

Research and Insights into the U.S. Army's Chemical, Biological, Radiological, Nuclear Forces

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Abstract: As technology advances and the nature of warfare evolves, nuclear, biological, and chemical (NBC) weapons have increasingly drawn public attention. NBC incidents, with their widespread impact and severe threats to life and property, have raised public demands for greater knowledge and improved response capabilities. As a result, militaries around the world are accelerating the development of their NBC response forces. The 20th CBRNE Command is the U.S. Army's primary unit for global NBC threat response, providing comprehensive support and expertise. This study offers an overview of the 20th CBRNE Command's structure, detailing the personnel organization and equipment allocation. It also analyzes the unique roles and functions of CBRN warrant officers at different levels, as well as the development trends in operational equipment for CBRN environments. These insights provide valuable guidance for optimizing Chinese military's organization and advancing equipment development, ultimately enhancing the ability to mitigate CBRN risks and improve response and defense capabilities.

Keywords: U.S. Army; CBRN; CBRN Warrant Officers; Defense; Equipment

1. Introduction

With the escalating prevalence of Chemical, Biological, Radiological, and Nuclear (CBRN) terrorist incidents in various emergencies, governments worldwide and the international community have universally intensified and fortified their preparations to combat CBRN terrorism[1]. Events such as the Fukushima nuclear leak, the Tianjin Port "8·12" explosion, and the global COVID-19

pandemic in 2019 have profoundly impacted national security and social stability. In comparison to damage caused by conventional weapons attacks, CBRN incidents have a wider impact and pose a more severe threat to the lives and properties of people, consequently increasing the public's demand for fundamental preparedness capabilities. In recent years, armed forces worldwide have placed a growing emphasis on CBRN units, not only making multiple adjustments in their organization but also continually incorporating new types of equipment.

Following the 9/11 attacks, the United States made significant strides in its CBRN response capabilities with the establishment of the 20th CBRN Command. [2] Since its inception in October 2004, the command has seen rapid expansion in its missions, personnel, and capabilities. This command acts as the Army's centralized support agency for the global response, assessment, control, and elimination of CBRN threats. [3] Stationed at Aberdeen Proving Ground, Maryland, the 20th CBRN Command is home to 75% of the Army's active-duty CBRN specialists. It includes: The headquarters and headquarters company; the 48th CBRN Brigade; the 2nd Explosive Ordnance Disposal (EOD) Group; the 71st EOD Group; three nuclear disablement teams; three weapons of mass destruction (WMD) coordination teams (A); and two WMD coordination teams (B). The 48th CBRN Brigade (Chemical Brigade) serves as the primary combat force of the command. Under its structure are the brigade headquarters and headquarters company, the 83rd CBRN Battalion (Chemical Battalion), the 2nd Chemical Battalion, and the 22nd Chemical Battalion. Their main responsibilities include monitoring and early warning, detection and reconnaissance, protective handling of CBRN

incidents, and providing CBRN response capabilities across the full spectrum of military operations. Furthermore, the 20th CBRN Command assigns CBRN warrant officers at all levels to provide specialized guidance and technical support for CBRN operations. To enhance the overall operational effectiveness of its equipment, the command extensively employs advanced technology, including unmanned and intelligent systems, to meet battlefield demands.

Nuclear, biological, and chemical activities pose an increasingly severe threat to the lives and property of the populace. This necessitates the military's ability to rapidly and efficiently deploy combat power in non-war military operations, presenting a significant historical challenge in accomplishing diverse military tasks[4]. By studying the composition of U.S. CBRN personnel and the configuration of their main equipment, we can analyze their characteristics and advantages to inform the development of our own chemical defense forces.

2. CBRN Personnel Structure

The CBRN companies represent the frontline defense forces of the U.S. military, with the role of CBRN Warrant Officer being crucial for countering CBRN threats, enhancing early detection capabilities, and elevating overall operational effectiveness.

2.1 CBRN Companies

Within the active Chemical Battalions, the U.S. military establishes 3-5 CBRN companies, commonly referred to as Chemical Companies. These include Hazard Response Chemical Companies, Technical Escort Chemical Companies, and Heavy Decontamination and Reconnaissance Chemical Companies. Each type of company has distinct tasks, allowing them to operate independently or collaborate effectively during CBRN incidents. The Hazard Response Chemical Companies are composed of 97 personnel: 4 officers, 1 warrant officer, and 92 soldiers. Their organizational structure includes 1 Reconnaissance Platoon and 2 Hazard Assessment Platoons, equipped with 4 M1135 Stryker Nuclear, Biological, and Chemical Reconnaissance Vehicles (NBCRVs), primarily responsible for

providing CBRN reconnaissance, assessment, and decontamination support within designated operational areas. The Technical Escort Chemical Companies consist of 70 personnel: 5 officers, 5 warrant officers, and 60 soldiers. Its organizational structure includes 4 CBRN Explosive Ordnance Disposal Teams and 1 Field Maintenance Team), primarily responsible for conducting sampling, detection, isolation, and disposal of CBRN materials, escorting relevant equipment and materials, and offering technical support for CBRN threat mitigation. The Heavy Decontamination and Reconnaissance Chemical Companies are composed of 100 personnel: 4 officers, 1 warrant officer, and 95 soldiers. Their organizational structure includes 1 CBRN Reconnaissance Platoon and 2 Heavy Decontamination Platoons, equipped with 4 M1135 Stryker NBCRVs, primarily responsible for providing CBRN reconnaissance and decontamination support within designated operational areas.

2.2 CBRN Warrant Officers

Warrant Officers, characterized by their high level of skill and specialized expertise, play a pivotal role in the professional structure of the U.S. military. [5] Comparable to specialized technical officers in China, their primary function is to furnish commanders with expert technical support. Specifically, CBRN Warrant Officers utilize their specialized knowledge to aid commanders in preparing for operations within CBRN environments. Additionally, they provide crucial technical advice and support during reconnaissance, protection, and decontamination missions.

The allocation of personnel within the 20th CBRN Command is detailed in Table 1. The headquarters of the 20th CBRN Command includes six CBRN Warrant Officers: one CW4 and five CW3s, primarily assigned to the Weapons of Mass Destruction (WMD) Liaison Group. The 48th CBRN Brigade has two CBRN Warrant Officers: one CW4 assigned to the Operations Group and one CW3 assigned to the Intelligence Group. The Chemical Battalion has one CW3 allocated to the Operations Group. The Technical Escort Chemical Company includes five CW2s, primarily assigned to the CBRN Response Group. The Hazard Response Chemical

Company has one CW2 assigned to the company headquarters, and the Heavy Decontamination and Reconnaissance Chemical Company also has one CW2 assigned to the company headquarters. From this analysis, several conclusions can be drawn: 1. Integration Across All Levels: The U.S. military integrates CBRN Warrant Officers across all levels of its defense forces, with a significant proportion among the Warrant Officer ranks. 2. Rank Allocation Based on Unit Size: The rank of Warrant Officers is correlated with the size of the unit. For example, CW4s are only assigned to brigades and command levels, CW3s to units above the Chemical Battalion level, and CW2s to Chemical Company levels. 3. Differentiation by Operational Needs: The number of Warrant Officers allocated varies according to operational needs. For instance,

CBRN Warrant Officers are assigned to Operations Groups in units above the Chemical Battalion level, while at the Command level, they are concentrated in the WMD Liaison Group. At the Chemical Company level, a Warrant Officer is assigned to the company headquarters, but there is also one allocated to the CBRN Response Group. 4. Rank Differentiation Based on Task: Higher and lower ranks are allocated according to task requirements. Both the Command and the CBRN Brigade have CW3s and CW4s, with CW4s assigned to the Operations Group, indicating the primary role of CBRN Warrant Officers is to provide operational guidance. In conclusion, the U.S. military meticulously allocates its CBRN defense forces, with a high demand for comprehensive defensive capabilities among frontline personnel and robust utilization of CBRN Warrant Officers.

Table 1. Personnel Allocation of the 20th CBRN Command

CBRN Warrant Officers							
Allocation Unit	Rank	Number	Subtotal	Officers	Warrant	Soldiers	Total
20th CBRN Command HQ	W4/W3	1/5	6	52	9	88	149
48th CBRN Brigade	W4/W3	1/1	2	24	6	44	74
Chemical Battalion	W3	1	1	13	3	53	69
Technical Escort Chemical Co.	W2	5	5	5	5	60	70
Hazard Response Chemical Co.	W2	1	1	4	1	92	97
Heavy Decontamination & Recon Chemical Co.	W2	1	1	4	1	95	100

Note: O5 = Lieutenant Colonel, O4 = Major, O3 = Captain, O2 = First Lieutenant, E7 = Sergeant First Class, W2 = Chief Warrant Officer 2, W3 = Chief Warrant Officer 3, W4 = Chief Warrant Officer 4.

3. Allocation of CBRN Equipment

Currently, the U.S. military employs various CBRN equipment, primarily categorized into reconnaissance and detection equipment, decontamination equipment, and protective equipment. These tools enable personnel to swiftly respond to CBRN incidents and ensure their safety.

3.1 Reconnaissance and Detection Equipment

Reconnaissance and detection equipment are used to identify and detect CBRN substances, providing early warning to personnel, identifying harmful substances, and aiding in the formulation of operational plans and personal protection. The reconnaissance and detection equipment currently allocated to

active-duty chemical companies includes: Short-range reconnaissance drones; JPD-1 Joint Personal Dosimeter, M256/M256A1 Chemical Agent Detection Kits, AN/VDR-2 Radiac Set, AN/UDR-13 Pocket Radiac Set, AN/PDR-75 Radiac Detector Indicator, M1135 Stryker CBRN Reconnaissance Vehicle, Chemical Agent Monitors, Joint Chemical Agent Detectors, Automatic Chemical Agent Alarms. [6] The JPD-1 Joint Personal Dosimeter is issued based on personnel allocation. Chemical Agent Monitors are allocated only to CBRN incident response teams and heavy decontamination squads. The AN/PDR-75 Radiac Detector Indicator is issued in limited quantities to hazard assessment teams and CBRN incident response groups. The M1135 Stryker CBRN Reconnaissance Vehicle is exclusively

allocated to reconnaissance squads.

3.2 Decontamination Equipment

Decontamination equipment is designed for the rapid cleansing of personnel, equipment, and areas contaminated by CBRN substances. It provides operational units with enhanced protection and more efficient, sustained combat capabilities. The primary decontamination equipment currently allocated to active-duty chemical companies includes: Decontamination tents, Lightweight Decontamination Systems (M17), Mobile Decontamination Units (mounted on JLTV-T Joint Light Tactical Trailers), M291 Skin Decontamination Kits, M295 Individual Equipment Decontamination Kits. Decontamination equipment is assigned to decontamination support teams within heavy decontamination squads and hazard assessment squads.

3.3 Protective Equipment

Protective equipment serves to provide comprehensive protection for personnel operating in CBRN environments, ensuring they are shielded from harmful substances and can work safely. The primary protective equipment currently allocated to active-duty chemical companies includes: M50 Joint Service General Purpose Masks, Joint Service Lightweight Integrated Suit Technology (JSLIST), and M20 Simplified NBC Collective Protective Equipment. Individual protective equipment is allocated according to the number of personnel, while collective protective equipment is less plentiful, mainly assigned to reconnaissance squads.

3.4 Development Directions

As the nature of warfare continues to evolve, the limitations of traditional equipment are becoming increasingly apparent. The influence of robust equipment capabilities on combat outcomes is undeniable. Based on intelligence and threat risk analysis, the military must invest in defense and protective equipment to minimize the impact of CBRN attacks. [7] The U.S. military is advancing towards the maturity of unmanned and intelligent equipment in operations. New principles and technologies, such as unmanned reconnaissance, broad-spectrum detection, multi-state detection, and

non-aqueous decontamination, are being widely applied in CBRN operations. Continuous research into new materials will further propel the development of U.S. military CBRN equipment. With ongoing advancements in science and technology, breakthroughs in technical challenges, and the deepening of technological innovation, the future of CBRN equipment technology development will present a new landscape. [8] The evolution of equipment is not only becoming more intelligent but also more user-friendly. In CBRN operations, to ensure public safety, civilians may sometimes be required to use protective equipment. The public should receive safety and first-aid training to learn how to use this equipment, practice self-protection measures, and enhance safety awareness.

4. Insights

Since the 1980s, the U.S. military's CBRN forces have experienced significant advancements, resulting in increasingly sophisticated positions and unit structures. [9] Through organizational reforms and adjustments, the U.S. military has optimized and reorganized its NBC capabilities. The establishment of specialized response units not only reduces NBC risks but also enhances overall operational efficiency in joint operations. In recent years, China has prioritized the development of NBC defense capabilities, continuously integrating specialized personnel and advanced technologies. This strategic focus aims to strengthen effectiveness in future joint operations. By examining the U.S. military's NBC personnel structures and equipment allocation, China can derive valuable insights and lessons to inform the development of its own NBC defense forces.

4.1 Increasing the Number of CBRN Warrant Officers

The U.S. military has integrated CBRN warrant officers at various levels—company, battalion, brigade, and headquarters—enhancing operational capability in CBRN scenarios through the combination of their specialized skills and the strategic command of operational officers. Currently, Chinese military has a limited number of technical officer positions, which

diminishes their overall impact. Introducing more CBRN technical officer positions would enable more precise assessments of CBRN environments, improve the CBRN operational command capabilities, and enhance both combat and protection capabilities. Assigning CBRN warrant officers at the company level would strengthen decision-making abilities on the front lines, expedite operational processes, and improve the CBRN operational support capabilities of our personnel.

4.2 Diversified Equipment Development

The U.S. military's deployment of unmanned and intelligent equipment is well-established, with the widespread application of emerging technologies significantly bolstering their combat effectiveness in CBRN operations. In recent years, Chinese military's CBRN equipment allocation has been relatively comprehensive. However, there are still issues such as high consumption of equipment parts and training materials, limited procurement channels, and high failure rates of some precise and technically sophisticated reconnaissance and laboratory equipment, resulting in long maintenance cycles. [10] Advancing the development and application of equipment will help improve the comprehensive combat capabilities of the Chinese military and enhance the NBC combat proficiency and protective abilities of its personnel.

5. Conclusion

In the face of CBRN threats, the U.S. military has enhanced its response capabilities through the establishment of specialized units, personnel adjustments, and the application of intelligent equipment. This paper examines the personnel structure and equipment allocation characteristics of the U.S. military's CBRN forces, analyzing the role of CBRN warrant officers and the direction of equipment development. Drawing insights from this analysis and considering the current state of the Chinese military, several recommendations emerge. Increasing the number of CBRN warrant officers would enhance the Chinese military's decision-making, command, and defense capabilities in NBC operations. Furthermore, developing and equipping intelligent systems can elevate overall operational efficiency and

self-protection capabilities.

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