HOPE FOR THE BEST, TRAIN FOR THE WORST

Modernizing Army Medicine's Premier Health Physics Course for Multi-Domain Operations and Large-Scale Combat Operations

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ABSTRACT

Radiological threats in a future operational environment (OE) will pose a significant health hazard to military forces and challenge their ability to operate as a synchronized joint force. The Army and its interservice partners should train to rapidly detect, identify, mitigate, and communicate risks associated with all radiological hazards. Modernizing Army Medicine's Radiological Hazards Operator Course (RHOC) for multi-domain operations and large-scale combat operations is critical as the joint force and its partners prepare for dynamic threats in geographically constrained environments. The RHOC specializes in training military service members to confront real-world radiological threats among joint all domain operations. RHOC students learn and train to rapidly triage and evacuate radiological casualties, conduct patient decontamination, and deliver mission-critical information while operating under the stresses of a contaminated area and enemy surveillance. This article discusses recent course modernization and how tactical realism coupled with technical precision can drive institutional training innovation for joint force readiness. Operating in a highly contested OE will be unforgiving. This underscores the consequences of simply admiring the problem and not enhancing our modern-day training effects with adequate funding, improving the quality of the military student experience, and removing barriers to properly train on radiological hazards.

INTRODUCTION

MODERNIZING RADIOLOGICAL TRAINING FOR A FUTURE OPERATIONAL ENVIRONMENT

The Global War on Terror forced the U.S. Army to shift its focus as a land force to counterinsurgency (COIN). Today, focusing on the future possibility of large-scale combat operations (LSCO) in a complex operational environment (OE) demands a shift away from COIN scenario-based training. U.S. adversaries may use weapons of mass destruction, including nuclear weapons, for asymmetric advantage in LSCO (TRADOC, 2024). The unforgiving nature of LSCO, especially if an enemy employs radiological or nuclear weapons, requires a trained and ready medical force. Medical insights from the conflict in Ukraine offer a glimpse into the complexity and lethality of a future OE (Epstein et al., 2023). These observations underscore the importance of Army leaders deliberately focusing on survivability by employing myriad training effects to challenge military medical personnel on the potential for radiological operations in both rural and urban environments.

THE U.S. ARMY RADIOLOGICAL HAZARDS OPERATOR COURSE

The Radiological Hazards Operator Course (RHOC), delivered by the Department of Force Health Protection at the U.S. Army Medical Center of Excellence (MEDCoE), is a critical training event that prepares military service members to confront real-world radiological threats. RHOC recently underwent a significant modernization to address capability gaps and align the course with the complexities of multi-domain operations (MDO) among a future OE by embedding authentic tactical dilemmas into every phase of its training. RHOC trains service members to operate under disruption, make rapid decisions amid complex hazards, and execute technical tasks while navigating tactical dilemmas.

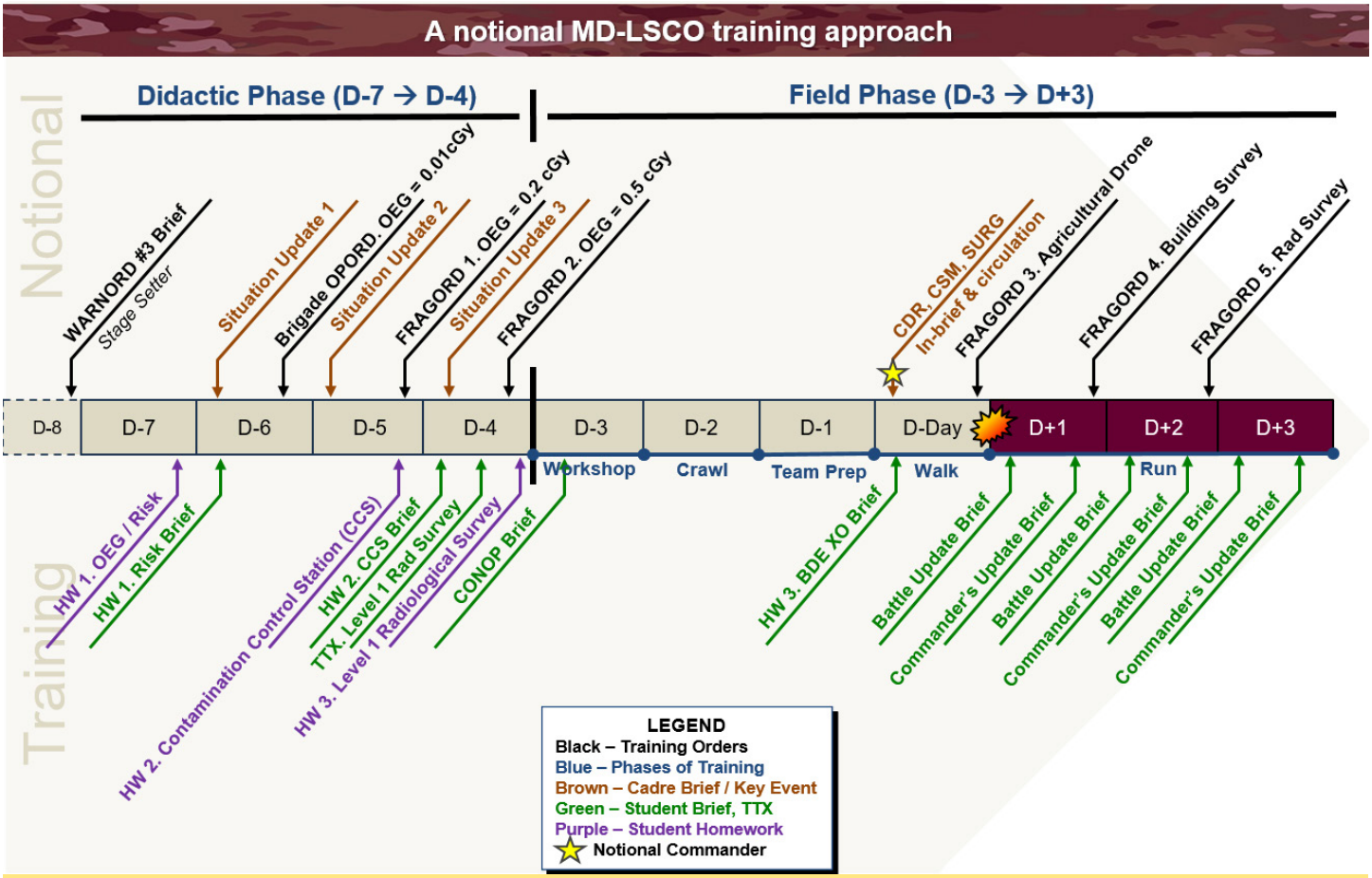

Figure 1. The notional MD-LSCO training scenario provides students with new and combined training effects in every phase of the training. The focus is on deliberate training progression from foundational health physics and radiation protection principles to the application of these technical proficiencies under tactical stresses. Abbreviations: BDE – Brigade, CDR – Commander, CSM – Command Sergeants Major, CONOP – Concept of Operation, FRAGORD – Fragmentary Order, HW – Homework, MD-LSCO – Multi-Domain Large-Scale Combat Operations, OEG – Operational Exposure Guidance, OPORD – Operations Order, SURG – Surgeon, WARNORD – Warning Order, XO – Executive Officer.

The Chemical, Biological, Radiological, and Nuclear (CBRN) Sciences Branch at the MEDCoE conducted the annual RHOC at the U.S. Department of Energy's Idaho National Laboratory (INL). The didactic and field training phases occurred in the classroom environment and radiological training ranges, supported by the INL Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) Response and Readiness. Students trained at the INL in highly radioactive and contaminated fields—an unparalleled opportunity that would require years of certification and massive infrastructure investment to replicate at any other training site. Set against a Decisive Action Training Environment (DATE) scenario, RHOC immerses students in high-stakes operational environments where they must rapidly identify, respond to, and mitigate radiological hazards layered within multi-faceted battlefield challenges.

NEW TRAINING EMPHASIS FOR A MODERN-DAY BATTLEFIELD

Special emphasis was placed on the training effects, including small unmanned aircraft systems (sUAS), electronic interference, radiological dispersal and exposure devices, unexploded ordnance, radiological casualty management, and risk communication. The course modernization included a notional DATE scenario, a verbal warning order, a brigade operations order, five fragmentary orders, three individual and team homework assignments, one tabletop exercise, and 12 student briefs to instructors and guest senior leaders (Figure 1). Additionally, phased training imagery was developed using the National Geospatial-Intelligence Agency training platform.

Radiological events, whether accidental or deliberate, can trigger far-reaching consequences in terms of maneuver, health, resourcing, and socioeconomic impact. An interplay between a notional Multi Domain-LSCO (MD-LSCO) training scenario and real-world training effects challenged students to use troop leading procedures while operating as a team (Figure 2). An instructor team, comprising commissioned and non-commissioned officers from the Army Medical Department (AMEDD) and Chemical Corps, as well as INL CBRNE Response and Readiness staff, provided immersive scenarios and hands-on student experiences in realistic, hostile conditions, with a focus on operationalizing health physics. Radiological threats, ranging from radiological dispersal devices to degraded communications and contested airspace, are increasingly central to the evolving threat landscape, driven by adversaries' asymmetric and hybrid tactics.

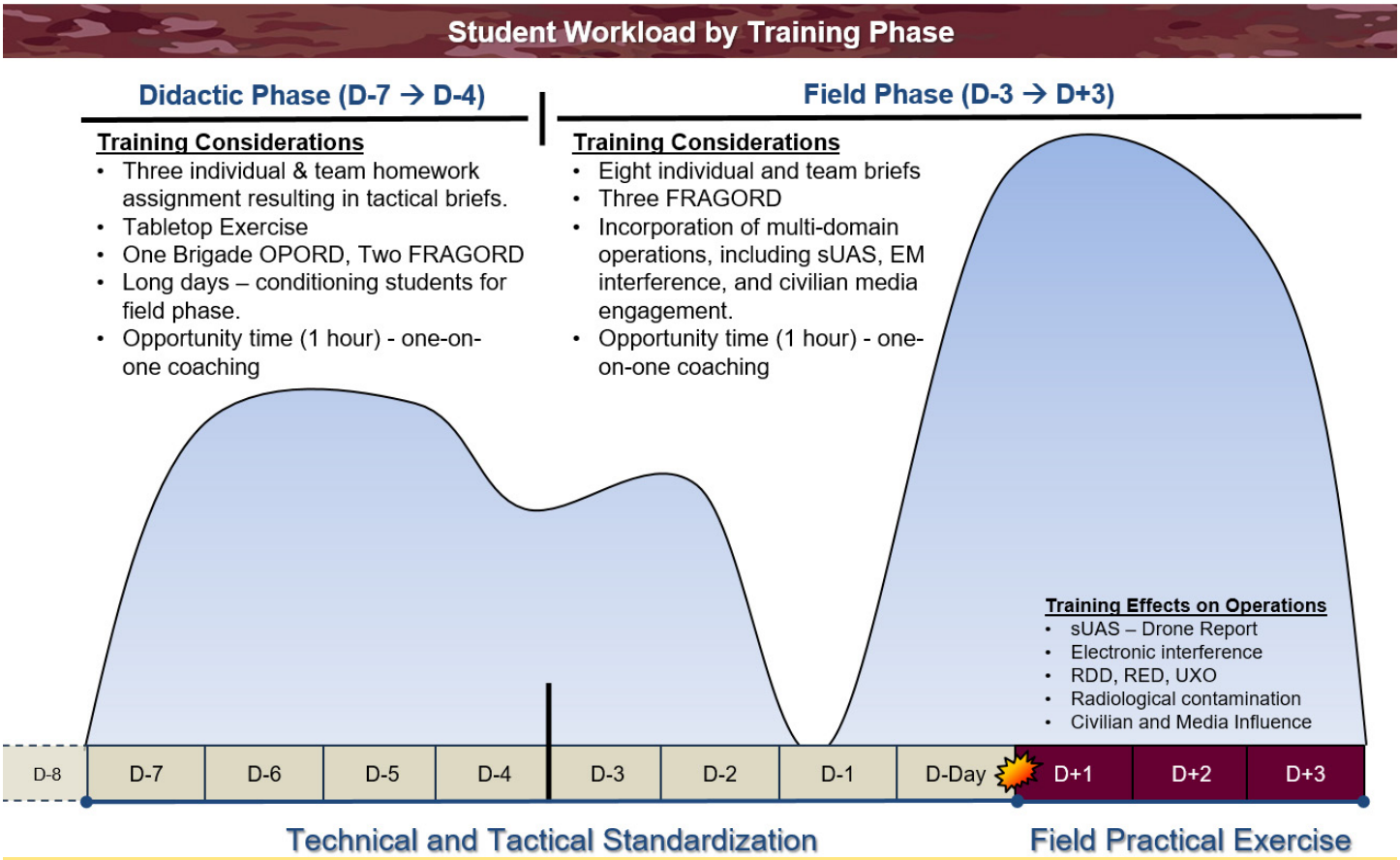

Figure 2. Workload focuses on building a strong technical foundation and battle rhythm for each student and team. Deliberate focus on one-on-one coaching and technical proficiencies with daily hands-on exercises and tabletops provides a challenge that ensures they are physically and mentally ready for the field practical exercise. Abbreviations: EM – Electromagnetic, FRAGORD – Fragmentary Order, OPORD – Operations Order, RDD – Radiological Dispersal Device, RED – Radiological Exposure Device, UXO – Unexploded Ordnance.

Tailored primarily for Preventive Medicine and CBRN specialists, the course equips service members with the skills to tackle some of today's most dangerous threats. As a joint force multiplier, Navy, Air Force, and Marine Corps participants enrich the training environment while learning how Army Medicine tackles radiological challenges as part of joint all domain operations. Through a specialized training arm of MEDCoE, Army health physics professionals provide the capability to train military personnel to conserve fighting strength across the joint force. To meet the demands of operating in a radiological environment, we must enhance our modern-day training methods with dedicated funding, improve the quality of the military student experience, and remove barriers to effectively train in the presence of radiological hazards.

ARMY OF 2030

The training demands of RHOC support the Army of 2030, which envisions a force capable of fighting and winning the Nation's wars across highly sophisticated domains against peer and near-peer adversaries (Army 2022). Course participants focus on larger friendly formations (division and higher) in a highly contested, cyber degraded OE and shape their risk communication skills for commanders across the joint force. The multi-faceted training effects such as the use of sUAS and electronic interference challenge trainees to sustain the warfighter across a notionally contested OE while detecting, identifying, assessing, mitigating, and communicating the risks associated with radiological hazards. Using existing and new equipment and technologies provides the opportunity to test the capabilities in a dynamic training environment to achieve tactical and technical proficiencies.

TACTICAL REALISM MEETS TECHNICAL PROFICIENCY

DYNAMIC TRAINING ENVIRONMENT

The quality of the military student experience centers on a training environment uniquely suited to challenge Army medical and CBRN soldiers in radiological operations. The seasonality and topography of the INL site offered a range of environmental and weather conditions. Conducting the training in a high-altitude desert environment with adverse weather conditions routinely challenged the personnel's field performance and equipment.

From day one during the field practical exercise, students faced high-intensity tactical and technical challenges amplified by multi-domain training effects:

- Operation in a radiologically contaminated environment
- Radiological dispersal and exposure devices
- Unmanned aircraft system threats

- Evacuation and decontamination of radiological casualties
- Communication blackouts from notional electronic warfare

TACTICAL REALISM SCENARIO MIRRORING POTENTIAL FUTURE THREATS

RHOC scenarios mirror potential future threats. One challenging scenario simulates a large agricultural drone crashing into a military police checkpoint, scattering radiological material across the area (Photo 1). Trainees must rapidly evacuate casualties, conduct emergency decontamination, and deliver precise battlefield reports—all while operating in hot, warm, and cold zones under enemy surveillance. After the initial emergency response, the students are left with other complex problems, including characterizing radiological areas, and remediating dispersed radiological materials. Graduates then return to their units to share knowledge about the unique blend of tactical realism and technical immersion essential for actual preparedness.

Photo 1. A simulated agricultural drone crashes into a notional military checkpoint. The training effect demonstrated the urgency and focus required by the students to respond effectively in a contaminated and complex environment.

OPERATIONAL SIGNIFICANCE

STRESSING A JOINT FORCE RESPONSE

The simultaneity of events and individuals will likely prevent a robust and timely response to support homeland defense and to project combat power overseas. Simultaneous events, including radiological and nuclear incidents, and their effects on National Guard and Reserve component forces in their local communities at home and abroad, may limit the overall Department of Defense (DoD) CBRN response. Therefore, deterrence and readiness through training are critical. More training with combined effects, such as sUAS, electronic jamming, and radioactive materials in operational medicine training courses like RHOC will only improve the Army's capabilities and synchronization within MDO. A cyber-degraded, highly contested OE that starts in the homeland and extends across multiple combatant commands' areas of responsibility will require Army medical forces to be at their best.

DECISION-MAKING UNDER STRESS

AArmy leaders must be prepared to make informed decisions in the event of sudden exigencies involving radiological hazards. Developing a notional training scenario focused on the Army's MDO doctrine allows the student cohort to operate and make mission-critical decisions in a time-constrained, contested OE supporting the joint force commander. RHOC provides a foundation for engaging, hands-on training in which students grapple with diverse training effects while developing mentally, physically, and emotionally. The technical demands of this course, combined with its unique training environment, distinguish it from other training courses in the Army portfolio.

CONSIDERATIONS FOR THE WARFIGHTER

PROTECTION WARFIGHTING FUNCTION – FORCE HEALTH PROTECTION

The protection warfighting function (WfF) aims to preserve the force, thereby maximizing the combat power available to the commander to accomplish the mission (ADP 3-0). Force health protection (FHP) measures "enable a healthy and fit force, prevent injury and illness, and protect the force from health hazards" (ATP 4-02.8). RHOC emphasized FHP within the protection WfF by focusing on troop leading procedures to identify, assess, and communicate the risk for a notional tactical-level commander.

Radiological Risk Management

Operational public health services, including health physics, aim to identify, assess, mitigate, and communicate the health threat to the commander in a CBRN-contested OE. The health threat is defined as "a composite of ongoing and potential adversary actions…and employment of CBRN agents that have the potential to affect the short- or long-term health (including psychological impact) of personnel" (ATP 4.02-7). Operationalizing health physics during LSCO by identifying risks to the force and mission helps prevent injuries and illnesses associated with radiation. RHOC students trained on the Operational Exposure Guidance (OEG) and Radiation Exposure Status (RES) to ensure they could communicate to commanders and their staff the significance of operational radiological risk management as defined in Joint Publication 3-11. Clear communication of radiological threats and mitigation strategies supports resilient operations in future LSCO. Preventing and mitigating radiological exposure and contamination will be critical to ensure military service members can operate effectively.

RHOC students conducted pre-mission analysis based on notional information about the OE and DATE scenario. After developing a thorough concept of the operation, the student

cohort briefed senior leaders on the risk to their team and the overall force posture. Each team recommended an OEG based on the tracked cumulative dose for each teammate to conserve their combat effectiveness.

SUSTAINMENT WARFIGHTING FUNCTION – HEALTH SERVICE SUPPORT

The sustainment warfighting function "provides support and services to ensure freedom of action, extended operational reach, and prolong endurance" (ADP 3-0). In other words, sustainment provides force readiness for the commander. Health service support (HSS) is one of the four elements of sustainment that provides support and services for medical treatment, hospitalization, evacuation, and logistics (ADP 4-0). One of the most challenging HSS tasks is treating and managing radiological casualties.

Radiological Combat Casualty Care

Radiological casualty management is uniquely challenging due to the resourcing burden, priority of evacuation, and prolonged field care requirements. According to Marsh and Hampton (2022), "Injuries caused by CBRNE events place a substantial demand on personnel and resources to minimize collateral exposure. This causes temporary reduction of operational medical capabilities by extending casualty treatment times and increasing time to evacuation from the battlefield". Evacuating and treating radiological casualties among the Army Health System is complicated, especially when radiation exposure or contamination is combined with trauma and thermal burns. Epstein et al. (2023) state, "Care of burn casualties imposes a significant logistical and medical burden because of the complexity of care and the extensive resuscitation required". Similarly, cutaneous radiation injuries and acute radiation syndrome (ARS) produce a similar burden and require supportive care in specialized medical wards.

Photo 2. Patient assessment and decontamination. Students immediately assess a notional combined radiological casualty near the point of injury for blast injury and radiological exposure.

RHOC students train to decontaminate radiological casualties and assess notional patients with combined injuries, including ARS. By doing so, they determined the urgency of casualty evacuation and the necessary role of care for medical treatment and stabilization (Photo 2). Even team members of the student cohort exceeded their notional OEG, which degraded their team's combat effectiveness, requiring the reporting of the Commander's Critical Information Requirements to a higher echelon. The complexity of operating in a radiological environment under time constraints posed a challenge to the students that they did not anticipate.

ACTIONABLE LESSONS LEARNED

Without radiological training, coupled with the combined effects of combat operations, the Army cannot accurately assess the anticipated outcomes and standards required to operate in a radiological environment. Developing and implementing the RHOC curriculum based on MDO and LSCO revealed the following lessons. We highlight considerations for future training events.

1. Operationalize health physics.
   a. Enable freedom of maneuver and action by emphasizing the operational impacts, and risks to force and mission for commanders and their staff.
   b. Clearly communicate risks associated with radiological hazards to joint force commanders and interagency partners to help determine the OEG.
   c. Focus on radiological casualty management within hardened and improvised locations to protect the medical roles of care (Photo 3).

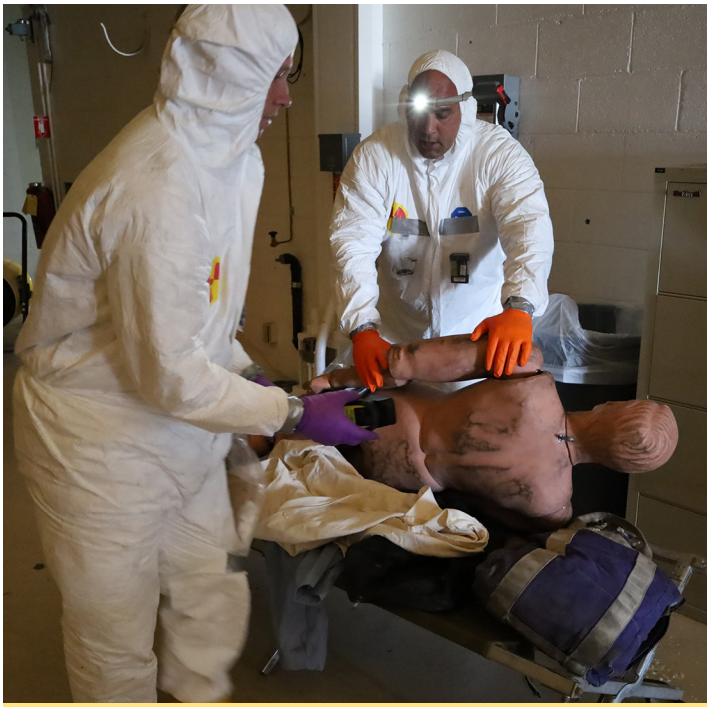

Photo 3. Triage and reassessment of a radiological casualty. Students conduct a patient triage assessment of a notional radiological casualty discovered during a building survey.

d. Rapidly detect, identify, characterize, and mitigate radiological hazards, including radiological dispersal and exposure devices, and an improvised nuclear device to reduce the risk of harm to friendly forces and joint partners.

2. Stress multi-domain training effects to challenge the training cohort.
   a. Choose a DATE scenario based on a real-world radiological medical threat analysis.
   b. Operate in a radiological environment, uniquely characterized by contamination and source exposure problem sets.
   c. Employ sUAS to demonstrate the aerial pursuit of medical assets through enemy surveillance and reconnaissance.
   d. Simulate the degradation of primary communication, forcing the use of alternative means of communication.
   e. Focus public affairs training on risk communication and avoiding pitfalls (Photo 4).

Photo 4. Student interviews with local civilian media. Media experts interviewed students throughout all phases of the course, putting public affairs training into action.

3. Emphasize the quality of the military student experience.
   a. Standardize the workload and information dissemination to enable all students to learn effectively.
   b. Emphasize rapid team building under stress. The joint medical and CBRN force must frequently train together to operate effectively (Photo 5).
   c. Condition students mentally and physically during the didactic phase to meet the demands of the field phase.
   d. Opportunity Time—The instructors demonstrate their commitment to the training standard and the students by providing additional opportunities to receive one-on-one coaching or tutoring on technical and tactical training objectives. This provides a sterile focus, driving clarity resulting in tangible training outcomes.
4. Remove the barriers to training in an immersive, realistic OE.
   a. Prioritize funding for radiological training with specific outcomes for the complexities of future military operations.

Photo 5. Rapid team building. The course thrusts its students into 12 days of intense training, demanding them to become a cohesive, effective team in a short period of time. The students relied on one another to solve complicated operational health physics problems.

   b. Location, location, location. Train at the places that provide the best opportunity for a team to learn. Sometimes it is not a DoD facility.
   c. Risk aversion among Army leaders remains a training barrier overall. Train to respond to the exigencies of modern warfare, including the synchronization across multiple domains.
   d. Take a customer-based approach to developing and implementing radiological training for military students. Provide outcomes that are tracked to build a sustainable, evolving training course.

INVESTING IN TACTICAL REALISM TO DRIVE INSTITUTIONAL INNOVATION

In February 1940, General George Marshall wrote, “The expense of maintaining our Army is heavy, but to maintain the troops without properly training them would be inexcusably wasteful, as well as highly dangerous in the present world situation” (Davis 2022). He knew that training developed to stress and test leaders’ character and tactical effectiveness was expensive yet necessary (Davis 2022). General Marshall’s concerns regarding proper training for service members remain relevant today. The Army faces training innovation challenges to ensure highly specialized teams remain ready for future warfare. Importantly, specialized medical training in the Army such as RHOC faces uncertainty.

RHOC is a functional program susceptible to budget cuts unlike Professional Military Education, which is funded institutionally. Continuing to expand and evolve this course in response to a growing global threat environment ensures the preservation of a one-of-a-kind joint medical training capability, offering hands-on experience with highly radioactive material and contamination under operationally realistic conditions. RHOC embodies the principle: it is better to have a capability and not need it than to need it and not have it. Pausing this course in the upcoming fiscal years will reduce Army Medicine’s capability to train military personnel on mass casualty events in a radiological environment, whether across LSCO or homeland defense missions.

Delivering this unmatched level of tactical realism and specialized training comes at a steep cost. Recreating this training environment requires years of partnership building and millions of dollars in resources, which is difficult to justify without immediate, measurable returns. These challenges reflect broader issues in the Army's functional training enterprise, where high-fidelity education competes with limited resources. Despite its clear value, the course's resource demands invite scrutiny. RHOC proves what is possible when tactical realism meets technical precision. Investing in RHOC today preserves an elite, medical cadre of radiological experts who can rapidly scale to meet emerging threats and conserve the fighting strength of the joint force. To preserve this edge, the Army and joint force must protect specialized courses like RHOC with adequate funding because the cost of unpreparedness is far greater.

CONCLUSION

Failure to recognize the importance of multi-domain training effects, the quality of the military student experience, and removing barriers to proper training may lead to vulnerabilities in the Army's training portfolio, thereby compromising the readiness of its subject matter experts and leaders for radiological operations. The course modernization demonstrates a commitment to provide high-quality training for the joint force. RHOC supports the joint force commanders of the future by deliberately evolving training to joint all domain operations within a realistic radiological environment. The course lessons reinforced the uncertainty and constraints of future warfare, preparing subject matter experts and future leaders to operate effectively within a joint land force. The future OE in LSCO will be unforgiving. Therefore, no matter how imaginative strategic leaders are about future warfare, the reality will probably be much worse. To prepare for this uncertain and violent reality, the Army must continue to invest in high-quality training to ensure that it is simultaneously ready to operate within a highly contested and threatening radiological environment.

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