2003	Re-deployed to Albuquerque, NM
7 December 2003	Deployed to Fort Detrick, MD (Part II)
8–12 December 2003	Collected operational F3 assessment data
13 December 2003	Redeployed to Albuquerque, NM
15 December–1 March 2004	Analyzed data and wrote draft Final Report
May 2004	Complete and distribute Final Report

Scope and Limitations

Table 5 details the limitations, impacts, and mitigation strategies of this LMUA.

Table 5. Limitations, Impacts, and Mitigation Strategies: *Det 1 AFOTEC identified five limitations that impacted the assessment.*

Limitation	Impact	Mitigation Strategies
Neither live NBC agents nor simulants were employed during this event.	The technical effectiveness of the NBC equipment was not assessed during this LMUA. The primary focus was an AS evaluation and military utility assessment.	The NBC equipment used during this assessment was COTS technologies whose effectiveness has been previously determined. Although actual soil, air, and water samples were taken, the assessment scope was limited to suitability and ease-of-use considerations.
Collection of traditional reliability, availability, and maintainability (RAM) data was not accomplished due to the short duration of the event.	RAM data were limited to documentation of equipment failure events and short-term maintenance issues identified by the operators.	Det 1 AFOTEC assessors structured the questionnaires and operator debriefings to gather available RAM data to support trend analysis.
Due to a power disruption in the work center on the first night of the LMUA, the NBC equipment batteries were not sufficiently charged at the start of operations the following day.	The low-battery condition delayed the initiation of operational scenarios on day 2 of the assessment and limited the ability of assessors to collect battery life data on some equipment.	Det 1 AFOTEC assessors delayed the start of the scenario to ensure the equipment was sufficiently charged to meet scenario requirements.
The TVA 1000B could not be operated during the assessment.	The TVA 1000B was not used at any time during the LMUA.	The problem could not be mitigated due to the absence of hydrogen gas, which is required to operate this piece of equipment.
The narrow scope of the assessment limited collection of sufficient usability data for the NBC equipment.	Usability data regarding the NBC equipment could not be collected for all environmental conditions.	Det 1 AFOTEC assessors and AFMESA personnel developed and provided an environmental impact table, which is contained in Annex D.

Participants

The following agencies, with their associated responsibilities, supported the MNBC LMUA:

- **AFMESA:** AFMESA provided a project officer, two SMEs, assessment technical support, the event venue, all assessment coordination and oversight, and frequency clearance coordination. AFMESA also handled related administrative support requirements.
- **ACC:** ACC provided four SMEs, including the project leader. ACC identified and coordinated the selection of all BEE personnel who participated in the LMUA as members of the MNBC Defense Team. ACC identified and selected six MNBC Defense Team personnel from Whiteman AFB, MO, and five from Langley AFB, VA, to participate in this event. All assessment participants from Whiteman AFB were

BEE personnel. The assessment participants from Langley AFB included one BEE, two BEE technicians, one laboratory technician, and one lab officer.

ACC coordinated shipment of the MNBC Defense Team AS equipment package required to conduct this LMUA. ACC also coordinated with vendor personnel and ensured that each participating vendor developed an appropriate training plan for the NBC equipment integrated into the LMUA.

- **Air Force Medical Logistics Office (AFMLO):** Two SME observers from AFMLO participated and provided logistical perspective and planning and assisted with supportability criteria and requirements for the MNBC Defense Team concept. AFMLO provided logistics support input and documentation, as required.
- **Det 1 AFOTEC:** Det 1 AFOTEC provided a test director, a lead analyst, a communications technician, three data collectors, and one research assistant. Det 1 AFOTEC personnel planned, developed, and conducted the assessment, conducted data collation and analysis, and completed the MNBC Defense Team LMUA Final Report.

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Execution

Operators

The 509th Medical Group (MDG) from Whiteman AFB, MO, and the 1 MDG from Langley AFB, VA, provided the personnel who participated as MNBC Defense Team and BAT members during this LMUA. Nine operators rotated participation in each of the NBC scenarios as the participating MNBC Defense Team. Six of the nine operators were members of the pilot unit from Whiteman AFB and averaged 10 years experience; three of the operators were BEE personnel from Langley AFB who averaged two years experience (see Figure 4). Pilot units helped develop and, at designated intervals, review, update, and validate UTCs, conduct logistics details, and document changes to an AS.

Figure 4. Assessment Support: *The operators who participated in this assessment were all BEE personnel and most had deployment experience.*

1 MDG personnel participated as the BAT. Where appropriate, these personnel also provided notional support as PAM team members to facilitate completion of the NBC scenario requirements.

Assessment Methodology

The objective of this LMUA was to assess deployment, employment, and F3 of the MNBC Defense Team and associated equipment package for use in the deployed operational environment pursuant to the MNBC Defense Team CONOPS. The assessment goals were to determine the adequacy of the MNBC Defense Team AS equipment package, to identify the optimal configuration for packaging and palletization of the equipment package, and to assess the utility of the advanced NBC equipment when used in various environmental conditions and while the operators were in MOPP gear.

The assessment measures Det 1 AFOTEC developed in conjunction with ACC and AFMESA were designed to determine the military utility, sufficiency, and suitability of the equipment package, identify interoperability issues, and to elicit operator input regarding the utility of the CONOPS. A complete list of the COIs, objectives, and subobjectives addressed by this LMUA are identified in Table 6.

Assessors evaluated various aspects of the MNBC Defense Team AS equipment package, including the Motorola 5000 communications system, the NBC equipment, and infrastructure equipment, focusing on F3 issues important to MNBC Defense Team operational effectiveness. Usability,

utility, and interoperability were of particular importance, although other attributes were evaluated as well.

Table 6. COIs, Objectives, and Subobjectives: *Assessment measures were developed to determine the adequacy and suitability of the MNBC Defense Team AS.*

COI 1: Is the MNBC equipment package adequate to support MNBC Defense Team operations in the deployed environment?
Objective 1-1: Assess whether the allowance standard equipment package provides adequate infrastructure to support an MNBC Defense Team operational work center.
Subobjective 1-1-1: Determine the adequacy of the infrastructure equipment package to support operation of the MNBC Defense work center.
Subobjective 1-1-2: Determine the adequacy of the size and sufficiency of the equipment of the SSS to support MNBC work center operations.
Subobjective 1-1-3: Determine the adequacy of the field deployable ECU to sustain work center operations.
Subobjective 1-1-4: Validate collocation compatibility of the MNBC Defense Team with the BAT.
Subobjective 1-1-5: Determine the sufficiency of equipment to mitigate environmental impact.
Objective 1-2: Assess the adequacy of the supply allowance to support 30-day mission capability of the MNBC Defense Team.
Subobjective 1-2-1: Determine the adequacy of consumables to sustain 30-day mission capability.
Subobjective 1-2-2: Identify additional consumables that would enhance the effectiveness of the MNBC Defense Team.
Objective 1-3: Assess the adequacy of the Motorola 5000 communications system to meet the communications requirements of the MNBC Defense Team.
Subobjective 1-3-1: Validate the most effective configuration of the Motorola communications system.
Subobjective 1-3-2: Determine the most effective number of radios required to support MNBC Defense Team operations.
Subobjective 1-3-3: Determine the sufficiency of the radio system to maintain effective communication with the Survival Recovery Center (SRC), the PAM, and the BAT.
Subobjective 1-3-4: Determine the sufficiency of the radio system to maintain communication with the medical facility Commander.
Objective 1-4: Assess the ability of the MNBC Defense Team to effectively utilize the advanced NBC collection and analysis equipment to support the operational health service support mission of the MNBC Defense Team.
Subobjective 1-4-1: Characterize user assessment of the utility/adequacy of the equipment to meet performance requirements established to monitor, collect, identify, and quantify chemical agents.
Subobjective 1-4-2: Characterize user assessment of the utility/adequacy of the equipment to meet performance requirements established to monitor, collect, identify, and quantify biological hazards.
Subobjective 1-4-3: Characterize user assessment of the utility/adequacy of the equipment to meet performance requirements established to monitor, collect, identify, and quantify nuclear and radiological agents.
Subobjective 1-4-4: Characterize user assessment of the sufficiency of the NBC sample packaging and storage equipment.
Subobjective 1-4-5: Determine the usability and suitability of the data collection methodology to compile exposure data and track exposures and to support production of a health risk assessment.
Subobjective 1-4-6: Assess the chemical, biological, radiological, nuclear threat capability spectrum of the MNBC equipment package as required by the CONOPS and medical doctrine.

Continued

Table 6. COIs, Objectives, and Subobjectives (Concluded): *Assessment measures were developed to determine the adequacy and suitability of the MNBC Defense Team AS.*

COI 2: Is the MNBC equipment package suitable to support the requirements of the MNBC Defense Team health service support mission?
Objective 2-1: Identify training issues or shortfalls that impact operator proficiency.
Subobjective 2-1-1: Characterize user assessment of the adequacy of the equipment training.
Sub-objective 2-1-2: Characterize user assessment of the adequacy of MNBC Defense Team process and procedure training.
Objective 2-2: Assess the ease of setup of the MNBC sampling, analysis, and monitoring equipment by the three-person MNBC Defense Team.
Subobjective 2-2-1: Characterize user assessment of ease of unpacking and assembly of the NBC equipment in the SRC.
Subobjective 2-2-2: Characterize user assessment of the ease of calibration of the NBC equipment.
Objective 2-3: Assess the ease-of-use of the MNBC sampling, analysis, and monitoring equipment.
Subobjective 2-3-1: Characterize user assessment of the ease of operation of each piece of NBC equipment while in MOPP 0.
Subobjective 2-3-2: Characterize user assessment of the ease of operation of each piece of NBC equipment while wearing MOPP 4.
Objective 2-4: Identify reliability and logistics supportability issues of the MNBC Defense Team allowance standard.
Subobjective 2-4-1: Identify operational failures of the NBC equipment.
Subobjective 2-4-2: Characterize user assessment of ability to maintain the NBC equipment in an operational environment.
Subobjective 2-4-3: Characterize user assessment of ability to maintain the NBC equipment in an operational environment during the mandated minimum 30-day mission capability.
Objective 2-5: Assess the compatibility of the MNBC Defense Team equipment configuration in the SSS when collocated with the BAT.
Subobjective 2-5-1: Assess the adequacy of space to support interoperability of the BAT and the MNBC Defense Team.
Subobjective 2-5-2: Assess sufficiency of power to support collocated operations in the SSS.
Objective 2-6: Identify design and operational safety issues.
Subobjective 2-6-1: Identify system design flaws that impact user safety.
Subobjective 2-6-2: Characterize user risk level assessment for potential operator injury while conducting NBC monitoring, sample collection, and analysis activities.
COI 3: Is the MNBC equipment allocation package the optimum configuration for support of the MNBC mission?
Objective 3-1: Validate the optimum equipment allowance standard suitable to support MNBC Defense Team operations.
Subobjective 3-1-1: Characterize the adequacy of the MNBC equipment allowance.
Subobjective 3-1-2: Identify additional technology, both supplementary and complementary, that could address shortfalls in the current capability offered by the allowance standard.
Objective 3-2: Determine the optimal packaging/palletization of the MNBC equipment package.
Subobjective 3-2-1: Assess the size, weight, and cube of the MNBC allowance standard to identify impacts on transportability limitations.
Subobjective 3-2-2: Characterize user assessment of the suitability and sufficiency of the two-pallet transport limitation.

Data Sources

The Det 1 AFOTEC assessment team used multiple methods to gather data to address the measures. Data collection event logs were used to record event-timing data and issues and operator comments and observations. Questionnaires were the primary tool used to gather operator assessment of utility, usability, suitability, and recommended system configuration changes.

Observers used ***event logs and timelines*** to record a variety of events encountered during the LMUA, including equipment failures, performance inadequacies, and times required for task operation.

The assessment team administered ***questionnaires*** to all MNBC Defense Team members. Questionnaire items asked respondents to rate the adequacy of the individual NBC equipment, the MNBC Defense Team AS, and utility and usability of the Motorola 5000 communication system. The questionnaires included requests for operator input regarding design features, functions, and utility using a simple four-point agreement rating scale (Strongly Disagree, Disagree, Agree, and Strongly Agree).

The assessment team held daily ***interviews and debriefings*** to elicit operator feedback regarding equipment operation and to obtain general comments regarding adequacy, sufficiency, and suitability of the MNBC Defense Team equipment package. The assessment team documented operator comments using handwritten notes. Debriefing sessions provided evaluators with an opportunity to document circumstances surrounding significant assessment events that may not have been directly observed. One-on-one interviews were used to explore key areas with specific operators. These interviews also provided an opportunity to identify problems or issues that required immediate attention.

Training

Training was conducted during Part I of this LMUA. Vendors provided training for the HAZMAT ID and the HAPSITE. A Det 1 AFOTEC communications technician provided training for the Motorola 5000 communications system. Follow-up familiarization training was provided for the Motorola 5000 communications system prior to the initiation of assessment activities during Part II of the LMUA.

Experienced operators (from the user group) provided additional training for the RADeCO air sampler, the XMX Bio-aerosol Collector, the Drager CDS Kit, the Drager CMS, the ADM-300A radiac meter, and the HAZCAT.

Each of the training modules included hands-on participation by the operators (see Figure 5), which afforded each assessment participant with the opportunity to exercise each piece of NBC and communications equipment prior to initiation of the LMUA scenarios. Training activities included removal and replacement of various parts and batteries, as well as use of the NBC equipment while in MOPP gear and in notional operational settings.

Figure 5. Training: *Training was conducted by vendors, Det 1 AFOTEC, and experienced operators.*

Although personnel from the 311th Human Systems Wing (311 HSW) and AFMESA set up the SSS and the FFCPA, informal instruction and guidance were also provided to the participants at the start of Part I of the assessment. The purpose of this instruction was to familiarize the operators with the operation of this equipment and to enable them to successfully operate this equipment in a notional CP environment during Part II of the LMUA.

The Det 1 AFOTEC technician also conducted a walk-through of the Motorola 5000 communications system setup with the MNBC Defense Team, including antenna and base station setup, to ensure that the system was operational and met functionality requirements for the exercise.

Post-Event Activities

At the conclusion of the assessment, the Det 1 AFOTEC assessment team backed up all electronic media on disks, which were hand-carried to Det 1 AFOTEC. All Motorola 5000 communications system equipment was inventoried and returned to AFMESA. The MNBC Defense Team AS equipment package was returned to ACC and other agencies, as appropriate.

Upon return to home base, the assessment team completed data entry and verification activities. Analysts generated charts, graphs, and tables to portray results of each assessment, where applicable, for insertion into this Final Report. Material from interviews, debriefings, and field observations has been used to supplement and explain important findings.

Data sources, including completed questionnaires and observer logs, were stored at Det 1 AFOTEC. The database and supporting software have been archived on compact disk so electronically stored data are available for future review. A complete set of final analysis products also was archived.

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Results

This section of the Final Report includes the results of operator observations and feedback regarding the utility, adequacy, suitability, and usability of the revised MNBC Defense Team AS equipment package. Operators considered two distinct parts of the AS: the infrastructure equipment and the NBC equipment included in the new AS.

The AS infrastructure equipment includes the SSS, the shelter extension and related equipment, the Motorola 5000 communications system, and the consumables package. The NBC equipment included items previously used to support BEE activities and NBC equipment that has been added to the new MNBC Defense Team AS equipment package.

COI 1: Is the MNBC equipment package adequate to support MNBC Defense Team operations in the deployed environment?

This COI addressed the effectiveness of the system to provide NBC support for medical operations. The supporting measures captured both objective and subjective data.

Operators favorably considered the suitability and effectiveness of the SSS and shelter extension to support MNBC Defense Team and BAT operations, although several shortcomings were noted. Operators also identified utility, usability, and suitability issues related to the NBC equipment items that are part of the AS equipment package.

Overall, the MNBC Defense Team AS equipment package was considered adequate to assess the spectrum of chemical, biological, and radiological threats as identified the team CONOPS and current medical doctrine.

Objective 1-1: Assess whether the allowance standard equipment package provides adequate infrastructure to support an MNBC Defense Team operational work center.

Adequacy of the Infrastructure Equipment

Although 78 percent of the operators *Agreed* that the infrastructure equipment (e.g., current field office equipment, computers, printers, and office supplies) was adequate (see Figure 6) to support the mandated 30-day mission capability of the MNBC Defense Team, numerous changes were suggested in order to improve the efficiency of work center operations.

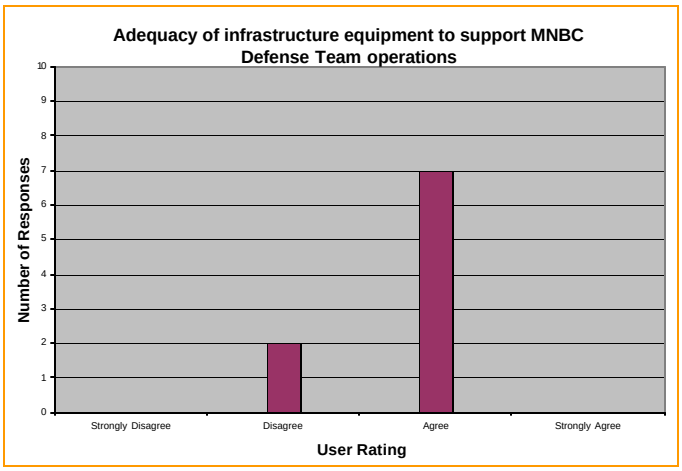


Figure 6. Adequacy of Infrastructure Ratings: *Seventy-eight percent of operators Agreed that the AS infrastructure equipment was adequate.*

During Part I of the LMUA, operators determined that, although the current infrastructure equipment provides military field desks and nesting boxes, which can be converted to shelving for storage and other uses, this equipment is inadequate to effectively support the amount and type of NBC equipment used by the MNBC Defense Team during operational activities. All operators suggested that the nesting boxes continue to be part of the AS until a suitable alternative is identified, such as high-density plastic shelving. Although some operators suggested that the number of nesting boxes be reduced, none were able to suggest a suitable number or type of boxes that should be retained. The weight of the nesting boxes and pallet space considerations were cited as their most significant shortcomings.

However, as an interim solution, BEE and BAT personnel suggested that wider field desks would be better suited to support the NBC equipment or that laboratory-type folding tables should be considered for inclusion in the AS.

During the LMUA, AFMESA provided the MNBC Defense Team and the BAT with four, 6-feet by 30-inch metal folding tables (see Figure 7). All four of these tables were used to support BAT equipment and operations. Two of these tables were located in the BAT work area and two were located in the MNBC Defense Team work area. Operators stated that, without these additional tables and a suitable number of additional folding chairs, arranging the MNBC Defense Team/BAT equipment in the work center in an efficient and effective manner would be difficult. At least two operators suggested that two additional laboratory-type tables with chairs and one additional, larger field desk would be required to adequately support equipment setup and operation.

Figure 7. Laboratory Tables: *Operators suggested that standard laboratory folding tables and chairs be included to support MNBC Defense Team and BAT interoperability in the work area.*

During execution of the assessment scenarios, users noted that a vehicle would be required to accomplish the CONOPS mission mandate of the MNBC Defense Team. Due to the anticipated operational environment, all users identified the need for a four-wheel drive vehicle to move equipment and transport personnel to the sampling and perimeter equipment sites.

Night operations were conducted during Part II of the LMUA. The lights at the AFMESA assessment site were turned off and the operators attempted to operate the NBC equipment using ambient light and blue, red,

and white chemical light sticks provided in the MNBC Defense Team equipment package (see Figure 8). Red and white light sticks were insufficient light sources, and the blue light sticks proved to be totally inadequate. Operator consensus was that color light sticks should not be included in the AS equipment package unless tactical considerations dictate otherwise. Until an improved light source is identified, operators recommended that the overall number of light sticks be increased and that the light sticks be larger and longer lasting.

Figure 8. Night Illumination: *The light sticks that are included in the MNBC Defense Team AS proved inadequate to support night operations.*

In lieu of color light sticks, operators noted the utility of light-emitting diode (LED) headlamps. Several operators cited previous operational experiences with headlamps and recommended consideration be given for inclusion of the headlamps in the MNBC Defense Team AS.

The only flashlight available was a small penlight included in the Quicksilver Sampling Kit (see Figure 9). The penlight proved to be virtually useless to support MNBC Defense Team night operations. Operators identified numerous operational requirements for flashlights or headlamps. The flashlights were considered essential for general operational activities conducted in no- or low-light conditions, including maintenance of the ECU, safety considerations, and exterior shelter repair activities. Operators also noted the utility of hands-free operation of the NBC equipment afforded by use of the headlamps.

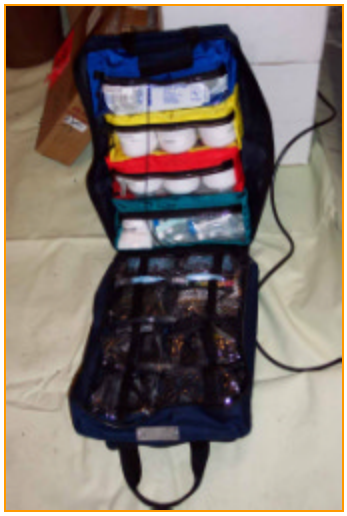


Figure 9. Quicksilver Sampling Kit: *The Quicksilver Sampling Kit contained the only flashlight available to support night operations.*

The software loaded on the two laptop computers included in the equipment package was outdated and had not been appropriately upgraded. Additionally, lack of sufficient replacement computer and printer supplies, such as spare printer cartridges, was cited as unacceptable.

The operators did not have an administrative pass code, and the computers were not equipped with an Ethernet card. As a result, MNBC Defense Team personnel spent most of the morning on the first day of operations trying to access the computers and completing computer software upgrades. Operators noted that a regular schedule of maintenance and software upgrades should be in place to address this deficiency in a timely manner.

Operators suggested that the laptop computers include a CD/RW capability, as well as other pertinent upgrades. The CD/RW capability facilitates timely exchange of NBC information with the BAT, the PAM, the CEX, and other medical, chemical, and biological personnel and organizations.

The following items were identified by operators as infrastructure items necessary to improve the performance of the MNBC Defense Team and the BAT:

- A propane tank for the HAZCAT (required for HAZCAT use) (Note: Transport of a suitable propane tank will require appropriate hazardous cargo training. No systematic procedures for propane refill in the field have been established, and no alternative deployed propane source has been identified. This is an important consideration and bears directly on the utility of the HAZCAT.)
- A trolley or hand truck to move equipment to, from, and within the shelter
- Hearing protection, such as disposable earplugs, for use when operating the generators
- Soft backpacks for toting NBC equipment to sampling locations
- A full-size refrigerator or suitable alternative to the current small refrigerator, which was considered inadequate (Note: The refrigerator is essential since it is used to store HHAs, ice packs, sample collections, batteries, and other equipment.)
- Extra power cables since the BAT AS does not have power cables that are compatible with the shelter power distribution hardware.
- Push brooms to replace straw brooms
- Tamper proof tape which is tear resistant

One operator noted the absence of sufficient power cables, stating, *"Power cables were being taken from the MNBC to BAT, which may potentially cause problems in deployed areas."*

SSS Extension and Related Components

The MNBC Defense Team work center is designed with a standard SSS that is used normally to support EMEDS operations and a shelter extension. The SSS is a 32.5-foot by 20-foot shelter. The 20-foot by 8-foot extension is dedicated to BAT operations and is used to provide a work area for the BAT, which may be collocated with the MNBC Defense Team work center. For this assessment only, a 15 foot-long vestibule also was added to support CP operations (see Figure 10).

The work center is a field deployable SSS and extension, and includes the FFCPA. Chemical protection is achieved through the use of CP liners, combined with NBC filters at the ECUs. Two blowers push air through the hermetically sealed filter canister to pressurize the shelter.

The CP liners (see Figure 11) are connected to the shelter with ties and are sealed with two-track zipper closures where the liners adjoin. The CP liners are designed to resist liquid and vapor chemical and biological threats. The entire shelter system (including the vestibule) is pressurized. The vestibule

facilitates work center access and egress for supplies and equipment in a deployed environment.

The vestibule is fitted with two, two-door bump-through door (BTD) assemblies, and is pressurized by an all-weather, positive pressure, air filtration system, which circulates and filters the air in the vestibule. This system ensures appropriate air quality. Air pressure loss due to bleeding at the doors is mitigated by the BTD assemblies. The work center and the CP liners were installed by personnel from the 311 HSW and AFMESA prior to the initiation of the LMUA. AFMESA reviewed the SSS components listed on the AS and verified that it was complete and therefore will be interoperable with the FFCPA. Setup of the shelter and CP liner was not assessed during the assessment events.

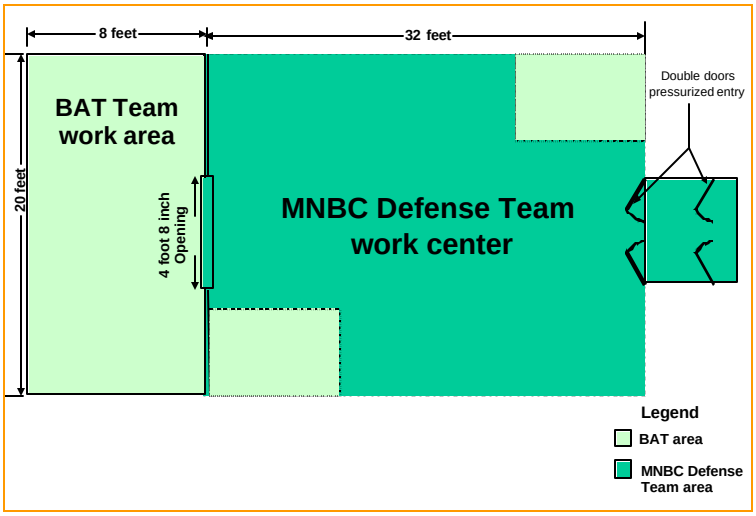


Figure 10. MNBC Defense Team/BAT Shelter Setup: *The MNBC Defense Team work center is collocated with the BAT work area to provide interoperability and facilitate exchange of NBC samples and documentation.*

Prior to initiation of the NBC operational scenarios, MNBC Defense Team and BAT personnel received an orientation for the FFCPA, but no formal training. The MNBC Defense Teams inspected the work center and the operational components to validate operation and to identify any pre-event setup issues. No issues were noted. Positive pressure was maintained, and no shelter or shelter component failures were noted during Part II of the LMUA.

Figure 11. CP Liner: *The CP liner is installed throughout the MNBC Defense Team work area to enable operations in a chemical environment.*

Anecdotal user comments and assessor observations indicate that properly trained MNBC Defense Team and BAT personnel, augmented by EMEDS, PAM, or other available personnel, would be able to successfully set up the SSS, shelter extension, and install the CP liner.

The MNBC Defense Team CONOPS does not identify procedures for access and egress of personnel and equipment to the work center in a contaminated environment, and an assessment of this critical process could not be completed. In the absence of formal training, direct user involvement in the setup and the operation of the FFCPA, the lack of TTPs, and the absence of established processes and procedures, definitive conclusions regarding the use of the FFCPA are limited to the need for ACC to address employment and

training shortfalls. Operator training and implementation of required process and procedures were not addressed by ACC during this assessment.

The BTDs functioned as designed to maintain positive pressure and quality of air requirements; however, Det 1 AFOTEC assessors and numerous operators noted that the operation of the interior BTD assembly was inhibited by poor CP liner fit above the BTD assembly. Even while pressurized, the BTDs could not be easily opened without rubbing against the CP liner. In order to facilitate access and egress, and to prevent potential damage to the liner, MNBC Defense Team personnel used cotton rope to raise the CP liner and keep it in place.

Figure 12. BTD: *Smooth operation of the BTD between the work center and the vestibule became a serious functional problem for MNBC Defense Team and BAT personnel.*

Eighty-eight percent of operators *Agreed* or *Strongly Agreed* that the size of the SSS used to support MNBC Defense Team and BAT operations, which was enlarged by the addition of a shelter extension, is sufficient to effectively perform work center operations (see Figure 12). However, four operators *Agreed* that the "tent will be tight with Ruggedized Advanced Pathogen Detection Device (RAPID), BAT, and UTC FFGL1 personnel."

None of the operators noted any issues regarding the overall quality of the internal work center environment, including the adequacy of the lighting, the capability to maintain acceptable noise levels, temperature and humidity levels, and the sufficiency of the number of straps for hanging various types of equipment. However, at least three operators indicated concern with the durability of the flooring used in the SSS. Without citing previous experience or actual durability data, the operators stated their belief that the flooring would not survive the rigors of daily use by the MNBC Defense Team and BAT. Operators noted that personnel and equipment are constantly being brought into and taken out of the MNBC Defense Team work area, creating heavy traffic on the flooring.

Adequacy of the ECUs

Eighty-eight percent of operators *Agreed* or *Strongly Agreed* that the ECU included in the equipment package is adequate for MNBC Defense Team and BAT work center operations. No ECU failures were noted during Part II of the LMUA.

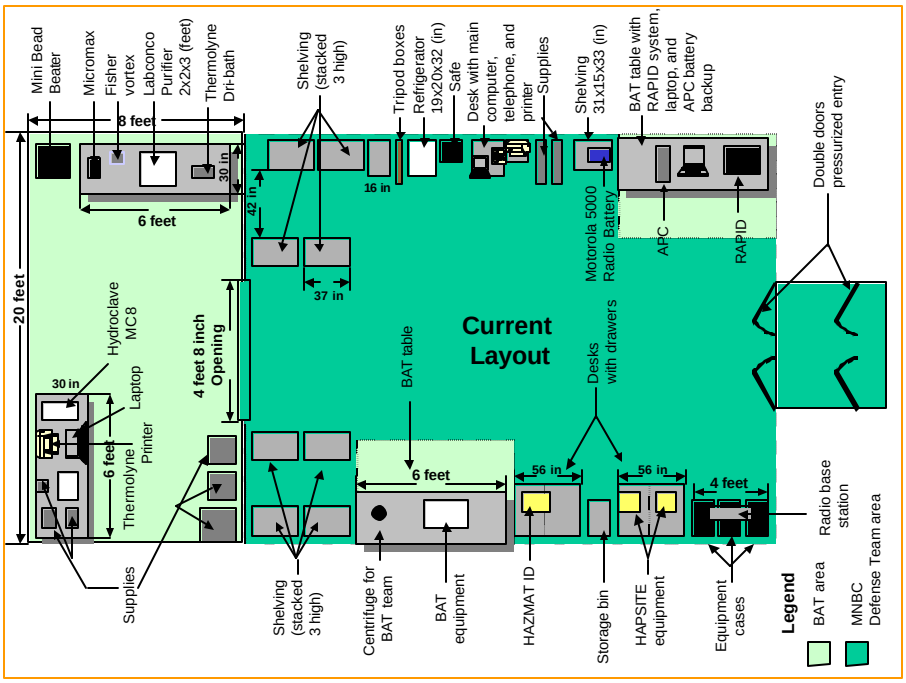
MNBC Defense Team/BAT Collocation Compatibility

The MNBC Defense Team CONOPS describes the MNBC Defense Team and the BAT as part of a base-level NBC defense package. As such, the CONOPS calls for consideration of co-location of these two teams at a bed-down location where an NBC threat is anticipated or develops. The CONOPS defines tactical procedures and the health service support mission of the MNBC Defense Team and the BAT and identifies the scope and nature of the

interface between the two teams. The CONOPS mandates that the MNBC Defense Team will perform various NBC sample collection activities, will provide presumptive identification of biological agents and various pathogens of operational concern, and will assist and support the BAT with follow-on pathogen and agent identification activities.

The MNBC Defense Team CONOPS states that the BAT may be collocated with the MNBC Defense Team due to similarity of mission focus and equipment needs and requirements. The MNBC Defense Team infrastructure package is designed to serve as a collocated MNBC Defense Team and BAT work center. For purposes of this LMUA, ACC requested that this assessment be conducted based on the assumption that the MNBC Defense Team and the BAT will, in fact, be collocated. The space provided in the SSS extension was designed to support compatibility of these two NBC defense teams.

The scenarios used to support this assessment were set up to require interface between the MNBC Defense Team and the BAT in order to identify any collocation incompatibilities related to the mission mandate of each team. The MNBC Defense Team CONOPS does not provide direction regarding the configuration of the equipment package in the work center. Therefore, during Part I of the LMUA, the assessment participants, both MNBC Defense Team and BAT personnel, were encouraged to establish a usable work center configuration. This schematic, which is reflected in Figure 13, represents the initial configuration developed by the team members, which served as the configuration template used to support work center operations during Part II of the LMUA.



APC = American Power Conversion (battery); in = inches

Figure 13. MNBC Defense Team and BAT Work Center Layout: *This figure represents the initial equipment layout in the work center.*

The initial equipment layout identifies placement of both the MNBC Defense Team and BAT NBC equipment in the work center. Due to concerns for cross contamination of samples and other potential BAT sample handling issues, some BAT equipment, including the RAPID, were located in the front of the MNBC Defense Team work area. Operators generally agreed that this layout and available workspace were adequate to support the mission of the two teams. Overall, 89 percent of the operators agreed the mission of the two teams was compatible with collocation in the work center.

However, as a result of their experience during the LMUA, the operators reconfigured the work center, indicating a preference for a more effective and efficient alternative interior equipment configuration (see Figure 14).

BAT SMEs specifically recommended that the table where reagents are added should be moved to the corner of the shelter. Changing the location of the reagent worktable to a relatively isolated corner of the shelter is intended to provide a more isolated work area when used in conjunction with a divider or curtain. The purpose of this change is to reduce or mitigate the possibility for cross contamination of the samples.

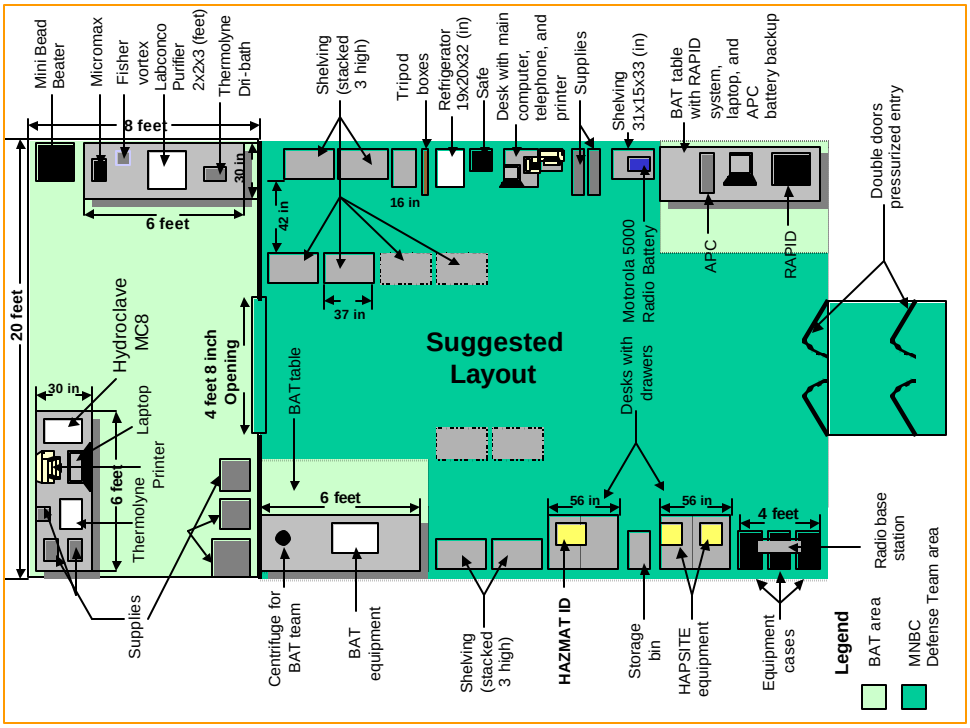


Figure 14. Revised Equipment Configuration: *As a result of the LMUA, operators designed an alternative equipment configuration to provide an isolated work area for the BAT.*

Environmental Impact

Operators identified potential sources of pollution and other environmental impacts of the MNBC equipment.

Operators noted that there is no current methodology identified for the MNBC Defense Team AS to address the need for effective hazardous and infectious waste disposal. The AS does not include hazardous waste containers that can be used to safely dispose of the waste generated by the MNBC Defense Team. For example, HAZMAT ID waste includes used containers and collection tools, plastic tarps, gloves, and MOPP gear. In addition, there is no standardized method identified in the CONOPS for conducting low-level decontamination of personnel and equipment. Both of these issues will require CONOPS and AS reconsideration.

Objective 1-2: Assess the adequacy of the supply allowance to support 30-day mission capability of the MNBC Defense Team.

Although 71 percent of the operators *Agreed* that the AS consumables are sufficient to sustain a 30-day mission capability, 29 percent *Disagreed* with the statement (see Figure 15). Operators identified several consumables that may be inadequate given deployment in a far-forward, austere operational environment, including:

- Spare printer cartridges (consider three optimal)
- Additional Ziploc bags of various sizes for sampling
- Additional 9-volt batteries

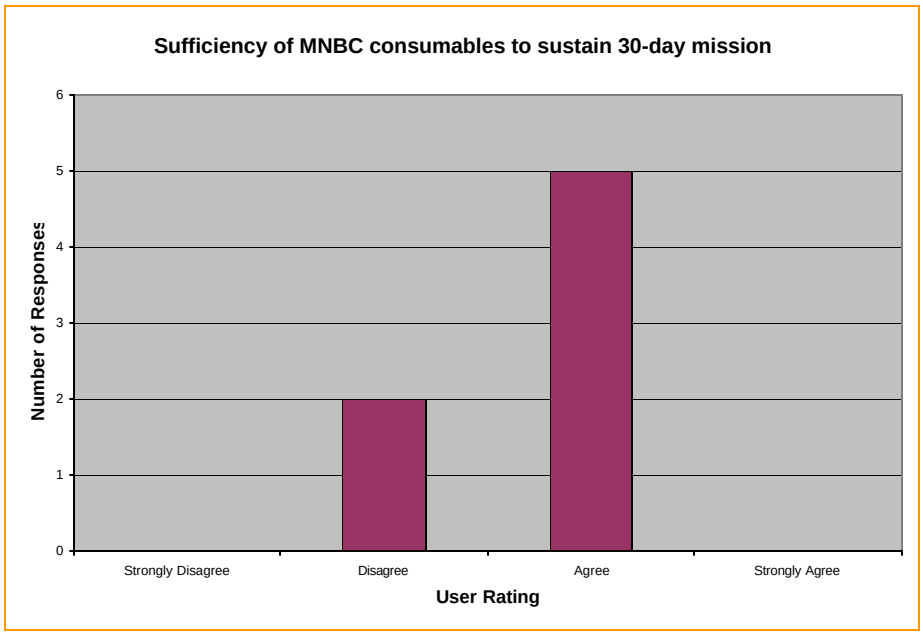


Figure 15. Sufficiency of MNBC Consumables Rating: *Seventy-one percent of operators Agreed that the consumables were sufficient; however, operators also identified several consumables that may be inadequate given deployment in a far-forward, austere operational environment.*

Objective 1-3: Assess the adequacy of the Motorola 5000 communications system to meet the communications requirements of the MNBC Defense Team.

The Motorola 5000 communications system will replace the Scope Shield mobile radios currently used to support MNBC Defense Team operations. Communications integration with the base communications network was simulated, with connectivity established with a notional SRC manned by a representative of ACC who functioned as the MNBC representative at the SRC.

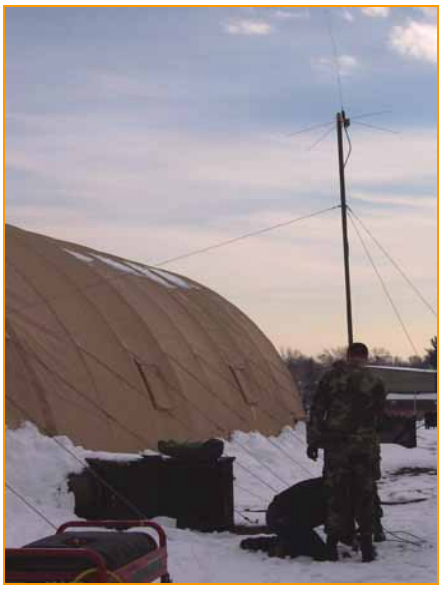


Figure 16. Motorola Communications System: *A Det 1 AFOTEC technician provided direction to the operators to support setup of the antenna/mast kit.*

AFMESA provided the Motorola 5000 communications system used to support this LMUA. The equipment included five Motorola 5000 handheld radios with belt clips, 10-inch rubber duck antennas, extended microphones, a base station, a six-gang charger, and an exterior antenna set. The antenna setup included a 292 antenna kit, a 50-foot helix cable, a 20-foot mast, and a ground plane antenna (see Figure 16). The handheld radio transmits signals at 5 watts via its own rubber duck antenna. The Det 1 AFOTEC instrumentation and communications specialist who participated in this LMUA coordinated the assignment of sufficient frequencies to support the event.

The revised AS for communication equipment calls for five Motorola 5000 radios and one base station. The base station requires the use of one of the Motorola 5000 radios, which leaves four radios available for the MNBC Defense Team. There is currently no provision in the MNBC Defense Team AS for a radio mount for a vehicle.

To support the operational scenarios, a base station was set up in the MNBC Defense Team work center with a six-gang charger. A 292 antenna kit mounted on a 20-foot mast was erected approximately 15 feet from the SSS. The antenna was connected to the base station using a 50-foot helix cable. The remaining four radios were used by MNBC Defense Team personnel throughout the LMUA. Radio use was limited to the AFMESA assessment site, and the radios were used at a radial distance of no more than 300 feet from the mast-mounted antenna.

Using the radio simplex mode, operators attempted to communicate with the base station and radio-to-radio at various sites in the immediate vicinity of the MNBC Defense Team work center. No encrypted communications were used.

At no time during the LMUA was communication lost. Assessors noted the locations where communications were attempted and noted the ranges from which communications were effected. The radios were used by MNBC

Defense Team personnel with and without MOPP 4 gear and while supporting day and night operations.

There was some operator disagreement over the appropriate number of radios to be included in the AS. Although 78 percent of the operators *Agreed* or *Strongly Agreed* that a standard allocation of five handheld Motorola 5000 radios, which is the current AS allocation, is adequate to support MNBC Defense Team operations, several noted that the BAT did not have handheld radios (see Table 7). This issue would more properly be considered as part of a follow-on BAT AS validation.

Forty-five percent of operators indicated that they *Agreed* and 55 percent *Strongly Agreed* that the Motorola 5000 communication systems were easy to use. While wearing MOPP 4, the operators were less sanguine and caveated their responses. While 79 percent of the operators *Agreed* that the radios were easy to use while wearing MOPP 4, this perspective was predicated on the use of voice emitters with the standard NBC mask and extended microphones. Without the mask voice emitters and extended microphones, the usability of the radios while the operator is in MOPP 4 is significantly reduced.

Table 7. Recommended MNBC Defense Team Radio Equipage: *This table reflects operator recommendations regarding the number Motorola 5000 radios and system components that would be sufficient to support MNBC Defense Team operations.*

Equipment	Quantity
Handheld radio with belt clips	5
Extended microphones	4
Base station	1
292 antenna kit	1
20-foot mast and erection hardware	1
500-foot helix cable	1
Ground plane antenna	1
Six-gang charger	1

One operator commented that the 10-inch rubber duck antenna used with the handheld radio is too long and “got in the way.” He suggested that a shorter antenna be considered, particularly when operators are wearing MOPP 4 gear. Another operator indicated that the length of the radio antenna affects ease of use. He noted particularly that, while wearing MOPP gear, the antenna tended to get caught on equipment or parts of the over-blouse. He suggested that a shorter antenna also be considered as an alternative for use in operational environments where movement is constricted or difficult due to specialized equipment, such as the MOPP gear. It should be noted that during this event, use of the radio was limited and operators were not required to change channels on the radio when the radio was attached to the belt clip. The operators were not required to view the LED display to change or verify channel selection.

The short duration of this assessment precluded collection of traditional RAM data for the Motorola 5000 communications system. However, during the LMUA, no system failures were noted, and all operators *Agreed* (55 percent) or *Strongly Agreed* (45 percent) that the system performed reliably during the operational phase of the LMUA (see Figure 17).

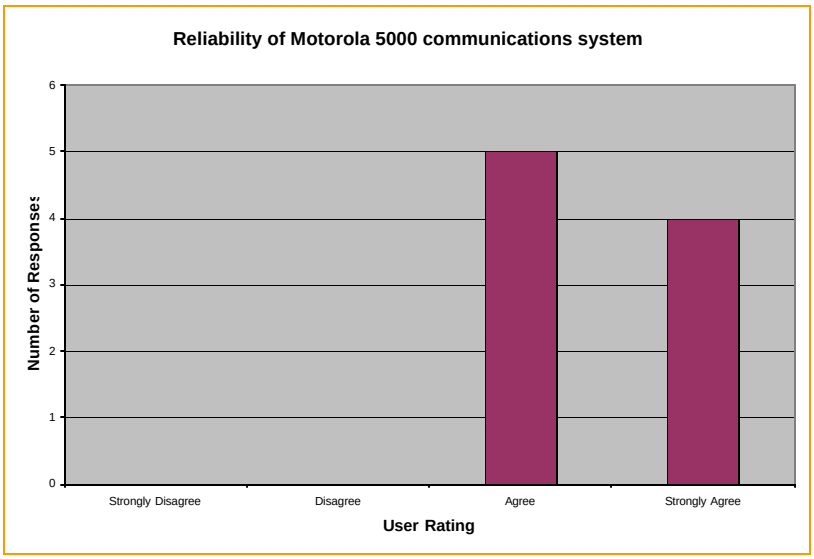


Figure 17. Reliability of Motorola 5000 Ratings: *One hundred percent of operators Agreed/Strongly Agreed that the Motorola 5000 communications system operated reliably.*

Objective 1-4: Assess the ability of the MNBC Defense Team to effectively utilize the advanced NBC collection and analysis equipment to support the operational health service support mission of the MNBC Defense Team.

AFMESA, ACC, and Det 1 AFOTEC developed a set of five realistic operational scenarios that were used to support this LMUA (see Annex C). These scenarios included a variety of deployment, employment, and operational activities that were designed to demonstrate the operational capabilities of the MNBC Defense Team, to validate sample collection and passive monitoring and surveillance capabilities, and to assess the usability and suitability of the NBC equipment for NBC agent identification and quantification.

All NBC equipment was used by MNBC Defense Team personnel without MOPP gear and while wearing MOPP 4. Although various samples were taken and analyzed using the NBC equipment, no actual identification, quantification, or NBC agent collection was performed. Although antifreeze was used to reflect the presence of VX, and both a chromatogram and spectra were used to program VX, no simulants or actual agents were used during this assessment, and the technical capabilities of the equipment to identify agents or simulants was not assessed. Actual use of the NBC equipment included air, water, and soil samples taken at the test site. RICs and confidence checkers

were used to support the scenarios. The operational use of the NBC equipment was limited to existing environmental conditions at the assessment site.

The primary NBC equipment used during the operational scenarios included the following:

- ADM-300A Multifunction Radiac Meter
- M272 Chemical Agent Water Testing Kit
- Drager CMS
- Drager CDS Kit
- EPDs
- HAPSITE GC/MS and HAPSITE HSS
- HAZCAT Chemical Identification System
- HAZMAT ID
- RADeCO Grab Air Sampler
- SAM 935 Portable Surveillance and Measurement System
- TVA 1000B
- XMX Bio-aerosol Collector
- Quicksilver Sampling Kit Model 256A1

Various MNBC Defense Team members operated each piece of NBC equipment during the operational scenarios. None of the NBC equipment was universally operated by all the individuals in the operator group. Operators were asked to assess the usability and suitability of the NBC equipment to support the operational performance requirements of the MNBC Defense Team, whether for passive monitoring, collection, or sample identification.

The list of NBC equipment contained in the MNBC Defense Team AS includes equipment items that are long-term staples used to support NBC operations, such as the M272 Chemical Agent Water Testing Kit and the ADM-300A radiac meter. The remaining pieces of NBC equipment have recently been added to the MNBC Defense Team AS. This assessment was primarily focused on the upgraded MNBC Defense Team equipment. ACC requested that operators identify AS NBC equipment items that do not meet the utility, usability, or effectiveness requirements of the MNBC Defense Team mission. The new AS items include chemical, biological and radiological sampling, identification, and quantification equipment pieces that are being used to support the MNBC Defense Team CONOPS methodology.

One operator noted, *"HAPSITE is very complicated and (requires) high maintenance, but does offer low chemical agent detection level (capabilities)."*

All of the operators indicated that the XMX Bio-aerosol Collector, the Quicksilver Sampling Kit, and the HAZMAT ID enhanced the ability of the

MNBC Defense Team to accomplish the MNBC Defense Team missions. The EPD was also considered to be a valuable safety tool to prevent personal exposure to radiation. One operator described the EPDs as "good instruments once learned."

The HAPSITE GC/MS and the HAPSITE HSS received mixed reviews. While both were rated positively overall, several operators indicated that this equipment requires a high level of experience on the part of the operator to successfully employ and is somewhat complicated to use. However, the operators also indicated that the HAPSITE equipment enhances the ability of the MNBC Defense Team to successfully accomplish the team mission.

The Drager CDS Kit and the Drager CMS were used by a limited number of MNBC Defense Team members. One of the salient issues identified was the use of the hand pump, which requires the user to use both hands to operate this piece of equipment. A second person is needed to provide assistance with checklists and directions. This equipment was successfully used during the scenarios and operators considered this equipment to be a viable enhancement to the MNBC Defense Team AS.

The HAZCAT was considered to be very complicated. The flowchart provided with this equipment required the operator to be very familiar with the process. Overall, the operators indicated that the utility of this piece of equipment was questionable and should be reconsidered prior to inclusion in the MNBC Defense Team AS.

The TVA 1000B could not be operated during this assessment and was not used during any of the operational scenarios. The wrong model was included in the AS for this assessment and hydrogen gas was not provided to operate the equipment. Operators indicated that a newer model is currently under consideration, which is designed to be more durable and easier to use; however, this model was not available for this assessment.

All operators indicated that the current NBC equipment package, including the new items, is sufficient to address the CONOPS mandated mission of the MNBC Defense Team. The operators validated sample collection methodology and suitability for use in compiling exposure data. Eighty-eight percent of the operators *Agreed* that the data collection process is effective for supporting the primary tasks of the MNBC Defense Team identified in the CONOPS. These tasks include force protection through identification and quantification of human health hazards in a health risk assessment. The purpose of the health risk assessment is to enable the medical treatment facility to provide adequate exposure-based treatment and base population surveillance strategies.

Eighty-eight percent of questionnaire respondents *Agreed* that the NBC equipment currently identified in the MNBC Defense Team AS is adequate for the team to assess the spectrum of anticipated chemical, biological, and radiological threats, as required by the CONOPS. It should be noted that one

operator did Disagree, specifically indicating that the HAPSITE process takes too long; he is concerned that this will make it difficult for the team to provide timely, accurate health risk data. However, HQ ACC/SGPB anticipates that the HAPSITE in the hands of a trained user would provide results in approximately 30 minutes instead of days currently required using existing field procedures.

COI 2: Is the MNBC equipment package suitable to support the requirements of the MNBC Defense Team health service support mission?

Objective 2-1: Identify training issues or shortfalls that impact operator proficiency.

During Part I of this LMUA, vendors provided training for the HAZMAT ID and the HAPSITE. The Det 1 AFOTEC communications specialist provided training for the Motorola 5000 communications system. Designated experienced operators from the participant group provided familiarization training for the RADeCO air sampler, the XMX Bio-aerosol Collector, the Drager CDS Kit, the Drager CMS, the ADM-300A radiac meter, the TVA 1000B, and the HAZCAT.

Follow-up familiarization training was provided for the Motorola 5000 communications system prior to the initiation of assessment activities during Part II of the LMUA. Basic operation of the Scope Shield radio and the Motorola 5000 communications systems is essentially the same and, overall, minimal training was required for personnel who were familiar with the operation of the Scope Shield radio.

The focus on hands-on participation by the operators afforded each assessment participant the opportunity to exercise each piece of NBC equipment and Motorola 5000 communications system prior to initiation of the LMUA scenarios. Training activities included setup and calibration, as appropriate, removal and replacement of various parts and batteries, and use of the NBC equipment while wearing MOPP gear.

An overview of the SSS and CP liner setup and use was provided for the operators. This overview was limited to an informal orientation provided by designated SMEs. The operators were then provided with instruction regarding the shelter components, such as operation of the ECUs, maintenance of shelter overpressure, electrical and lighting layout, and general operation of the SSS.

All training took place in the MNBC Defense Team work center or in an administrative shelter immediately adjacent to that location. As previously noted, the NBC equipment that has been in the inventory and in use by BEE and laboratory personnel required little additional, on-site training. Generally, training tended to be informally presented, with the exception of vendor

training for the HAPSITE, and to a lesser extent, the HAZMAT ID. In addition, not all participants were present at each training event.

No systematic survey of the assessment participants was conducted to identify variations in the level of prior training and familiarity with the COTS NBC equipment recently added to the MNBC Defense Team AS. However, discussions with the operators conducted by the Det 1 AFOTEC assessors during Part I of the LMUA indicated that there were significant variations in the level and type of training previously received by each participant. This made valid conclusions regarding the adequacy of training difficult.

A BEE stated that, *"An in-service training program is needed with specific operating instructions for all equipment. There is nothing current."*

No training issues were noted regarding the SSS, the FFCPA, or the shelter components. In addition, no training issues were noted regarding the Motorola 5000 communications system. It should be noted, however, that no formal training was conducted for the integration of the FFCPA with the MNBC Defense Team AS. The setup team provided a limited orientation to enable the users to operate the equipment. Users suggested that the MNBC team should receive formal training to set up the equipment, and training manuals should be provided for each team. All questionnaire respondents stated that FFCPA training should be part of the standard MNBC Defense Team training rotation.

Operator observations regarding training inadequacy tended to focus on several specific pieces of NBC equipment, including the HAZMAT ID and the HAPSITE, and to a lesser extent, the RADeCO air sampler and the XMX Bio-aerosol Collector. Of the equipment identified, the HAPSITE was the one most often cited by operators as requiring a more expansive training protocol, including troubleshooting techniques.

Of the questionnaire respondents, 89 percent *Agreed* or *Strongly Agreed* that the training was adequate (see Figure 18). However, one respondent *Strongly Disagreed* that the training was adequate overall and cited the need for more formal training to achieve proficiency. This respondent is a BEE who identified numerous pieces of NBC equipment that will require formal training to achieve acceptable levels of proficiency. He specifically cited the HAPSITE, the HAZCAT, the HAZMAT ID, the SAM 935, and the XMX Bio-aerosol Collector. One other respondent, who is also a BEE, also stated both the HAPSITE and the RADeCO will require much more formal training for proficiency.

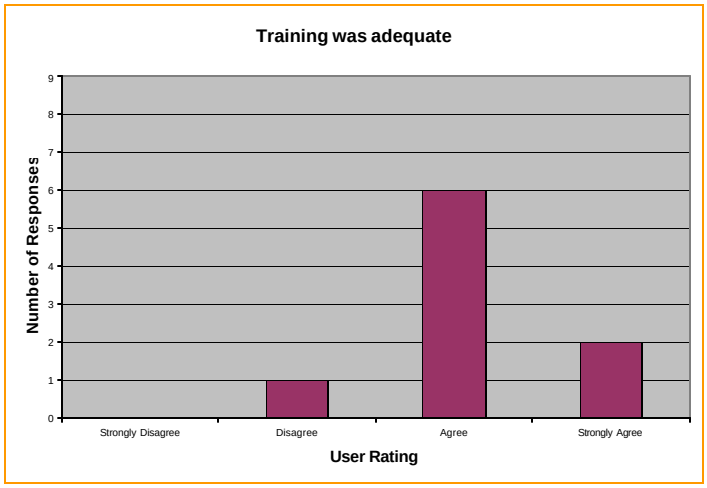


Figure 18. Training Ratings: *Eighty-nine percent of respondents Agreed/Strongly Agreed that the training was adequate.*

Generally, the operators considered the training to be too brief to be effective. One operator suggested that systematic training be conducted at regular intervals, perhaps every 12 to 18 months for new personnel, and immediately prior to deployment. The absence of manuals was noted as a training shortfall. The use of equipment manuals was considered a must, particularly for the vendor trainers.

MNBC Defense Team process and procedure training was provided in the context of the equipment training. Although all questionnaire respondents indicated that they *Agreed* or *Strongly Agreed* that this training was adequate, the same BEE respondent who cited the need for more formal training characterized the process and procedure training as "barely adequate," given the complexity of the equipment and the NBC collection and identification process.

Objective 2-2: Assess the ease of setup of the MNBC sampling, analysis, and monitoring equipment by the three-person MNBC Defense Team.

Some operators were not involved in the setup process of all of the NBC technologies used to support MNBC Defense Team operations. The TVA 1000B could not be operated due to the lack of hydrogen gas, which is used with this piece of equipment. In addition, the model used during the assessment was the wrong model and is not included in the AS.

Operator opinion regarding ease of setup of the sampling, analysis, and monitoring equipment varied; some BEE operators considered two pieces of equipment fairly difficult to set up, the HAPSITE and the EPD.

Figure 19. The HAPSITE GC/MS: *The HAPSITE was the piece of NBC equipment most cited by operators as being difficult to set up.*

Of all questionnaire respondents, 44 percent suggested that ease of setup was an issue with the HAPSITE (see Figure 19), while 22 percent indicated that the EPD was difficult to set up.

Three operators noted setup difficulties with the HAPSITE system and identified the HAPSITE as being the most difficult system to set up. Although one operator noted that he had no "real problems" setting up the HAPSITE, he indicated that extensive training generally would be required to enable an individual operator to independently set up this system.

Figure 20. Personal Dosimeters: *The setup difficulties described by two operators were related to the one-button functionality of the EPDs, which are used to initiate operation of these devices.*

Two operators identified the EPD as being difficult to set up (see Figure 20); it should be noted, however, that both primarily indicated that the one-button function process is too painstaking and difficult to use, and it takes some time to become familiar with the instrument. After completion of the assessment, the ACC project leader determined that software and an infrared reader were not used during the assessment and are required to properly set the EPDs.

Objective 2-3: Assess the ease-of-use of the MNBC sampling, analysis, and monitoring equipment.

Operators used all NBC equipment without MOPP gear and while wearing MOPP 4 during both daytime and night operations to determine their ability to adequately use each piece of equipment, to see all dials, meters, and indicators through the MOPP faceplate, and to determine their ability to operate system controls while wearing MOPP gloves. Det 1 AFOTEC assessors also solicited operator input regarding the operator compatibility (e.g., size and weight) of the equipment to support mobile operations such as passive NBC monitoring activities.

At least three questionnaire respondents identified the following NBC equipment as being difficult to use: the HAZCAT, the HAPSITE, and the EPD. In addition, one respondent identified the Chemical Agent Water Testing Kit as difficult to use.

Operators identified the EPD one-button function as a "painstaking process" that takes some time to learn, although the EPD was also described by the same respondent as a good instrument once he was familiar with it.

The HAPSITE was cited by half of the questionnaire respondents as difficult to use. One operator, who is a BEE, stated that the HAPSITE "requires a lot of training to gain expertise," while another, who is a BEE Craftsman, described it as "very complicated." Neither of these operators had received the formal training course on the HAPSITE but had received onsite training provided by the HAPSITE vendor prior to the exercise. In addition, one operator noted that he felt that the HAPSITE screen was easier to use during night operations than during daytime operations due to better visibility of the screen. One of the users, a BEE from the Pilot Unit with BNBC deployment experience, stated that, "The HAPSITE is almost too sensitive to take into a field setting. It is very hard to warm up and use." Another respondent noted that the HAZMAT ID screen was hard to see.

The HAPSITE is a relatively large piece of NBC equipment. The portable part of the HAPSITE, which is taken from the MNBC Defense Team work center to perform external NBC collection and analysis, has a large, box-like shape and weighs 42 pounds. Overall, operators did not consider the HAPSITE easy to transport by either male or female personnel. Operators characterized the HAPSITE as being too heavy to carry around for a long period of time.

The MNBC Defense Team improvised a backpack to carry the HAPSITE to the NBC site (see Figure 21), but operators noted that long-term transport of this, as well as other bulky or heavy equipment, would require the use of a four-wheel drive vehicle to ensure timely response to the sample site.

Of the nine questionnaire respondents, 100 percent *Agreed* that operation of the NBC equipment was easy while not in MOPP gear and while wearing MOPP 4 gear.

Ease of use for the individual NBC equipment items is presented in Table 8. The operators were asked to rate overall ease of operation without MOPP and while wearing MOPP 4.

The results of this table suggest that there are some ease-of-use issues regarding the Chemical Agent Water Testing Kit, the EPD, the HAPSITE, and the HAZCAT, which may require additional scrutiny to determine whether the issue is training, suitability, or another aspect pertinent to employment of these pieces of NBC equipment.

Operators did not identify any issues related to calibration of the equipment. All operators *Agreed* that calibration of the NBC equipment was easy.

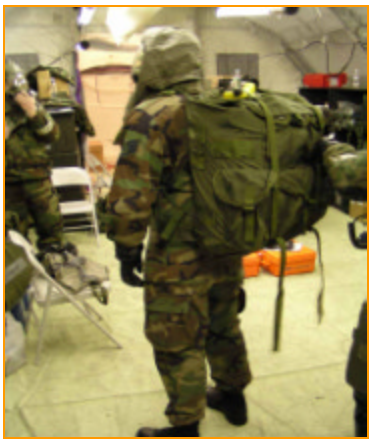


Figure 21. HAPSITE Backpack: *Operators improvised a backpack to facilitate transport of the HAPSITE to the sample site.*

Table 8. Ease of Use Ratings for NBC Equipment: *This table reflects the ease-of-use ratings for the NBC equipment used by the MNBC Defense Team.*

Ease of Use Ratings (Numbers Represent Questionnaire Respondents)		
Equipment	**Number of Respondents**	**Agree/Strongly Agree**
ADM-300A radiac meter	9	9
Chemical Agent Water Testing Kit	9	7
Drager CMS	9	9
Drager CDS Kit	9	9
EPD	9	7
HAPSITE	9	6
HAZCAT	8	6
HAZMAT ID	9	9
RADeCO air sampler	9	9
SAM 935	9	9
XMX Bio-aerosol Collector	9	9

Objective 2-4: Identify reliability and logistics supportability issues of the MNBC Defense Team allowance standard.

Due to the short duration of this assessment, traditional RAM data could not be collected. However, Det 1 AFOTEC assessors were present during both parts of the LMUA and, during each of the daily events, collected event data related to equipment failures and potential maintenance and logistics support issues.

The weather during Part II of the LMUA was cold and windy with snow on the ground from a previous snowfall. Temperatures varied from a low of 29 degrees Fahrenheit at the onset of the assessment to a high of 42 degrees Fahrenheit at the end of the day. Winds were variable, and averaged

approximately 2 miles per hour. During the unpacking and setup process, several operators noted that the HAPSITE and HAZMAT ID equipment were cold and required a warm-up period before calibration could be initiated (the HAPSITE generally takes 20 minutes to warm up under normal operating conditions). Each equipment item was turned off and restarted, and after restarting, each system performed appropriately.

Environmental factors that impact operational performance of the NBC equipment included in the MNBC Defense Team AS are listed in Annex D of this report. This annex lists temperature extremes that impact the effective operation of specific pieces of NBC equipment.

The HAPSITE was inoperable during part of the first day of the scenario events. After troubleshooting the system, the operators determined that the battery was dead. After replacement of the battery, the HAPSITE was turned on and operated appropriately. In addition, users noted that the HAPSITE laptop computer was not properly configured to connect to base communications. The users initiated a work around and established connectivity. Users also noted that, in a deployed environment, proper configuration of the laptop by base/medical communications must be coordinated in a timely manner.

Also, during the first day of Part II of the LMUA, the HAPSITE service module did not operate. The vendor conducted system troubleshooting to identify the source of the malfunction. During this time, operators noted that maintenance support is not available under the current logistics plan, and the unit would have to be returned for factory service or replacement. This requirement is the same for the HAZCAT, the HAZMAT ID, the EPDs, and the XMX Bio-aerosol Collector. Operators noted the potential impact on the logistics tail of the MNBC Defense Team.

Although 88 percent of questionnaire respondents *Agreed* that it would be relatively easy to maintain the NBC equipment in the operational environment, this opinion could not be validated during this assessment given the truncated timeframe for this event and the narrow scope of environmental conditions at the time of the LMUA. One respondent suggested that maintenance requirements are a function of the deployed environment and stated that a general opinion regarding reliability and 30-day mission capability cannot be made predicated solely on the circumstances of this LMUA. This individual, who is a BEE with extensive deployment experience, would only commit to being “slightly” in agreement that the NBC equipment would be relatively easy to maintain in the operational environment or in support of a 30-day mission capability.

The MNBC Defense Team AS includes four Honda 1.5 kW portable generators that are used to power the RADeCO air samplers. During initial training and testing, MNBC Defense Team personnel discovered that the XMX Bio-aerosol Collectors cannot be operated without a generator, and the

current portable generators cannot simultaneously operate the RADeCO air sampler and the XMX Bio-aerosol Collector (see Figure 22). The XMX Bio-aerosol Collector is primarily designed for interior operation, while the RADeCO air sampler is primarily designed for exterior, perimeter detection operations. However, although not primarily used in this configuration, when appropriate, the XMX Bio-aerosol Collector and the RADeCO air sampler can be similarly sited for exterior operation during deployment of the MNBC Defense Team.

Figure 22. Honda 1.5 kW Generator: *The REDeCO air samplers could not be simultaneously operated with the XMX Bio-aerosol Collector using one Honda generator.*

BEE personnel attempted to simultaneously power one XMX Bio-aerosol Collector and one RADeCO air sampler using one of the Honda 1.5 kW generators. The power draw proved to be too much and the circuit breaker shut down the generator. This activity was repeated with identical results. Under these conditions, the assessors found that the Honda 1.5 kW generators could not produce enough power to operate the RADeCO air sampler and the XMX Bio-aerosol Collector units simultaneously. The results of mathematical analysis showed the Honda generator being overdrawn by 170 watts.

After discussions with MNBC Defense Team personnel, the consensus of the team was that an additional generator is required to power each XMX Bio-aerosol Collector and should be included in the AS. The AS currently includes one XMX Bio-aerosol Collector. The additional generators would serve two purposes: to power the XMX Bio-aerosol Collectors and to serve as backup generators in the event that one of the generators is no longer operable. There were no reported generator failures during Part II of the LMUA, and no operator identified any significant maintenance or logistics issues.

Objective 2-5: Assess the compatibility of the MNBC Defense Team equipment configuration in the SSS when collocated with the BAT.

One BEE stated, *"Work space will be limited and conditions tight with both teams in the tent."*

All operators, including BAT personnel, suggested that, while somewhat confined and "tight," the space in the work center was adequate for collocated operations. There is currently no protocol for configuration of the work center. Two operators suggested that the RAPID unit, which is part of the BAT equipment package, be moved from the work center to an EMEDS laboratory. BAT personnel rejected this suggestion primarily for team integrity reasons. After additional discussion, the initial work place configuration was reworked by MNBC Defense Team and BAT personnel to better accommodate BAT operational integrity and safety and to attempt to optimize available space. During hotwash discussions, MNBC Defense Team and BAT personnel stated that the reconfigured interior space of the work center should be validated to ensure that the most efficient and effective equipment management and placement plan is identified.

The molecular biologist who served as the BAT commander indicated that one of the primary concerns of the BAT is the potential for contamination of

the deoxyribonucleic acid (DNA) extraction process by amplified product. He advised that contamination is a significant potential problem in a molecular laboratory and, once contaminated, affected articles are very difficult to clean.

To determine the sufficiency of power to support collocated MNBC Defense Team and BAT operations, the Det 1 AFOTEC assessors identified each piece of equipment that required electrical power. The assessors used the work center configuration identified in Figure 13 to represent the relative placement of the equipment in the work center and to aide in the analysis of power distribution requirements.

After identifying each piece of equipment, current and voltage specifications were recorded using data from specification tags on the equipment, supplemented by portable oscilloscope-ammeter readings of the equipment while in operation. A calculation analysis of power requirements for each piece of equipment was performed to determine the total power draw (see Table 9).

In alternating current circuits, a power factor is used to derive the total power consumed in watts. To provide a maximum power draw on each piece of equipment, a power factor of one was used in the calculations. This was done to represent purely resistive loads and also because equipment specification sheets rarely include power factors.

Table 9 provides a complete listing of equipment voltage, current, and summation of total power requirements separated by individual teams. To estimate peak power demand, power draw was calculated with the assumption that all the equipment would be running simultaneously.

Although the MNBC Defense Team is designed to operate with ECS support, in the event that work center operations are required to rely on the 10 kW generator included in the AS, the calculations in Table 9 indicate that the peak power demand for collocated MNBC Defense Team and BAT operations exceeds the capacity of the generator. Also, the power requirement to operate the ECU, which is 14,000 watts, surpasses the capability of 10 kW generator. The ACC project leader has indicated that the 10 kW generator was never intended to provide sufficient power to operate an ECU. However, some of the advanced NBC equipment included in the AS have recommended operating temperature ranges identified by the manufacturer which may impact equipment performance when employed in austere operational environments, to include extremes of heat and cold.

The 10 kW generator is capable of providing sufficient power for emergency lighting and the main station computer, although the generator will not operate the ECU. Other pieces of equipment can be operated; however, simultaneous operation is dependent on the equipment package being used. While able to operate in this mode, neither the MNBC Defense Team nor the BAT would have the ability to operate the ECU to maintain climate control in the work center.

Table 9. Power Requirements: *This table reflects the power requirements for all MNBC Defense Team and BAT electrical equipment expected to be used in the work center.*

Model	Quantity	Volts	Amperes	Watts
MNBC Defense Team Equipment				
HAZMAT ID	1	120	1.50	180.00
Battery charger	1	120	1.80	216.00
Battery charger for M5000 radio	1	120	3.00	360.00
Laptop	1	120	1.50	180.00
Laser Jet 3200 printer	1	120	3.00	360.00
Refrigerator	1	120	1.10	132.00
Motorola 5000 base station*	1	120	3.00	360.00
HAPSITE GC/MS	1	120	3.60	432.00
HAPSITE battery charger	1	120	1.20	144.00
HAPSITE service module	1	120	1.66	199.20
HAPSITE HSS	1	120	1.66	199.20
TVA 1000B	1	120	0.15	18.00
Field sink ADU-40CF	1	120	12.50	1500.00
SAM 935 Portable Surveillance and Measurement System	1	120	0.36	43.20
SAM 935 Battery Charger	1	120	0.10	12.00
XMX Bio-aerosol Collector**	1	120	6.52	782.40
Air Sampler H-809VII**	1	120	8.00	960.00
Air Sampler Calibrator D-8528**	1	120	0.15	18.00
			Subtotal	**4335.60**
BAT Equipment				
Purifier Hood	1	120	0.71	85.20
16500 Dribath	1	120	3.75	450.00
Mini Beadbeater-8	1	120	9.50	1140.00
Genie2 Mixer	1	120	0.65	78.00
Hydroclave MC8	1	120	12.00	1440.00
Laptop	1	120	1.50	180.00
Deskjet 350 Printer	1	120	0.35	42.00
Cimarec 2 Mixer	1	120	9.50	1140.00
RAPID 7200CE	1	120	5.25	630.00
Laptop for RAPID	1	120	1.45	174.00
Smart Uninterrupted Power Source 1500 for RAPIDS	1	120	12.00	1440.00

Notes:
* Although exact power measurements could not be acquired for the Motorola 5000 base station, 360 watts is a safe approximation for the purpose of calculating total power.
** These are operated with Honda 1.5 kW generators and were not included in the summation.

Continued

Table 10. Power Requirements (Concluded): *This table reflects the power requirements for all MNBC Defense Team and BAT electrical equipment expected to be used in the work center.*

Model	Quantity	Volts	Amperes	Watts
BAT Equipment				
Micromax Centrifuge	1	120	4.00	480.00
Refrigerator	1	120	0.80	96.00
Mini Centrifuge	1	120	0.13	15.60
			Subtotal	7390.80
Facility Equipment				
ECU: 54,000 British Thermal Units 208-volts alternating current, 50/60 hertz	1	208	40.90	14000
Light Set General Illumination	8	120	0.33	320
			Subtotal	**14320**
			Total Power	**22433.40**

Notes:

* Although exact power measurements could not be acquired for the Motorola 5000 base station, 360 watts is a safe approximation for the purpose of calculating total power.

** These are operated with Honda 1.5 kW generators and were not included in the summation.

Objective 2-6: Identify design and operational safety issues.

The questionnaire respondents did not identify any significant equipment design or operational safety issues. Two general safety issues were identified, which are primarily related to policy and procedures. The first issue was the MNBC Defense Team provides no method to dispose of hazardous waste. The AS does not include hazardous or infectious waste disposal bags or other means of safely discarding waste that may be contaminated, including gloves. The second issue noted was the lack of procedures for personnel decontamination before re-entry into the MNBC Defense Team work center.

COI 3: Is the MNBC equipment allocation package the optimum configuration for support of the MNBC mission?

Objective 3-1: Validate the optimum equipment allowance standard suitable to support MNBC Defense Team operations.

Using the initial equipment layout depicted in Figure 13 as a baseline, assessment personnel solicited operator input and recommendations for the adequacy of the Motorola 5000 communications system, the adequacy of the NBC equipment included in the AS by type and number, and identification of shortfalls in current capability offered by the equipment package.

One hundred percent of respondents *Agreed* or *Strongly Agreed* that the MNBC Defense Team equipment AS is adequate (see Figure 23); however, operators made numerous recommendations, which are contained in this report, that potentially will address identified shortfalls in the capability offered by the current AS.

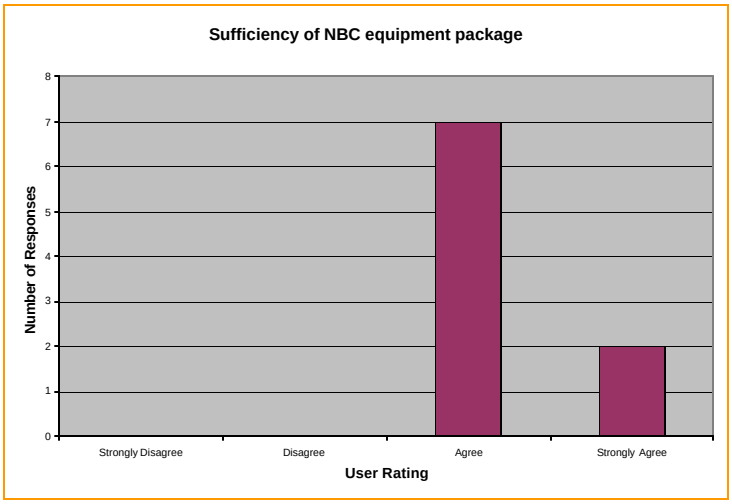


Figure 23. Equipment Sufficiency Ratings: *One hundred percent of respondents Agreed/Strongly Agreed that equipment AS was adequate; however, operators made a number of recommendations.*

Objective 3-2: Determine the optimal packaging/palletization of the MNBC equipment package.

A logistics detail (LOGDET) was completed during Part I of this assessment, and the participants determined that the MNBC Defense Team AS fits on two pallets. The assessment participants unpacked the equipment during the first day of Part I of the LMUA. The equipment was repacked, re-palletized, and then stored for use during Part II of the LMUA.

Although some small, miscellaneous equipment items were not present during the LOGDET, they were considered inconsequential and would not impact the two-pallet requirement identified during the LOGDET (see Figure 24). A vehicle is not included in the MNBC Defense Team AS. The CP liner and associated CP equipment, such as the blowers, are not included in the current AS.

Figure 24. Palletization: *The MNBC Defense Team AS was palletized using two pallets (left and center), while the BAT AS was loaded on one pallet (right).*

All operators agreed that two pallets would be sufficient to accommodate the current MNBC Defense Team AS.

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Conclusions and Recommendations

Conclusions

On the final day of the LMUA, assessment participants were given the opportunity to provide an overall assessment of their level of satisfaction of the MNBC Defense Team AS.

Eighty-eight percent of the respondents *Agreed* that the AS is sufficient to perform the MNBC Defense Team mission, although numerous suggestions were made to improve the effectiveness and utility of the AS. All operators considered the Motorola 5000 communications system to be a significant improvement over the current Scope Shield radios.

When asked whether the MNBC Defense Team equipment package is adequate to assess the spectrum of chemical, biological, and radiological threats as required in the MNBC Defense Team CONOPS and current medical doctrine, 88 percent *Agreed*. Assessors noted the possible impact of extreme environmental conditions on usability of the NBC equipment. These operational limitations are listed in Annex D.

The 10 kW generator, currently included in the team AS for backup and emergency power requirements, does not generate adequate power for critical equipment used to maintain MNBC Defense Team operations. The Honda 1.5 kW generators cannot simultaneously operate the RADeCO air sampler and the XMX Bio-aerosol Collector. The current AS of four Honda generators is considered inadequate.

The assessment rating summary provided in Table 10 reflects operator satisfaction with the adequacy, sufficiency, and performance of the MNBC Defense Team AS equipment package. In addition, the table contains summary conclusions for each characteristic based on operator comments, questionnaire responses, and assessment team observations.

Table 11. Summary Assessment Ratings: *Utility ratings and key conclusions for each system characteristic are provided in this table.*

Capability Summary		
System Characteristic	**Rating**	**Conclusion**
Adequacy of the Motorola 5000 communications system	◉	The Motorola 5000 communications systems were considered a significant improvement over the Scope Shield. Operators considered them easy to use and did not require additional training to set up and operate.
Adequacy of infrastructure equipment	◉	Although operators identified improvements and additions to the infrastructure equipment, most considered the AS adequate for operational deployment.
Adequacy of NBC equipment	◉	Respondents considered the NBC equipment to be sufficient to address the broad spectrum of NBC threats identified in the CONOPS.
Compatibility with the BAT	◉	The MNBC work center provides adequate space and infrastructure support for the BAT. Additional refinement of the proposed interior configuration will produce greater efficiencies of scale.
Ease of setup	◉	Setup was considered easy, although some initial problems were identified.
Ease of use	◒	Although most NBC equipment was easy to use, some required more formal training to operate effectively.
Palletization requirements	◉	The current MNBC Defense Team AS equipment package will easily fit on two pallets.
Reliability	◒	The TVA 1000B could not be operated during the assessment and a HAPSITE failure was the result of a dead battery.
Power	◒	The 10 kW generator, currently included in the AS for critical equipment backup/emergency power, is inadequate. The Honda 1.5 kW generators could not produce enough power to simultaneously operate the REDeCO and the XMS Bio-aerosol Collector.
Legend	◉	Excellent demonstration of capability/characteristic
	◒	Good demonstration of capability/characteristic
	○	Marginal demonstration of capability/characteristic
	●	Unsatisfactory demonstration of capability/characteristic

Recommendations

Operators provided extensive feedback, which was used to validate mission requirements identified in the MNBC Defense Team CONOPS and the AS equipment package. The following is a summary of the key recommendations provided in this report:

- Maintain the AS standard for the Motorola 5000 communications system at five but consider the use of a smaller rubber duck antenna.
- Determine whether the current CONOPS adequately addresses the need for a vehicle to support MNBC Defense Team operations.
- Modify the MNBC Defense Team AS equipage as follows:

- Replace the current mini-refrigerator with a full-size model or add another mini-refrigerator. The current AS (one mini-refrigerator) is considered inadequate.
- Add a two-wheel hand truck to assist with lifting and moving equipment.
- Identify and include a suitable number of adjustable soft backpacks for use with the NBC equipment.
- Add hearing protection in the form of soft earplugs for use with the generators.
- Include a HAZCAT propane tank; the feasibility and procedures for field refilling of propane tanks should be identified.
- Replace the nesting boxes with high-density plastic shelving.
- Provide extra power cables and additional lighting to meet mission needs in the BAT work area in the shelter extension.
- Replace the current allocation of straw brooms with industrial strength push brooms.
- Add appropriate receptacles for hazardous waste disposal.
- Increase the use of light sticks (white) and add headlamps and flashlights.

- Identify and implement a viable training methodology that will develop and maintain sufficient operator proficiency with the NBC equipment, the SSS, and related components.
- Include pertinent operator and training manuals with the NBC equipment.
- Conduct a suitable assessment of the TVA technology in an appropriate operational environment to validate the utility of this equipment. The TVA 1000B could not be operated due to the lack of hydrogen gas, which is used with this piece of equipment. In addition, the model used during the assessment was the wrong model and is not included in the AS.
- Identify and implement procedures and methods to properly dispose of hazardous waste.
- Identify procedures for effective SSS access and egress to the MNBC Defense Team work center when deployed in a contaminated environment.
- Conduct a risk/benefit analysis to determine the impact of temperature extremes on the NBC equipment.
- Identify emergency power and portable power generators that meet current power requirements.

- Validate the BAT AS to identify and appropriately resolve communications, equipment, and supply requirements to support interoperability with the MNBC Defense Team.
- Ensure that the appropriate action is taken to configure the HAPSITE laptop computer in accordance with base/medical communications procedures and interoperability requirements.

Annex A
Acronyms

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°C	degrees Celsius
°F	degrees Fahrenheit
311 HSW	311th Human Systems Wing
ACC	Air Combat Command
AED	assessment execution document
AFB	Air Force Base
AFIERA	Air Force Institute for Environment, Safety, and Health Risk Analysis
AFMESA	Air Force Medical Evaluation Support Activity
AFMLO	Air Force Medical Logistics Office
AFOTEC	Air Force Operational Test and Evaluation Center
APC	American Power Conversion (battery)
AS	allowance standard
BAT	biological augmentation team
BEE	bioenvironmental engineer
BNBC	Bioenvironmental, Nuclear, Biological, and Chemical
BTD	bump-through door
CD/RW	compact disc/rewritable
CDS	Civil Defense Simultest
CEX	Civil Engineering Readiness
CMS	Chip Management System
COI	critical operational issue
CONOPS	concept of operations
COTS	commercial off-the-shelf
CP	collective protection
Det 1	Detachment 1
DNA	deoxyribonucleic acid
ECS	expeditionary combat support
ECU	environmental control unit
EMEDS	Emergency Medical Support
EOD	explosive ordnance disposal
EPD	Electronic Personal Dosimeter
F3	form, fit, and function
FTIR	Fourier Transform Infrared Spectroscopy
GC	Gas Chromatograph
GPS	Global Positioning System

HHA	handheld immunochromatographic assay
HSS	headspace sampling system
HVAS	high volume air sampler
in	inches
kW	kilowatt
LED	light-emitting diode
LMUA	limited military utility assessment
LOGDET	logistics detail
MDG	Medical Group
MNBC	Medical Nuclear, Biological, and Chemical
MOPP	mission-oriented protective posture
MS	Mass Spectrometer
NBC	nuclear, biological, and chemical
PAM	Preventive and Aerospace Medicine
RAM	reliability, availability, and maintainability
RAPID	Ruggedized Automated Pathogen Detection Device
RIC	referee inject cards
SBCCOM	Soldier and Biological Chemical Command
SGPB	Headquarters ACC Bioenvironmental Engineering
SME	subject matter expert
SRC	Survival Recovery Center
SSS	small shelter system
T-2	Trichothecene Mycotoxin
TTP	tactics, techniques, and procedures
USAF	United States Air Force
UTC	unit type code
VLSTRAK	vapor, liquid, solid tracking model
VX	nerve agent
WMD	weapons of mass destruction
XTI	Experimental, Exercise, and Technology Insertion

Annex B
MNBC Defense Team AS

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AS Number	National Stock Number	Item Description	Level of Care	Unit Identifier	Price	Part Number	Weight	Cube	AS	Federal Stock Class	National Item Identification Number
R902baa	1670008204896	Pallet cargo aircraft metal and wood 108-inches length 88-inches wide	2	Each	856.96	Mil-dtl-27443typei	200	70	R902b	1670	008204896
R902baa	1670009694103	Net, cargo tie down,	2	Each	107.47	67e46290	20	5	R902b	1670	009694103
R902baa	1670009962780	Net, cargo tie-down,	4	Each	90.34	67f46303-10	20	5	R902b	1670	009962780
R902baa	2340013954394	Bicycle all-terrain men's 21-inch frame 12 speed	2	Each	184.71	Atx21	45	12.5	R902b	2340	013954394
R902baa	4010001714427	Chain assembly single leg 20-foot-long .406-inch diameter	4		0	Rr-c-271	18	2	R902b	4010	001714427
R902baa	4020002402146	Cord fibrous polyamide nylon braided natural color 2100-feet	1		110.68	Mil-c-5040	9.5	0.3889	R902b	4020	002402146
R902baa	4020002460688	Cord fibrous nylon 32 or 36 strand 400 yards	1		53.11	Milc5040type3	8	0.001	R902b	4020	002460688
R902baa	4020009283438	Rope fibrous 1/4-inches diameter 200 yards	1		24.07	Mil-r-17343	20	1.6	R902b	4020	009283438
R902baa	4120014490459	Air conditioner	1	Each	10825.84	9454100	800	40.1	R902b	4120	014490459
R902baa	4140008519319	Fan, circulating	2	Each	33.32	W-f-101	15	4.6296	R902b	4140	008519319
R902baa	4210001654703	Extinguisher, fire	1	Each	22.03	Cp5j	6.5	0.247	R902b	4210	001654703
R902baa	4320008529036	Pump inflating low pressure tire pump 24-inch rubber air hose	1	Each	15.87	52161r91	42.36	3.204	R902b	4320	008529036
R902baa	4610ncm000367	Jug, water	4	Each	7.95		0	0	R902b	4610	Ncm000367
R902baa	5110008925071	Knife craftsman's shop removable blade 5.5-inch	1	Each	1.99	Pd5110-00-892-5071	0.07	0.05	R902b	5110	008925071
R902baa	5120000625413	Screwdriver bit set	1	Set	6.93	Ck3	0.63	0.014	R902b	5120	000625413
R902baa	5120002362127	Screwdriver flat tip .188-inch blade large 3-inch end thick 0.033 plastic	4	Each	1.29		3	0.5	R902b	5120	002362127
R902baa	5120002405328	Wrench open end adjustable 15 x 16 x 8 inch	1	Each	10.69	B107.8m	0.1	0.001	R902b	5120	002405328
R902baa	5120002657462	Hammer, hand	1	Each	10.68	Tadx1a	5	0.0556	R902b	5120	002657462
R902baa	5120007561156	Pliers hand	1	Each	21.27	B107.20m	10.5	0.03	R902b	5120	007561156
R902baa	5120008785932	Entrenching tool hand: combination	2	Each	29.85	128c728h01	2	0.5	R902b	5120	008785932
R902baa	5120009267116	Mallet wood	1	Each	53.14	5120-00-926-7116	42.5	3.75	R902b	5120	009267116
R902baa	5120011128350	Hammer, hand	1	Each	10.1	E16ctb	2	0.082	R902b	5120	011128350
R902baa	5140004736256	Bag tool satchel	1	Each	17.67	Mil-b-43663	1.24	0.16	R902b	5140	004736256
R902baa	5340014635841	Padlock set	1	Set	65.6	5200glka10	0	0	R902b	5340	014635841
R902baa	5440000618900	Stepladder fiberglass 6 inch	2	Each	91.62	203206	41	0.6	R902b	5440	000618900
R902baa	5640001032254	Tape duct plastic coated cloth vapor proof aluminum or silver 2 inches x 60 yards	12	Roll	2.53		1	0.042	R902b	5640	001032254
R902baa	5810010269620	Tape reader general purpose	1	Each	161	0n190315	1.5	0.067	R902b	5810	010269620
R902baa	5810014596441	Telephone secure unit	1	Each	3250		3.25	0.55	R902b	5810	014596441

AS Number	National Stock Number	Item Description	Level of Care	Unit Identifier	Price	Part Number	Weight	Cube	AS	Federal Stock Class	National Item Identification Number
R902baa	5820ncm021266	Radio, handheld with wideband antenna	6	Each	3248.71		0	0	R902b	5820	Ncm021266
R902baa	5820ncm021267	Carrying case for handheld radio, Motorola XTS 5000	5	Each	41.96		0	0	R902b	5820	Ncm021267
R902baa	5820ncm021268	Remote speaker microphone for handheld radio, Motorola XTS 5000	5	Each	88		0	0	R902b	5820	Ncm021268
R902baa	5820ncm021269	Lithium ion battery for handheld radio, Motorola xts5000	6	Each	83.7		0.436	0.004	R902b	5820	Ncm021269
R902baa	5820ncm021270	Smart charger for lithium ion battery	1	Each	669.8		0	0	R902b	5820	Ncm021270
R902baa	5820ncm021271	Programming cable, radio-rib	1	Each	225		0	0	R902b	5820	Ncm021271
R902baa	5820ncm021274	Radio service software	1	Each	250		0	0	R902b	5820	Ncm021274
R902baa	5820ncm021276	Plus key loader, kvl3000	1	Each	2430.42		0	0	R902b	5820	Ncm021276
R902baa	5820ncm021277	Charger, 110 volts alternating current/60 hertz for plus key loader kvl3000	1	Each	150		0	0	R902b	5820	Ncm021277
R902baa	5820ncm021278	Transportable base station	1	Each	7604.71		0	0	R902b	5820	Ncm021278
R902baa	5820ncm021279	Antenna, 3 database gain omni	1	Each	160.65		0	0	R902b	5820	Ncm021279
R902baa	5920014959613	Surge suppressor three line 6-foot cord with hardware	4	Each	10	Vcn6-6	0.55	0.12	R902b	5920	014959613
R902baa	6110012426691	Stand distribution	1	Each	42	5-4-3630	0.55	0.12	R902b	6110	012426691
R902baa	6110012510402	Distribution box rectangular surface mount 6 x 9 x 8 inches	1	Each	1465.12	5-4-4141	11	0.859	R902b	6110	012510402
R902baa	6110012518157	Convenience outlet assembly	8	Each	101.35	5-4-4147	6.5	0.292	R902b	6110	012518157
R902baa	6110ncm000192	Distribution box with light switch Alaska tent	1	Each	310		0	0	R902b	6110	Ncm000192
R902baa	6115ncm990822	Generator, Honda, portable 1.5 kW	4	Each	790		0	0	R902b	6115	Ncm990822
R902baa	6115ncm990871	Emergency generator, portable 120/240	1	Each	3600		0	0	R902b	6115	Ncm990871
R902baa	6130013862732	Analyzer charger battery 110/240 nickel cadmium maintaining	1	Each	3553.29		12	1.25	R902b	6130	013862732
R902baa	6150011871782	Cord extension electric	5	Each	11.98	Ec267a	2	0.25	R902b	6150	011871782
R902baa	6150012205588	Cable assembly power electrical 1 ground 100-feet long 600 volt	3	Each	959.93	Mil-c-29184	105	4.75	R902b	6150	012205588
R902baa	6150012624207	Cable assembly, power electrical 50-foot long copper core	4	Each	909.64	Mil-c-29184/3	75	3.5	R902b	6150	012624207
R902baa	6230012422016	Light set general illumination	2	Set	1184.24	Mil-l-44259	2.25	0.5	R902b	6230	012422016
R902baa	6520014565380	Sink field	1	Each	2189.56	ADU-40cf	45	3.13	R902b	6520	014565380

AS Number	National Stock Number	Item Description	Level of Care	Unit Identifier	Price	Part Number	Weight	Cube	AS	Federal Stock Class	National Item Identification Number
R902baa	6530013714321	Bag sterilized disposal 24 x 35.8-inch plastic orange heat seal 100s	1	Pack	99	01-815c	7.5	1.4	R902b	6530	013714321
R902baa	6545ncm010520	Tear-aid patch product types A and B	1	Roll	109		0	0	R902b	6545	Ncm010520
R902baa	6645010468848	Clock wall 1.5 volts direct current 12 hour sweep hand black background	2	Each	16.66	6645-01-046-8848	0.69	0.151	R902b	6645	010468848
R902baa	7105014620602	Chair folding self contained with padded back, seat, and carry bag	6	Each	19.99	G618	6.5	2.8	R902b	7105	014620602
R902baa	7110009199306	Filing cabinet	1	Each	688	Aa-f-358	21	1.25	R902b	7110	009199306
R902baa	7110015025826	Desk field 21 x 30.750 x 28.5 inch portable with chair has 6 removable drawers	3	Each	688	472-fld-desk-ta	81.5	1.105	R902b	7110	015025826
R902baa	7240000893827	Can water military plastic color is lusterless sand 5 gallon	2	Each	9.32	145524465	0.1	0.001	R902b	7240	000893827
R902baa	7240001776154	Spout can flexible	2	Each	13.98	Ta13219e2600	0.55	0.05	R902b	7240	001776154
R902baa	7240004049793	Funnel plastic 1 quart rigid	1	Each	1.23	3u606	0.001	0.001	R902b	7240	004049793
R902baa	7240013375268	Can, gasoline	3	Each	22.71	Cid a-a-59592	0.68	0.12	R902b	7240	013375268
R902baa	7290002248308	Dustpan	1	Each	1.33		1.5	0.2778	R902b	7290	002248308
R902baa	7310014541281	Extension cord 110 volts alternating current 50 feet in length 12 gauge	4	Each	79.1	Mil-prf-44485	1.65	0.55	R902b	7310	014541281
R902baa	7920002051170	Handle mop wood spring lever 60 inches long	1	Each	5.37	7920-00-205-1170	0.45	0.27	R902b	7920	002051170
R902baa	7920002638528	Mopping outfit floor	1		46.47	7920-00-263-8528	2	0.45	R902b	7920	002638528
R902baa	7920002918305	Broom upright broomcorn or broomcorn and fiber not detachable	1	Each	6.85	7920-00-291-8305	3	0.417	R902b	7920	002918305
R902baa	7920009265493	Mophead, wet	2	Each	4.37	7920-00-926-5493	3	0.5625	R902b	7920	009265493
R902baa	8105002854744	Bag sand protective 26 x 14 mildew resistant	1		54.1	Mil-b-12233	3	0.037	R902b	8105	002854744
R902baa	8115002906016	Box set organizational equipment green 150-pound capacity	8	Set	595.09	Mil-b-8111	30	12	R902b	8115	002906016
R902baa	8145014791325	Lid shipping container plastic green	7	Each	63.2	Mhc100-2pg	2.25	0.75	R902b	8145	014791325
R902baa	8145014791329	Shipping and storage container miscellaneous equipment plastic	7	Each	208.2	Mhc100pg	3.25	0.55	R902b	8145	014791329
R902baa	8340ncm000196	Vestibule end panel Alaska tent (green)	2	Each	726		0	0	R902b	8340	Ncm000196
R902baa	8340ncm990366	Alaska tent 32 x 20 (green)	1	Each	16000		1000	0	R902b	8340	Ncm990366
R902baa	8340ncm990369	Alaska tent container (green)	1	Each	2395		310	0	R902b	8340	Ncm990369

AS Number	National Stock Number	Item Description	Level of Care	Unit Identifier	Price	Part Number	Weight	Cube	AS	Federal Stock Class	National Item Identification Number
R902baa	8340ncm991008	Extension Alaska tent (green)	1	Each	4000		0	0	R902b	8340	Ncm991008
R902baa	8465000016475	Frame, field pack	6	Each	20.75	Mils43835	0	0	R902b	8465	000016475
R902baa	8465010199103	Field pack: combat nylon duck water repellent large size	6	Each	44.8	Mil-f-43832	68	5.08	R902b	8465	010199103
R902baa	8465012535335	Field pack: combat nylon duck water repellent og106 medium size	6	Each	38.95	Mil-f-43833	3.2	0.265	R902b	8465	012535335
R902bba	6160015017267	Battery box	2	Each	0	930-4061-g1	0	0	R902b	6160	015017267
R902bba	6665001303616	Calculator set Radiac and nuclear yield	6	Set	3.01		0	0	R902b	6665	001303616
R902bba	6665015113033	Conversion tube, HAPSITE systems	10	Each	20.5	90024	0.5	0.005	R902b	6665	015113033
R902bba	6665015125180	Adapter calibrator air flow aluminum to connect to air sample	1	Each	83.72	2500-43	2.25	0.25	R902b	6665	015125180
R902bba	6665ncm030506	HAPSITE accessories case	1	Each	1300		0	0	R902b	6665	Ncm030506
R902bba	7025ncm990022	Laptop server	1	Each	4229		0	0	R902b	7025	Ncm990022
R902bba	7025ncm990023	All-in-one printer	1	Each	727		0	0	R902b	7025	Ncm990023
R902bba	7035ncm000336	Case, shipping and storage	1	Each	341		0	0	R902b	7035	Ncm000336
R902bba	7035ncm010090	Zip drive disks	1	Pack	49.99		0	0	R902b	7035	Ncm010090
R902bba	7045013684812	Disk flexible	2	Each	2		0.5	0.003	R902b	7045	013684812
R902bba	7045014352413	Disk flexible 3.5 inch, formatted	1	Box	4	47-6702	1.5	0.35	R902b	7045	014352413
R902bba	7045014445160	Disk disc recordable write once optical disk	7	Each	1.09	713382	0.2	0.002	R902b	7045	014445160
R902bba	7045014594985	Kit, computer cleaning	1	Each	7.39	Nib1998cmptrolkit050	0	0	R902b	7045	014594985
R902bba	7420013697117	Calculator electronic	1	Each	96.6		0.22	0.008	R902b	7420	013697117
R902bba	7510001648864	Lead pencil graphite 2b 4-inch large	2	Dozen	0.47	A-a-2801	0.001	0.001	R902b	7510	001648864
R902bba	7510002729662	Staples paper fastening office type .5 inch (width) .25 inch (length)	1	Box	0.81		0.43	0.02	R902b	7510	002729662
R902bba	7510009351005	Ruler plastic	1	Each	0.17	A-a-563	0.0001	0.0001	R902b	7510	009351005
R902bba	7510009400935	Pushpin aluminum steel .375 inch pin	4		0.72	3-20	0.01	0.001	R902b	7510	009400935
R902bba	7510009580743	Clip paper steel jumbo	1		0.57		0.12	0.06	R902b	7510	009580743
R902bba	7510013166213	Eraser, whiteboard	2	Each	2.37	920-335	0	0	R902b	7510	013166213
R902bba	7510013479580	Protector document poly clear transparent 11 x 8.5 inch 7 holes	2	Box	3.37	94420	1.6	0.05	R902b	7510	013479580
R902bba	7510013778162	Portfolio	1	Box	25	50425-05	0	0	R902b	7510	013778162
R902bba	7510014556067	Cartridge toner	1	Each	52.33		0.15	0.07	R902b	7510	014556067
R902bba	7510ncm990765	Protractor 360 degree	4	Each	3		0	0	R902b	7510	Ncm990765
R902bba	7510ncm990766	Ruler stainless 18 inches	1	Each	6		0	0	R902b	7510	Ncm990766
R902bba	7520001393902	Perforator paper desk adjustable 2 punches round perforation 0.2	1	Each	3.72	A-a-1020	0	0	R902b	7520	001393902
R902bba	7520001632563	Perforator paper	1	Each	29.64	7520-00-163-2563	4.2	1	R902b	7520	001632563

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R902bba	7520002271451	Pencil sharpening machine	3	Each	0.4	1000	0.0625	0.0001	R902b	7520	002271451
R902bba	7520002405727	Stapler paper fastener	2	Each	7.96	2fye-3	0.01	0.001	R902b	7520	002405727
R902bba	7520002718884	Rubber stamp band type dating die plate not including 4-band quantity	1	Each	1.32	0593	1.75	0.55	R902b	7520	002718884
R902bba	7520002815918	Clip board file 9 x 12.5 inch composition board back	4	Each	1.48	7520-00-281-5918	0.01	0.01	R902b	7520	002815918
R902bba	7520003126124	Marker tube-type fine tip black permanent no odor dries instantly	1	Dozen	8.71	120-3001	0.5	0.01	R902b	7520	003126124
R902bba	7520005901878	Pencil mechanical	2	Dozen	21.87	Ca-5	0.75	0.015	R902b	7520	005901878
R902bba	7520009041265	Marker, tube type	2	Dozen	1.81	7520-00-904-1265	0.0001	0.0001	R902b	7520	009041265
R902bba	7520009731059	Marker tube type felt chisel black permanent non-replaceable	2	Dozen	4.47	6003	0.1	2	R902b	7520	009731059
R902bba	7520013925296	Marker assorted tube type	2	Set	4.39	317wp4	0	0	R902b	7520	013925296
R902bba	7520013925299	Dispenser, post it note, 50's	4	Pack	5.8	680-pk	0	0	R902b	7520	013925299
R902bba	7520014207526	Marker assortment tube type Spotliter supreme fluorescent 6 color	1	Set	7.73	63144	0.75	0.15	R902b	7520	014207526
R902bba	7520014244867	Easel melamine board white 27-36 inches	2	Each	102.83	7520-01-424-4867	24	5.5	R902b	7520	014244867
R902bba	7520014575400	Pen, ball-point	1	Dozen	9.48	7520-01-457-5400	0	0	R902b	7520	014575400
R902bba	7530002223521	Book memorandum olive drab or gray 192 pages 8 x 5.5 inches	2	Each	2.1	0137a	0.35	0.1	R902b	7530	002223521
R902bba	7530002237939	Notebook stenographer's 6 x 9 inches 12s	2	Pack	12.92	7530-00-223-7939	70.5	1.8	R902b	7530	002237939
R902bba	7530002900617	Paper, bond	1	Box	53.69	O6g	3	0.1146	R902b	7530	002900617
R902bba	9330013584392	Plastic sheet, adhesive 50's	1	Box	10.16	A-a-2848	0	0	R902b	9330	013584392
R902bca	4110014645857	Refrigerator-freezer mechanical food	1	Each	194.15		35	2.25	R902b	4110	014645857
R902bca	5825015089698	Receiver radio navigation handheld portable	1	Each	743.9	400923	1.5	0.12	R902b	5825	015089698
R902bca	5830013644595	Audio project set voice amplifier	6	Each	150		5	2	R902b	5830	013644595
R902bca	5895015079409	Case electronic communications equipment	1	Each	9.95	010-10117-02	0.03	0.03	R902b	5895	015079409
R902bca	5970015018005	Insulation sheet, electrical	1	Each	0	931-408-p2	0	0	R902b	5970	015018005
R902bca	6130015064543	Charger battery 110/220 volts alternating current	1	Each	908	270-2547-130	2.15	0.225	R902b	6130	015064543
R902bca	6135008357210	Battery non-rechargeable 1.5 volt cylindrical	3	Pack	9.84	Ms75059	3.5	0.027	R902b	6135	008357210

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R902bca	6135009002139	Battery non-rechargeable alkaline 9.0 volts snap-on 12s	1	Pack	10.7	Pp3	0.1	0.001	R902b	6135	009002139
R902bca	6135014407774	Battery non-rechargeable lithium sulfur dioxide 6.4 ampere	12	Pack	157	Mil-prf-49471/11(er)	4	0.45	R902b	6135	014407774
R902bca	6135014470950	Battery non-rechargeable	6	Pack	2.42	115 a	0	0	R902b	6135	014470950
R902bca	6140014002902	Battery storage potassium hydroxide 6 volt	3	Each	79.52	Mp/3155-1	3.25	0.55	R902b	6140	014002902
R902bca	6140ncm031978	Rechargeable, AA battery kit	1	Each	49.5		0	0	R902b	6140	Ncm031978
R902bca	6140ncm031979	Battery, AA 4-pack	1	Pack	14.99		0	0	R902b	6140	Ncm031979
R902bca	6150015017248	Cable assembly power elect 14 receptacle & stripped	1	Each	279	930-246-g1	0.21	0.08	R902b	6150	015017248
R902bca	6150015018437	Cable assembly special purpose electrical	1	Each	45	010-10165-00	1.75	0.12	R902b	6150	015018437
R902bca	6260011785560	Light chemiluminescence	2	Box	5.14	95277-20	0.35	0.12	R902b	6260	011785560
R902bca	6260011960136	Light chemiluminescence	2	Box	6.45	9-01360	0.55	0.12	R902b	6260	011960136
R902bca	6260012185146	Light chemiluminescence	2	Box	0		0	0	R902b	6260	012185146
R902bca	6260012470368	Light chemiluminescence	2	Box	10.77	9-03680	0.55	0.12	R902b	6260	012470368
R902bca	6510007863736	Pad isopropyl alcohol impregnated cotton/ rayon white 200s	2	Pack	2.58	Milp36792	0.5	0.1	R902b	6510	007863736
R902bca	6515013992984	Cooler insulated can be used for warming/ chilling/carrying fluid	3	Each	10.63	K12	2	0.7	R902b	6515	013992984
R902bca	6515015077279	Applicator disposable wood shaft	1	Pack	7.53	14-959-97a	0.04	0.12	R902b	6515	015077279
R902bca	6550014257957	Chlorine test table iethyl-p-phenylene diamine	2	Pack	6.53	6999-j	0.2	0.01	R902b	6550	014257957
R902bca	6550ncm030234	Liquid sample collector for outdoor use (bio-aerosol collector)	1	Each	18000		50	9	R902b	6550	Ncm030234
R902bca	6605011966971	Compass, magnetic	3	Each	33.8	Mil-c-10436	0.5	0.005	R902b	6605	011966971
R902bca	6630010124093	Test paper chlorine determination range 10-50-100-200 parts/million10	1	Pack	42.75	Cm-240	0.5	0.013	R902b	6630	010124093
R902bca	6630010273914	Comparator color: hydrogen ion and residual chlorine	2	Each	110.85	6980	2.3	0.209	R902b	6630	010273914
R902bca	6630015017263	Concentrator	1	Each	149	930-251-g1	0	0	R902b	6630	015017263
R902bca	6630015098565	Meter handheld digital display 0.0 to 14.0 indicator	1	Each	79	Ex-ph-100	2.25	0.25	R902b	6630	015098565

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R902bca	6640011853289	Tape sealing laboratory glassware flex thermoplastic 125 feet	1	Roll	10.19	G3200	0.2	0.015	R902b	6640	011853289
R902bca	6640013831595	Tenax 50/100 milligrams sorbent tubes 50s	1	Box	226	226-35-03	0	0	R902b	6640	013831595
R902bca	6640014856075	Litmus paper strip f/onsite deter values 30 per package	1	Pack	9.95	57798	0.002	0.002	R902b	6640	014856075
R902bca	6640014954759	Swab polyester with screw on cap 16 x 15 millimeters	2	Pack	151.73	14-959-75	0.55	0.12	R902b	6640	014954759
R902bca	6640014957529	Pipet transfer plastic	1	Pack	28.69	13-711-48	0.55	0.12	R902b	6640	014957529
R902bca	6640015122881	Tube biological culture sampling 5.25 inches	1	Pack	62.89	B292892	2.25	0.25	R902b	6640	015122881
R902bca	6640015123590	Scoop laboratory plastic dispster flat bottom	1	Pack	42.95	14-375-250	2.25	0.25	R902b	6640	015123590
R902bca	6640ncm031969	Whirl-pak speci-sponge bags	1	Pack	72.75		0	0	R902b	6640	Ncm031969
R902bca	6640ncm031970	Sample tube, polypropylene	1	Pack	134		0	0	R902b	6640	Ncm031970
R902bca	6640ncm031971	Poison labels	1	Box	15.45		0	0	R902b	6640	Ncm031971
R902bca	6640ncm031976	Whirl-pak filter bag, 250's	1	Box	113.3		0	0	R902b	6640	Ncm031976
R902bca	6640ncm031982	Tygon ultra chemical resitant tubing	1	Each	83.15		0	0	R902b	6640	Ncm031982
R902bca	6640ncm031983	Chromosorb-102 sampling media, 20's	1	Box	162		0	0	R902b	6640	Ncm031983
R902bca	6645002504680	Stop watch type B timer 16 size 7 jewel	5	Each	35.96	982000-85	0.3	0.008	R902b	6645	002504680
R902bca	6650011086629	Binocular	2	Each	38.14		0.33	0.155	R902b	6650	011086629
R902bca	6665000508529	Paper chemical agent detector single sheet 4 x 2.5 inches	100	Book	0.77	D5-67-266	0.1	0.001	R902b	6665	000508529
R902bca	6665011334964	Detector kit, chemical	10	Kit	39.93	D5-77-2240	8	1.05	R902b	6665	011334964
R902bca	6665011340885	Water testing kit chemical agents	10	Each	235.1	D5-77-2500	28	0.147	R902b	6665	011340885
R902bca	6665011349714	Radiacmeter	12	Each	114	Im-143b/pd	0.4	0.001	R902b	6665	011349714
R902bca	6665012265589	Paper chemical agent	1	Roll	4.08	5-67-280	0.5	0.106	R902b	6665	012265589
R902bca	6665012932149	Simulator detector tickets chemical agent	1	Each	120	5-77-2914	12	1.1	R902b	6665	012932149
R902bca	6665013204712	Radiac set	4	Each	5200	ADM-300A kit	2.2	0.2	R902b	6665	013204712
R902bca	6665013578502	Monitor chemical agent	3	Each	5500	5-15-17100	25	1.25	R902b	6665	013578502
R902bca	6665014265071	Verification kit radiac	1	Each	750	ADM-300A kit	2.25	0.55	R902b	6665	014265071
R902bca	6665014806035	Detector gas 8.5 x 3.25 x 2.5 inch including passport	1	Each	3936	711402	12	1.2	R902b	6665	014806035
R902bca	6665014948725	Bio-sampling kit	50	Kit	74.83	Jpobskt-10	1.15	0.15	R902b	6665	014948725
R902bca	6665014974649	Charger radiac detector alternating current	1	Each	720	910	3.85	0.125	R902b	6665	014974649
R902bca	6665015077617	Sam nuclear spectroscopy system model 935	1	Each	13415	Sam model 935	0	0	R902b	6665	015077617

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R902bca	6665015081062	Canister carrier gas HAPSITE	1	Each	1375	930-432-p24	4.25	0.75	R902b	6665	015081062
R902bca	6665015081065	Case shipping portable shipping case e.i. 6630-01-507-3989	1	Each	900	930-464-p1	12	1.12	R902b	6665	015081065
R902bca	6665015081067	Case shipping HAPSITE headspace analyzer	1	Each	825	931-406-p1	12	1.12	R902b	6665	015081067
R902bca	6665015081073	HAPSITE cold weather insulating bag	1	Each	350	930-4051-p1	0	0	R902b	6665	015081073
R902bca	6665015081076	Insulation line use with HAPSITE headspace sampling system	1	Each	35	931-408-p1	1.15	0.15	R902b	6665	015081076
R902bca	6665015081296	HAPSITE headspace sampling system	1	Each	15750	931-205-g1	0	0	R902b	6665	015081296
R902bca	6665015083257	CDS Kit	1	Kit	3000	6400565s	0	0	R902b	6665	015083257
R902bca	6665015089619	Cannister internal standard gas 6630-01-508-9602	1	Each	868	930-433-p6	12	1.12	R902b	6665	015089619
R902bca	6665015089677	Holder filter aluminum air sampling media open faced 4-inch size	20	Each	131	2500-25a	1.15	0.15	R902b	6665	015089677
R902bca	6665015094866	Sampling kit chemical agent highly efficient	2	Each	1905.75	Qsa model 102	3.25	0.25	R902b	6665	015094866
R902bca	6665015096438	Sampler air radiological constant flow air sampler 3 wire cord	5	Each	880	H-809vii	0.55	0.12	R902b	6665	015096438
R902bca	6665015098572	Calibration source use with 935 spectroscopy nuclear system	1	Set	460	6918	2.25	0.25	R902b	6665	015098572
R902bca	6665015098587	Case carrying ruggedized external e.i. 6665-01-507-7617	1	Each	450	6908-2	3.25	1.15	R902b	6665	015098587
R902bca	6665ncm020875	Detector tube, drager, carbon tetrachloride	2	Pack	60		0	0	R902b	6665	Ncm020875
R902bca	6665ncm030227	Electronic personal dosemeter epd-n	2	Each	1000		0.3	0.01	R902b	6665	Ncm030227
R902bca	6665ncm030228	Electronic personal dosemeter epd mk 2	6	Each	700		0.5	0.01	R902b	6665	Ncm030228
R902bca	6665ncm030229	High volume air sample filter paper 4	2	Pack	68.4		0.5	0.01	R902b	6665	Ncm030229
R902bca	6665ncm030235	Meter roentgen rate	1	Each	2540		0	0	R902b	6665	Ncm030235
R902bca	6665ncm030253	Gas chromatograph/mass spectrometer, portable	1	Each	75900		35	1.24	R902b	6665	Ncm030253
R902bca	6665ncm030257	Sample needle, HAPSITE headspace	1	Each	90		0.1	0.01	R902b	6665	Ncm030257
R902bca	6665ncm030262	HAZMAT ID	1	Each	47000		20	6	R902b	6665	Ncm030262
R902bca	6665ncm030266	Shipping case, HAPSITE service module	1	Each	1078		0	0	R902b	6665	Ncm030266
R902bca	6665ncm031063	TVA	1	Each	11933		0	0	R902b	6665	Ncm031063
R902bca	6665ncm031968	Air sampling pump kit	1	Kit	3299		0	0	R902b	6665	Ncm031968

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R902bca	6665ncm031980	Complete chip management system emergency respiratory kit	1	Kit	2995		0	0	R902b	6665	Ncm031980
R902bca	6665ncm031981	HAZCAT kit without drager pump	1	Kit	2550		0	0	R902b	6665	Ncm031981
R902bca	6665ncm991047	Tripod instrumentation	5	Each	290		0	0	R902b	6665	Ncm991047
R902bca	6680015088950	Air flow calibrator	1	Each	1049	D-8528	0	0	R902b	6680	015088950
R902bca	6720ncm010143	Carrying case for digital camera	1	Each	50		0	0	R902b	6720	Ncm010143
R902bca	6720ncm990811	Digital camera	1	Each	900		0	0	R902b	6720	Ncm990811
R902bca	6850013578456	Decontamination kit individual	2	Box	498	5-77-3201	5	0.5	R902b	6850	013578456
R902bca	6850014586391	Freeze pack cool packs reusable 6 x 4 x 1 inch, -1 degree Celsius temperature rating 24s	1	Pack	21.59	M1067-1	0.55	0.11	R902b	6850	014586391
R902bca	7240ncm031975	1-quart tin container	1	Case	39.15		0	0	R902b	7240	Ncm031975
R902bca	7530013576851	Label	1	Box	35.45	4076	0	0	R902b	7530	013576851
R902bca	7640ncm031977	Worldmap	1	Each	116.65		0	0	R902b	7640	Ncm031977
R902bca	7690012715672	Label "biohazard" 3-inch width x 1-inch length orange-red background roll of 500s	1	Roll	20	Sbh-4	0.1	0.001	R902b	7690	012715672
R902bca	7920014545879	Towel, machinery wiping 150's	1	Box	28.18	7920-01-454-5879	0	0	R902b	7920	014545879
R902bca	8030008893535	Tape antiseizing polytetraflouroethylene unfused white 1/2 x 260 inches	4	Each	0.76		1	0.011	R902b	8030	008893535
R902bca	8105011839768	Bag plastic 39 x 33 inches 33 gallon capacity 30-pound load capacity 125s	1	Box	19.61	A-a-1668	8	0.36	R902b	8105	011839768
R902bca	8125004887952	Bottle, applicator	2	Each	0.91	5910aa	0.15	0.06	R902b	8125	004887952
R902bca	8415ncm031972	Ambi n-dex, powder free gloves, small	1	Box	16.7		0	0	R902b	8415	Ncm031972
R902bca	8415ncm031973	Ambi n-dex, powder free gloves, medium	1	Box	16.7		0	0	R902b	8415	Ncm031973
R902bca	8415ncm031974	Ambi n-dex, powder free gloves, large	1	Box	16.7		0	0	R902b	8415	Ncm031974
R902bca	9905013464716	Sign kit, contamination	5	Each	124	5-14-1	1	0.0025	R902b	9905	013464716
Count	**224**										

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Annex C
Assessment Scenarios

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Scenarios

Scenario One: Employment of the MNBC Defense Team (Day One—All Day)

Scenario Objective

Complete equipment and site setup; initiate active and passive NBC monitoring.

Scenario Description

This scenario required approximately 5 hours to complete. The scenario was initiated by notional deployment and employment of the MNBC Defense Team to a bare-base environment with base operating support. The SSS and the CP liner were erected prior to the start of this scenario. For purposes of this exercise, erection of the SSS and the CP liner were assumed to have taken place using the three-man MNBC Defense Team augmented by personnel from the EMEDS, the BAT, the PAM, or other personnel from units with access to the palletized MNBC Defense Team AS equipment package.

The MNBC Defense Team AS was secured on two standard 463L pallets. The BAT equipment was secured on a separate pallet. The MNBC Defense Team, working with BAT personnel, unpacked all equipment, developed a viable, interoperable MNBC Defense Team Work Center floor plan in the modified SSS, and completed BAT and MNBC Defense Team AS equipment package setup in the shelter.

The BAT and the MNBC Defense Team validated power requirements, calibrated and performed operational checks on all equipment, set up and checked out all communications equipment, established radio communication and computer connectivity, and initiated passive NBC monitoring using M8 and M9 paper in their sector.

Task #1: The MNBC and BAT personnel inspect and validate the SSS and CP liner setup to prepare the shelter for CP operations.

Activity: The MNBC Defense Team inspected the shelter and CP liner for proper employment. The team initiated operation of ECUs, lighting, generators, and other ancillary equipment, as appropriate. BAT and MNBC personnel validated power requirements, performed operational checks on all infrastructure equipment, and ensured that CP was operational.

Closing Action: After the MNBC Defense Team completed this scenario, the team submitted a verbal status report to the SRC representative.

Task #2: Set up, calibrate, and operate NBC and communication equipment.

Activity: MNBC personnel, working with BAT personnel, unpacked all equipment, developed a viable, interoperable floor plan, and completed BAT and MNBC equipment setup in the SSS. The BAT and MNBC Defense Teams calibrated and performed operational checks on all equipment, set up and checked out all communications equipment, and established radio and telephone communication and computer connectivity.

Closing Action: The MNBC Defense Team submitted a status report to the SRC representative following completion of the above actions.

Task #3: Initiation of passive monitoring.

Activity: The MNBC Defense Team received intelligence that hostile theater ballistic missile attacks may occur during the 24-hour period following initiation of MNBC Defense Team operations. The team developed an EMEDS sector NBC plan and initiated passive monitoring with M8 and M9 paper in the EMEDS sector. The MNBC Defense Team initially dressed in MOPP 0 for this scenario.

Closing Action: After the MNBC Defense Team appropriately deployed NBC monitoring equipment, MNBC and BAT personnel completed and submitted a medical Readiness-C Report to the EMEDS Commander.

End of Scenario Action: Det 1 AFOTEC personnel conducted a scenario hotwash immediately following the completion of the scenario.

Scenario Two: Chemical Attack (Day Two—Morning)

Scenario Objective

Identify the chemical agent, evaluate and confirm MOPP requirements, complete notional decontamination activities, and identify residual persistency.

Scenario Description

This scenario required approximately 5 hours to complete. Four artillery rounds containing ten pounds of V-series nerve agent landed in different locations. One round landed in a lake used as a water supply. Subsequent return United States Army artillery fire destroyed an enemy position that contained five additional enemy artillery shells loaded with V-series agent.

CEX initially identified hot zones using Improved Chemical Agent Monitors, M-22 automatic chemical detection alarms, and pre-positioned M8 and M9 paper. Using M8 paper, M-22s, and vapor, liquid, solid tracking model (VLSTRAK) plots, the MNBC Defense Team was informed that several base sectors were contaminated. These sectors are currently at MOPP 4.

Thirty minutes after the theater ballistic missile attack, based on an initial MNBC Defense Team assessment, MNBC Defense Team personnel initiated post-attack operations at MOPP 4. Personnel in the EMEDS/CP shelter removed MOPP gear after confirmation of the integrity of the CP. Predicated on persistency hazard tables, agent persistency in contaminated areas was expected to be 32 hours. The commander agreed that no critical operations would take place in the contaminated sectors prior to the 32-hour persistency contamination estimate. Personnel in the contaminated areas remained at MOPP 4.

Several sectors on the base reported no positive M8 paper or M-22 readings. The EMEDS sector was east of the area of attack and is crosswind (the wind was out of the north but light and variable) from the contaminated area. One piece of M8 paper located within the EMEDS sector had some questionable, green, nerve agent (VX) nerve spots. Although the M8 paper and M-22s were not positive, the VLSTRAK plot indicated that part of the EMEDS sector was in the contaminated zone.

The commander wanted to remove MOPP gear throughout the sector if the contamination level indicated that it was appropriate to do so. Therefore, the MNBC Defense Team was tasked to identify the risk level for unprotected personnel in the EMEDS sector.

Task #1: Following completion of initial detection activities, identify risk level for unprotected personnel in the EMEDS sector and provide follow-on assessment to CEX.
Note: Chromatograph and spectra were pre-loaded into the instruments. Notional VX was loaded in the MS to support MS-only survey at one designated location. Notional VX chromatograph/ spectra was loaded to support headspace analysis. A Fourier Transform Infrared Spectroscopy (FTIR) VX file was pre-loaded to support agent identification. The airborne concentration given to the team was predicated on the pre-load and converted to 0.00004 milligrams per meters cubed for HAPSITE concentrator reading.

Activity #1: The team conducted a field survey and developed an NBC surveillance plan for the sector. The MNBC Defense Team determined how many air, soil, and soil-gas samples (as applicable) should be taken throughout the sector.

Activity #2: Using the TVA 1000B (photo ionization detectors/flame ionization detectors), the HAPSITE, the Drager CDS Kit, and the FTIR, the MNBC Defense Team deployed to each sample location and appropriately screened each air and soil sample in the EMEDS sector. (Note: The TVA 1000B was inoperable and was not used during the assessment.)

The MNBC Defense Team used the Quicksilver Sampling Kit to collect samples for field analysis and returned the samples to the MNBC Defense Team work center for further analysis. Sample collection and analysis were performed at four sites. While conducting collection/ sampling activities, the MNBC Defense Team members were in MOPP 4. Note: Results for the TVA 1000B, the Drager CDS Kit, and the FTIR were for background use. Results of the HAPSITE MS-only mode were zero. However, results of the HAPSITE concentrator run at one sampling point for 5 minutes was set up to show 0.00004 milligram per meters cubed.

Activity #3: Using GPS equipment, handheld or HAPSITE GPS, the MNBC Defense Team plotted sample location points and contamination zones.

Activity #4: Based on low agent concentration, acceptable exposure time, and the toxicological data received in a follow-up assessment, the SRC determined that the hazard to personnel was negligible. The SRC representative recommended to the commander that personnel in the EMEDS sector use MOPP 2. The MNBC Defense Team initiated operational decontamination of personnel and equipment that was used in the contaminated environment

Closing Action: Using the Motorola 5000 communications system, the MNBC Defense Team provided a contamination report to the SRC representative, identifying the type of contamination found and the airborne and soil contamination concentration levels. The MNBC Defense Team also provided the SRC with a plot of the contaminated area. The plot was performed inside the work center. MNBC Defense Team members completed notional operational decontamination prior to re-entering the work center.

Task #2: The MNBC Defense Team collected, identified, and analyzed the level of water contamination in the lake where the artillery shell landed. Note: A water source provided by AFMESA was used to simulate the lake.

Scenario Description: The artillery round that landed in the lake did not explode and remains in the water supply. The commander has declared the water off-limits for consumption and showering. The Explosive Ordnance Disposal (EOD) unit retrieved the warhead from the lake, but EOD has not determined if the round leaked.

Activity: The MNBC Defense Team collected water samples from the water source, using the Quicksilver Sampling Kit, the M272 Chemical Agent Water Testing Kit, and the HAZMAT ID (FTIR) in the field. The team collected additional samples and returned the samples to the work center for analysis. Using the HAPSITE headspace analyzer, the MNBC Defense Team attempted to identify the presence of any chemical agents. The team also established a monitoring plan for the water system, which included frequency, method, and location of samples. (Note: This is intended to be a plan only and will not be implemented).

Closing Action: Based on negative results for VX from the M272 Chemical Agent Water Testing Kit, the HAZMAT ID, and the HAPSITE, the MNBC Defense Team provided the SRC with an appropriate analysis report.

Task #3: The MNBC Defense Team collected and analyzed soil samples to identify and quantify chemical agents using equipment at the MNBC Defense Team work center. Note: Prior to this event, AFMESA and ACC identified a suitable exterior location to simulate a contaminated sector. Also, since an actual casualty collection point was not established, processing through the casualty collection point from the contaminated sector was simulated.

Scenario Description: Thirty-two hours after the artillery attack, persistency tables indicated that VX levels in the contaminated sectors had subsided to a 16 percent-mild-response level. Since Security Forces Squadron personnel activities include direct contact with the ground (crawling) in this zone, the commander was concerned about possible exposure in the sandy soil of this area. Potential exposure to contaminants includes three routes: inhalation, percutaneous vapor, and liquid absorption.

Activity #1: Using the CHEMRAT process, the team assessed the hazard in the sector.

Activity #2: The MNBC Defense Team deployed to the contaminated sector and initiated screening of the air for vapor hazard using the HAPSITE MS-only and the concentrator. Using the HAPSITE, the MNBC Defense Team identified a notional VX concentration of 0.03125 milligram per meters cubed. In response to this determination, the team collected soil samples and transported the samples to the work center.

Activity #3: At the work center, the team identified, analyzed, and quantified the presence of chemical agents using the HAPSITE and the HAZMAT ID. Using the HAZMAT ID, the team notionally verified the presence of VX. Using the headspace analyzer, the team also identified a notional quantity of VX in the soil sample.

Activity #4: The team used notional concentration and exposure data (concentration + 480 minutes) with the CHEMRAT process to determine dose and physiological response data for inhalation, percutaneous vapor, and liquid exposure.

Closing Action: The MNBC Defense Team completed a health risk assessment for unprotected personnel operating for 8 hours per day in the contaminated sector.

The team used the Motorola 5000 communications system to transmit the results of the chemical analysis and a health risk assessment to the SRC.

End of Scenario Action: Det 1 AFOTEC personnel conducted a scenario hotwash immediately following the completion of this scenario.

Scenario Three: Radiological and Biological Attack (Day Two—Afternoon and Night)

Scenario Objective

Identify agents and contamination zones, and quantify levels for inclusion in a health risk assessment.

Scenario Description

This scenario required approximately 6 hours to complete. Three modified North Korean Silkworm missiles were fired. One was shot down directly over the north quadrant of the base. Patriot Missiles were used to shoot down the other two missiles within 1,000 meters north of base. One intact warhead landed on the shore of the lake, which is used as water supply, and burst. Winds were from the north. Available intelligence indicates that all three missiles may contain 250 kilograms of the radioactive material Strontium 90 and 250 kilograms of the biotoxins Trichothecene Mycotoxin (T-2). None of the missiles had detonation devices. The North Koreans were relying on Patriot missile interdiction to effect aerial dispersion.

For purposes of this scenario, the EMEDS sector represented the entire base. Prior to the initiation of this scenario, the MNBC Defense Team oriented RADeCO air samplers accordingly. The BAT Team has toxin capability and RAPID capability for T-2. The commander requested data regarding soil, air, and water contamination. The SRC directs the MNBC Defense Team to establish air monitoring using the REDeCO high volume air sampler (HVAS) and the XMX Bio-aerosol Collector. The team used EPDs when performing radiation sampling and monitoring.

Task #1: The MNBC Defense Team will perform field-screening analysis. Note: The water simulation source used was the same as that used to support the previous scenario.

Activity: EOD and CEX identified a potential radiological threat. In response, the MNBC Defense Team collected aerosol, soil, and water samples using sampling containers, the XMX Bio-aerosol Collectors, the HVAS, the Quicksilver Sampling Kit, and other appropriate equipment. Two multi-media samples were collected for on-site analysis. The activities of the MNBC Defense Team were divided into two categories: collection and analysis.

Collection

Activity #1: The team established four HVAS sites with generators at each compass side of the base.

Activity #2: The team used the XMX Bio-aerosol Collector for collection of biological samples in preparation for RAPID analysis.

Activity #3: The team collected water and soil samples for radiological and biological analyses using the Quicksilver Sampling Kit.

Analysis

Activity #1*:* The team used the HAZMAT ID to screen samples for biological agents.

Activity #2*:* Based on inconclusive biological threat analysis results, the team used the ADM-300A radiac meter and gamma ray spectrometer to analyze the samples to identify potential radiological hazards. The team used a beta probe to analyze the HVAS filter paper.

A notional result of 300 curies per minute was provided to the team with roentgen read of non-detect. The gamma ray spectrometer notionally indicated a background reading, and EPDs were used to notionally reflect an accumulation dose of 0.01 millirem for personnel performing sample collection in the field.

Activity #3*:* Water samples were screened as a bulk sample, then filtered onto filter paper and analyzed for radiological and biological hazards.

Activity #4: All media samples were passed to the BAT for analysis. The BAT provided feedback on the collection and preparation methods and suitability of the samples for use with RAPID.

Closing Action: The MNBC Defense Team transferred collected bio-samples to the BAT for analysis to validate sample transfer procedures and the effectiveness of the collection tools. The team provided a report of the results to the SRC.

Task #2: The MNBC Defense Team performed limited field surveillance and analysis operations at night. Note: AFMESA and ACC provided lighting accessories, as necessary; however, the team was required to use artificial light sources to support night operations that are provided to the MNBC Defense Team in the AS equipment package.

Activity: The MNBC Defense Team operated all essential equipment in low light conditions with the limitations identified below. All team members participated in some aspect of night operations. Personnel located in the work center participated in MOPP 0. During operations outside the work center, MNBC Defense Team personnel dressed in modified MOPP 4 (mask and gloves).

The team operated the following equipment: HAPSITE, HAZMAT ID, gamma ray spectrometer, EPD, Drager CDS Kit, Drager CMS, Roentgen meter, and XMX BIO-AEROSOL COLLECTOR.

The team prepared all equipment for night operations and demonstrated the operational capability of each piece of equipment during low-light conditions. Team personnel primarily used light sticks, which are included in the MNBC Defense Team AS, and a flashlight, which is included in the Quicksilver Sampling Kit, as the artificial light sources.

Closing Actions: None.

End of Scenario Action: Det 1 AFOTEC personnel conducted a scenario hotwash immediately following the completion of this scenario.

Scenario Four: Terrorist Attack with WMD (Day Three)

Scenario Objective

Determine extent of airborne and soil hazards response sector to identify and quantify known chemical hazards to support generation of a health risk assessment.

Scenario Description

This scenario required approximately 4 hours to complete. Terrorists fly an airplane into a chemical weapons storage facility in MD. United States Northern Command deploys the local MNBC Defense Team to the scene within 3 hours of incident. The Air Force area of responsibility is outside the hot zone; therefore, personal protective equipment is not immediately required. The MNBC Defense Team is assigned to conduct air monitoring, collect soil samples, and analyze these samples using the all pertinent analysis equipment to identify the full spectrum of possible contamination. Note: No positive sample injects were used during this scenario.

Task #1: The MNBC Defense Team used all available, pertinent NBC assets to identify and quantify contamination, including the HAPSITE, the HAZMAT ID, and the HAZCAT.

Activity: Team members attempted to verify and identify the presence of any chemical compounds using soil, water, and air samples. The team used calibration curves or ratios as an estimate, and the HAPSITE headspace analyzer to provide quantity in parts per million/billion/trillion, and milligram per meters cubed. The MNBC Defense Team performed the following activities:

Activity #1*:* Using available sample collection tools, the MNBC Defense Team collected environmental samples to support restoration of operations. During collection of the samples, the team performed screening of the air with the Drager CDS Kit, the Drager CMS, the TVA 1000B, and the HAPSITE.

Activity #2*:* Restoration samples were screened with the HAZMAT ID, the ADM-300A radiac meter, the SAM 935, and the HAPSITE and prepared for shipment to a state certified laboratory for analysis.

Activity #3*:* The MNBC Defense Team also conducted environmental sampling to identify potential biological and radiological hazards. Biological aerosol and radiological particulate monitoring was established and samples analyzed at the MNBC Defense Team work center using the ADM-300A radiac meter and the SAM 935.

Activity #4*:* The team used the HAZCAT to analyze for metals in air samples collected from the HVAS.

Closing Action: Using the secure communications capability of the Motorola 5000 communications system, the MNBC Defense Team provided a report to the commander.

End of Scenario Action: Det 1 AFOTEC personnel conducted a scenario hotwash immediately following the completion of this scenario.

Scenario Five: Redeployment of the MNBC Defense Team (Day Four)

Scenario Objective

Successfully re-pack and palletize the MNBC Defense Team equipment.

Scenario Description

This scenario required approximately four hours to complete. The MNBC Defense Team receives a redeployment notice, and initiates packing and palletization activities to prepare for redeployment.

Activity: The MNBC Defense Team disassembled and repackaged the MNBC Defense Team FFCPA, including all equipment and supplies. Following completion of this process, the equipment was palletized in accordance with the LOGDET plan. The equipment was prepared for redeployment using appropriate cargo netting.

Closing Action: None.

End of Scenario Action: Det 1 AFOTEC personnel conducted a final assessment hotwash immediately following the completion of this scenario.

Annex D
MNBC System Performance Limitations

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Environmental Impact on NBC Equipment Performance

Instrument	Manufacturer's Recommended Operating Temperature Range	Inclement Weather Issues	Battery Life	Technical Limiting Factors
HAPSITE	5 degrees Celsius (°C)–45°C 41degrees Fahrenheit (°F)–113°F	Moisture levels above 8 percent, extremely high humidity, high wind, and extreme dust can affect performance or results	3 hours	Requires nitrogen supply for carrier gas and internal standard gas for calibration Fragile; drop test not to exceed 6 inches
Drager CDS Kit	5°C–30°C 41°F–86°F	Humidity, high/low temperatures can affect equipment sensitivities		Need tube warmer
HAZMAT ID	-7°C–50°C 19°F–122		2 hours run time 3 hours to charge	Liquid crystal display screen clarity reduced in bright light Fragile; drop test not to exceed 18 inches
TVA 1000B	0°C–50°C 32°F–122°F		8 hours run time 16 hours to charge	Requires hydrogen supply for FID
Idaho PCR	25°C–48°C 77°F–120°F	Indoor use	None	Reagent shelf life six months if stored at room temperature; rapid degradation if stored above room temperature
RADeCO air sampler	None	Limits—95-percent non-condensing humidity Will not function in hard rain, high dust	None	Requires a cover in inclement weather; operation in high dust may shorten life span of motor
XMX Bio-aerosol Collector	0°C–50°C 32°F–122°F	None	None	

Environmental factors such as temperature extremes, dust, and other environmental contaminants may impact the operation of automated sampling and analysis equipment. The table above identifies the normal operating ranges for several equipment items on the proposed AS. Temperature extremes and adverse environmental conditions could affect each piece of equipment differently.

CDS Kit: A February 1999 study by the SBCCOM which evaluated Drager chemical agent tubes over a temperature range from 0–40°C (32–104°F) and 0–90-percent humidity states, "The colorimetric tubes performed consistently well under all conditions." These tubes have a one-order of magnitude lower detection limit than the M-22 and ICAM. Also, these tubes were tested with 16 different chemical products common to military operations and "none of the potential interferents tested caused them to falsely report the presence of a CW agent."

HAPSITE: During the F3, the HAPSITE was operated at temperatures ranging from 19–52°F. However, this assessment was not designed to determine the accuracy or reliability of the equipment items, and operational problems were not noted. Extreme low temperatures can adversely affect the battery and the LCD. It is important that the HAPSITE maintain a constant temperature in the column relative to the method that is being run. If the column temperature or vacuum are not held constant, the HAPSITE will not allow the run to occur and will prompt the user with an error message. The HAPSITE has been operated at temperature extremes of -20°F (Alaska) to 130°F (Afghanistan), however no data was available from these operations to assess system function.

HAZMAT ID: The HAZMAT ID performs internal checks to ensure proper system operation. Temperature extremes may adversely affect the computer system components and LCD display.

RADECO: The RADECO was calibrated on-site during the F3 and operated properly at a temperature range of 19–52°F and during rain. Rain however presents a potential problem with the filter. If the filter becomes wet, then the flow rate is changed which invalidates quantitative analysis of the sample.

Performance limitations should be identified and included in the applicable operator maintenance manuals, the MNBC Defense Team training protocol, and other appropriate documents.

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