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SAVING OUR OWN: MAXIMIZING CBRN URBAN SEARCH AND RESCUE CAPABILITIES TO SUPPORT CIVIL AUTHORITIES

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SAVING OUR OWN: MAXIMIZING CBRN URBAN SEARCH AND RESCUE CAPABILITIES TO SUPPORT CIVIL AUTHORITIES

by

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This thesis seeks to determine how the Chemical Biological Radiological Nuclear (CBRN) Response Enterprise's urban search and rescue (US&R) elements can better accomplish the Department of Defense's (DOD) Defense Support of Civil Authorities mission following a domestic nuclear attack. To this end, it poses the following research question: How can the DOD maximize the employment of existing CBRN Response Enterprise US&R capabilities to support civil authority–directed lifesaving efforts following a domestic nuclear detonation? Research interviews were conducted with federal and local civil US&R authorities that inquired about their expectations of enterprise US&R elements after a nuclear detonation. Additionally, an analysis was conducted of the enterprise's ability to overcome the challenges presented by post-nuclear detonation environments when delivering this support. It was discovered that federal civil US&R authorities intend to use the CBRN Response Enterprise's US&R elements as force multipliers, while local authorities have more ambiguous expectations since they receive far less exposure to the enterprise's US&R capabilities. Furthermore, to improve the delivery of life-saving aid, the enterprise should enhance its capabilities to address the threat of fire and added challenges to the performance of US&R skills incurred by post-nuclear detonation environments.

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SAVING OUR OWN: MAXIMIZING CBRN URBAN SEARCH AND RESCUE CAPABILITIES TO SUPPORT CIVIL AUTHORITIES

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Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

This thesis seeks to determine how the Chemical Biological Radiological Nuclear (CBRN) Response Enterprise's urban search and rescue (US&R) elements can better accomplish the Department of Defense's (DOD) Defense Support of Civil Authorities mission following a domestic nuclear attack. To this end, it poses the following research question: How can the DOD maximize the employment of existing CBRN Response Enterprise US&R capabilities to support civil authority–directed lifesaving efforts following a domestic nuclear detonation? Research interviews were conducted with federal and local civil US&R authorities that inquired about their expectations of enterprise US&R elements after a nuclear detonation. Additionally, an analysis was conducted of the enterprise's ability to overcome the challenges presented by post-nuclear detonation environments when delivering this support. It was discovered that federal civil US&R authorities intend to use the CBRN Response Enterprise's US&R elements as force multipliers, while local authorities have more ambiguous expectations since they receive far less exposure to the enterprise's US&R capabilities. Furthermore, to improve the delivery of life-saving aid, the enterprise should enhance its capabilities to address the threat of fire and added challenges to the performance of US&R skills incurred by post-nuclear detonation environments.

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LIST OF ACRONYMS AND ABBREVIATIONS

ALARA	as low as reasonably achievable
C2CRE	command and control CBRN response element
CBIRF	chemical biological incident response force
CBRN	chemical biological radiological nuclear
CERFP	chemical biological radiological nuclear and high-yield explosives enhanced response force package
DCRF	defense CBRN response force
DHS	Department of Homeland Security
DOD	Department of Defense
DSCA	defense support of civil authorities
ESF	emergency support function
FEMA	Federal Emergency Management Agency
HRF	homeland response force
ICS	Incident Command System
IND	improvised nuclear device
INTF-1	Indiana Task Force 1
IRB	Institutional Review Board
JTF-CS	Joint Task Force Civil Support
NFPA	National Fire Protection Association
NG	National Guard
NIMS	National Incident Management System
NORTHCOM	United States Northern Command
NRF	National Response Framework
NSP	United States National Search and Rescue Plan
NYTF-1	New York Task Force 1
PPE	personal protective equipment
RDD	radiological dispersal device
RFA	request for assistance
SAR	search and rescue
SecDef	Secretary of Defense

TXTF-1	Texas Task Force 1
US&R	urban search and rescue
USAR	urban search and rescue
USC	United States Code
WMD	weapons of mass destruction
WMD-CST	Weapons of Mass Destruction Civil Support Team

EXECUTIVE SUMMARY

A. PROBLEM STATEMENT

The Chemical Biological Radiological Nuclear (CBRN) Response Enterprise offers local and federal civil authorities its urban search and rescue (US&R) capabilities in the event a nuclear detonation traps victims in collapsed buildings.[1] These assets have two tiers of capability: search and extraction and search and rescue.[2] Located within Title 32 Chemical Biological Radiological Nuclear and High-Yield Explosives Enhanced Response Force Packages and CBRN Task Forces, all search and extraction soldiers are trained to the operations level (level I) in structural collapse rescue.[3] Conversely, all search and rescue soldiers of the Title 10 Defense CBRN Response Force and Command and Control CBRN Response Elements are trained to the more in-depth technician level (level II).[4] Theoretically, this system allows state-level National Guard Bureau forces to augment the US&R efforts of local responders quickly after an event, with heavier-equipped and trained Title 10 forces arriving later to reinforce the operation.[5]

However, due to a lack of mutual understanding and enterprise synchronization, it remains unknown how the civil authorities in many major metropolitan areas and the federal government would employ enterprise US&R resources. Furthermore, it is unclear

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[1] Department of the Army, *Training Circular Number 3-37.51: Urban Search and Rescue* (Washington, DC: Department of the Army, 2020), sec. Foreword, https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN30224-TC_3-37.51-000-WEB-1.pdf.

[2] Chad English, email message to author, May 26, 2020.

[3] Department of the Army, *ATP 3-11.47/AFTTP 3-2.79: Chemical, Biological, Radiological, Nuclear, and High-Yield Explosives Enhanced Response Force Package (CERFP)/Homeland Response Force (HRF) Operations* (Washington, DC: Department of the Army, 2013), E-3.

[4] Chad English, email message to author, May 26, 2020; Homeland Defense Civil Support Office, *Urban Search and Rescuer Course Welcome Letter* (Washington, DC: Department of the Army, n.d.), 2, accessed February 15, 2021, https://home.army.mil/wood/application/files/1816/0278/5304/USR_Rescuer_Course_Welcome_Letter_15_Oct_2020.pdf.

[5] Government Accountability Office, *Defense Civil Support: DOD Has Made Progress Incorporating the Homeland Response Force into the Chemical, Biological, Radiological, and Nuclear Response Enterprise*, GAO-16-599 (Washington, DC: Government Accountability Office, 2016), 8, https://www.gao.gov/assets/680/678054.pdf; William E. Sumner, email message to author, February 12, 2020.

if these elements would be able to overcome the unique challenges presented to US&R efforts by post-nuclear detonation environments to deliver this support. Consequently, it is unknown how the Department of Defense (DOD) could maximize the employment of existing US&R capabilities to support civil authority–directed lifesaving operations after a nuclear detonation.

B. RESEARCH QUESTIONS

How can the DOD maximize the employment of existing CBRN Response Enterprise urban search and rescue capabilities to support civil authority–directed lifesaving efforts following a domestic nuclear detonation?

- What are the expectations of civil authorities for the search and extraction and search and rescue elements of the CBRN Response Enterprise following a nuclear detonation?
- How can the CBRN Response Enterprise overcome the challenges presented to urban search and rescue efforts by a post-nuclear detonation environment to meet those expectations?

C. RESEARCH DESIGN

Interviews were conducted to assess the needs of civil US&R agencies during a nuclear detonation response. Since the enterprise must collaborate with both local and federal civil authorities for such a response, interviewees were categorized into two groups: local civil authorities and federal civil authorities. Local civil authority interviewees were selected from major metropolitan areas, and they were special operations coordinators for fire departments charged with US&R responsibilities in these jurisdictions. Conversely, federal civil authority interviewees were selected from the Federal Emergency Management Agency's National US&R Response System who hold the rank of task force leader or program manager.[6] In the event of a nuclear detonation, these leaders would have

[6] Federal Emergency Management Agency, *Emergency Support Function #9—Search and Rescue Annex* (Washington, DC: Department of Homeland Security, 2019), 4, https://www.fema.gov/pdf/emergency/nrf/nrf-esf-09.pdf.

direct responsibility for coordinating tactically and operationally with CBRN Response Enterprise US&R assets, all while considering the strategic aims of the response efforts.

Additionally, the challenges presented to US&R operations by a post-nuclear detonation environment were examined, particularly within the context of defense support of civil authorities (DCSA) and the CBRN Response Enterprise. The enterprise's ability to overcome these challenges were analyzed and both strengths and shortcomings were identified. By taking this systematic, investigatory approach, recommendations were ascertained for maximizing the employment of existing CBRN Response Enterprise US&R capabilities to support civil authority–directed lifesaving operations following a domestic nuclear attack.

D. FINDINGS

Civil response agencies have authority for coordinating domestic nuclear detonation response at both the federal and local levels of government, so it is imperative for the DOD to embrace its supportive role.[7] To this end, it must have a better understanding of the expectations of civil US&R authorities after such an event. Subsequently, the CBRN Response Enterprise must be tailored to meet these expressed needs. Doing so would allow the civil response agencies to become a force multiplier for civil US&R authorities, which would empower them to lead the effort to save lives after a domestic nuclear detonation.

For federal civil US&R authorities, force multiplication means providing capable manpower to sustain US&R efforts in a post-nuclear detonation environment based on interviews with Director Jeff Sanders on December 4, 2020, Program Manager Thomas Neal on December 10, 2020, and Task Force Leader Mike Kenny on January 20, 2021. These responders are well trained and highly experienced; thus, they are very capable of coordinating federal response efforts. However, according to the interviews with Sanders and Neal, the restrictions of work/rest cycles and stay times make US&R extremely labor

[7] Federal Emergency Management Agency, 4; Department of Homeland Security, *NIMS: Frequently Asked Questions* (Washington, DC: Department of Homeland Security, n.d.), 2, accessed December 15, 2020, https://www.fema.gov/pdf/emergency/nims/nimsfaqs.pdf.

intensive under such conditions. Consequently, they expect the enterprise to integrate into their response to maintain their battle rhythm.

On the other hand, local civil US&R authorities are less sure of their needs and expectations. They have far less exposure to the CBRN Response Enterprise's US&R elements, and they dedicate fewer planning resources to domestic nuclear detonation response. Regardless, based on interviews with Division Chief Kevin Jones on July 28, 2020, Private Jacob (Jake) Hoffman on December 27, 2020, and Battalion Chief Craig Cooper, on January 15, 2020, they are also highly trained and experienced responders, and they are open to military aid.

Based upon this feedback, the DOD can begin to reshape its US&R response doctrine. However, even with this deeper understanding, certain conditions are presented by post-nuclear detonation environments that the enterprise must address to render aid effectively. These conditions include the threat of fire and added challenges to the performance of US&R skills while utilizing personal protective equipment (PPE), which can be mitigated by changes in gear and training.

E. RECOMMENDATIONS

(1) Consider Embracing the "Super Squad" Concept

As suggested by Kenny in the interview, this concept involves the direct embedding of enterprise US&R personnel into national US&R response system rescue squads.

(2) Emphasize Operations-Level (Level I) US&R Skills

With the added complexities presented to US&R efforts by post-nuclear detonation environments, it should not be assumed that US&R-capable soldiers and airmen will be able to perform at an advanced level after a nuclear attack. Therefore, the enterprise should emphasize mastery of operations-level (level I) US&R skills among all US&R elements.

(3) Emphasize Wide Area Search Training

The enterprise should place greater emphasis on wide area search training, as wide area search is relatively less technical in nature, more suited for light damage zone

operations, and a potential gap in preparedness and planning for civil US&R authorities, as also noted in the interview with Sanders.[8]

(4) Require Soldiers and Airmen to Practice US&R Skills in CBRN PPE during Initial, Individual Training

Considering the limitations on dexterity and vision incurred by PPE, CBRN Response Enterprise soldiers and airmen should have the opportunity to practice relevant US&R skills in full PPE during initial training.[9]

(5) Issue Self-Contained Breathing Apparatuses to all CBRN Response Enterprise US&R Elements

Given the prevalence of fire in post-nuclear detonation environments, all enterprise US&R forces should have immediate access to self-contained breathing apparatuses.

(6) Improve Communication with Federal and Local Civil US&R Authorities

Across all levels of incident response, misconceptions exist about the CBRN Response Enterprise's US&R capabilities and response doctrine. Furthermore, from the research interviews, it is apparent that local US&R authorities have far less interaction with the enterprise than their federal counterparts do. Consequently, as stated in the interviews with Jones, Hoffman, and Cooper, they struggled to articulate their expectations of the DOD, as they had little understanding of its capabilities. Since Defense Support of Civil Authorities is the DOD's mandate, it bears the responsibility for engaging these authorities and rectifying any misunderstandings.[10]

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[8] Urban Search & Rescue, *Wide Area Search: (PER213)* (College Station, TX: Texas Engineering Extension Service, n.d.), accessed January 20, 2021, http://www.riccorp.com/psani/Ric5.pdf; "Damage Zones, Radiations Zones and Likely Rescue Activities after a Nuclear Detonation: Table," U.S. Department of Health and Human Services Radiation Emergency Medical Management, accessed January 23, 2021, https://www.remm.nlm.gov/zoned_approach_table.htm.

[9] Mehdi Pourmoghani, "Effects of Gloves and Visual Acuity on Dexterity," *Scholar Commons*, April 9, 2004, https://scholarcommons.usf.edu/cgi/viewcontent.cgi?article=2204&context=etd; Arthur Johnson, "Respirator Masks Protect Health but Impact Performance: A Review," *Journal of Biological Engineering* 10, no. 4 (February 9, 2016), https://jbioleng.biomedcentral.com/articles/10.1186/s13036-016-0025-4.

[10] Joint Chiefs of Staff, *Chairman of the Joint Chiefs of Staff Instruction 3125.01D*, CJCSI 3125.01D (Washington, DC: Joint Chiefs of Staff, 2015), 2, https://www.jcs.mil/Portals/36/Documents/Library/Instructions/3125_01.pdf?ver=7vpntUK9kYgjWqyrDMf0jg%3d%3d.

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This thesis is dedicated to my grandfather, Fireman First Class Robert Joseph Wagner, USS *Tennessee*, whose stories of naval service during World War II captured my imagination as a child and inspired me to pursue a career in public service.

Additionally, I would like to extend a special thank you to Lieutenant Colonel William E. Sumner, PhD, Deputy Program Manager, Chemical, Biological, Radiological, and Nuclear Response, United States Northern Command. Without his support, this project could not have been completed.

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I. INTRODUCTION

> It is far better to grasp the universe as it really is than to persist in delusion, however satisfying and reassuring.
>
> —Carl Sagan

A. PROBLEM STATEMENT

Triggered by the spike in concern for chemical biological radiological nuclear (CBRN) terrorism during the 1990s, the Nunn-Lugar-Domenici Act of 1997 mandated that the Department of Defense (DOD) take a leading role in preparing civil authorities for domestic CBRN incident response.[1] Today, organized under United States Northern Command (NORTHCOM) and the National Guard Bureau, DOD forces are assigned the mission to provide support to civil authority initiatives during weapons of mass destruction incidents through the CBRN Response Enterprise.[2] Composed of both Title 32 National Guard and Title 10 federal forces, the enterprise is organized into a progressive response matrix, intended to deliver life-saving aid to civil authorities during CBRN incidents in a timely manner.[3]

The CBRN Response Enterprise offers local and federal civil authorities its urban search and rescue (US&R) capabilities in the event a nuclear detonation traps victims in collapsed buildings.[4] These assets have two tiers of capability, search and extraction and search and rescue.[5] Located within Title 32 Chemical Biological Radiological Nuclear and High-Yield Explosives Enhanced Response Force Packages (CERFP) and CBRN Task Forces, all search and extraction soldiers are trained to the operations level (level I) in

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[1] "National Defense Authorization Act for Fiscal Year 1997," Congressional Record Daily Edition—Senate, 142, no. 97 (June 27, 1996): S7074, ProQuest.

[2] Joint Chiefs of Staff, *Joint Publication 3-41: Chemical, Biological, Radiological, and Nuclear Response* (Washington, DC: Joint Chiefs of Staff, 2016), C-1, https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_41.pdf.

[3] Joint Chiefs of Staff, C-1—C-2.

[4] Department of the Army, *Training Circular Number 3-37.51: Urban Search and Rescue* (Washington, DC: Department of the Army, 2020), sec. Foreword, https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN30224-TC_3-37.51-000-WEB-1.pdf.

[5] Chad English, email message to author, May 26, 2020.

structural collapse rescue.[6] Conversely, all search and rescue soldiers of the Title 10 Defense CBRN Response Force (DCRF) and Command and Control CBRN Response Elements (C2CRE) are trained to the more in-depth technician level (level II).[7] Theoretically, this system allows state-level National Guard Bureau forces to augment the US&R efforts of local responders quickly after an event, with heavier-equipped and trained Title 10 forces arriving later to reinforce the operation.[8]

Since no nuclear detonation or similar-sized CBRN event has occurred in the United States to require a full-scale CBRN Response Enterprise activation, any evaluation of the efficacy of this model is speculative, at best. Further, while frequent exercises are conducted to assess the US&R readiness of CBRN Response Enterprise units, they are conducted with minimal input from civilian emergency planners and responders. Given that the DOD's Defense Support of Civil Authorities (DSCA) mission is to assist—not replace—local authorities, prior planning and collaboration is essential for the efficient use of US&R assets.[9] However, it remains unknown how the civil authorities in many major metropolitan areas and the federal government would employ enterprise US&R resources due to a lack of mutual understanding and enterprise synchronization. Consequently, it is unknown how the DOD could maximize the employment of existing US&R capabilities to support civil authority–directed lifesaving operations after a nuclear detonation.

Additionally, it is unclear if the search and extraction and search and rescue forces of the CBRN Response Enterprise would be capable of meeting the expectations of civil

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[6] Department of the Army, *ATP 3-11.47/AFTTP 3-2.79: Chemical, Biological, Radiological, Nuclear, and High-Yield Explosives Enhanced Response Force Package (CERFP)/Homeland Response Force (HRF) Operations* (Washington, DC: Department of the Army, 2013), E-3.

[7] Chad English, email message to author, May 26, 2020; Homeland Defense Civil Support Office, *Urban Search and Rescuer Course Welcome Letter* (Washington, DC: Department of the Army, n.d.), 2, accessed February 15, 2021, https://home.army.mil/wood/application/files/1816/0278/5304/USR_Rescuer_Course_Welcome_Letter_15_Oct_2020.pdf.

[8] Government Accountability Office, *Defense Civil Support: DOD Has Made Progress Incorporating the Homeland Response Force into the Chemical, Biological, Radiological, and Nuclear Response Enterprise*, GAO-16-599 (Washington, DC: Government Accountability Office, 2016), 8, https://www.gao.gov/assets/680/678054.pdf; William E. Sumner, email message to author, February 12, 2020.

[9] Bert B. Tussing and Robert McCreight, *Introduction to Homeland Defense and Defense Support of Civil Authorities (DSCA): The U.S. Military's Role to Support and Defend* (Boca Raton, FL: CRC Press, 2015), 140-41.

authorities during post-nuclear detonation US&R efforts. Such operations are highly technical and require advanced levels of skill in rope, confined space, trench, vehicle, machinery, and structural collapse rescue techniques.[10] While all search and extraction team members of the CBRN Response Enterprise attend a 12-day course that culminates in structural collapse rescue operations, and all search and rescue-capable soldiers and airmen attend a full structural collapse technician course, these skills are only revisited during occasional collective training events, 24–36-month external evaluations, and large exercises.[11] The added challenges of performing these techniques in a contaminated environment are not factored into introductory training, continuing education, or response doctrine. Even professional rescuers, which may train on these skills for decades over the course of their public service careers, may struggle to perform basic US&R techniques under the added stress, sensory deprivation, and layers of complexity imposed by CBRN personal protective equipment (PPE) and other hazard control measures. Therefore, the challenges presented to military US&R support by post-nuclear detonation environments must be factored into any assessment of CBRN Response Enterprise search and extraction and search and rescue capabilities.

B. RESEARCH QUESTIONS

How can the DOD maximize the employment of existing CBRN Response Enterprise urban search and rescue capabilities to support civil authority–directed lifesaving efforts following a domestic nuclear detonation?

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[10] National Fire Protection Association, *NFPA 1670: Standard on Operations and Training for Technical Search and Rescue Incidents* (Quincy, MA: National Fire Protection Association, 2017), 16, https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1670.

[11] Homeland Defense Civil Support Office, *Urban Search and Rescue Extractor Course Level I Welcome Letter* (Washington, DC: Department of the Army, n.d.), 2, accessed February 15, 2021, https://home.army.mil/wood/application/files/7616/0278/5305/USR_Extractor_Course_Level_I_Welcome_Letter_15_Oct_2020.pdf; Homeland Defense Civil Support Office, *Urban Search and Rescuer Course Welcome Letter*, 2; National Guard Bureau, *Chief National Guard Bureau Manual: National Guard Homeland Response Force and Chemical, Biological, Nuclear, and High-Yield Explosives Enhanced Response Force Package Procedures* (Arlington, VA: National Guard Bureau, 2016), C-5, C-8.

- What are the expectations of civil authorities for the search and extraction and search and rescue elements of the CBRN Response Enterprise following a nuclear detonation?

- How can the CBRN Response Enterprise overcome the challenges presented to urban search and rescue efforts by a post-nuclear detonation environment to meet those expectations?

C. LITERATURE REVIEW

This literature review examines the conventional thought on nuclear detonations as it pertains to US&R and the concept of DSCA following domestic nuclear attacks. More specifically, it explores the topical areas of domestic nuclear attack sources and risk, modeling, US&R during these incidents, and the CBRN Response Enterprise. By understanding what the literature has to say, a starting point for a deeper analysis can be identified.

While the likelihood of a nuclear attack on the continental United States has been heavily debated since the invention of nuclear weapons, policy and research concerning the sources and risk of a domestic nuclear detonation have shifted between state and non-state threats. As early as 1976, an interagency intelligence memorandum from the Department of State found the probability of a foreign terrorist organization acquiring a nuclear weapon to be low.[12] However, with much of the conventional thought on nuclear warfare fading into the background at the end of the Cold War, the rise of international terrorism at the turn of the century birthed a new emphasis on unconventional threats.

In the years following the 9/11 attacks, a confusing dichotomy erupted between government and academic thinking on the nature of this unconventional threat, with government reports pointing primarily to non-state actors and terrorists as the future proliferators of nuclear weapons. In his 2008 testimony to the U.S. Senate Committee on Homeland Security and Governmental Affairs, Matthew Bunn called on Congress to act

[12] Department of State, "The Likelihood of the Acquisition of Nuclear Weapons by Foreign Terrorist Groups for Use against the United States" (interagency intelligence memorandum, Washington, DC: Department of State, 1976), https://www.documentcloud.org/documents/359467-2-iam.html.

and warned of the growing likelihood that terrorists would eventually develop a nuclear weapon.[13] This sentiment was echoed in a 2011 Department of Energy technical report, which warned, "The likelihood of a single nuclear bomb exploding in a single city is greater today than at the height of the Cold War."[14]

Conversely, many scholars like Bruce Hoffman believe a nexus must exist to state-actors for such a scenario to be probable.[15] In *Physics for Future Presidents*, Richard A. Muller agrees, "In many ways, the real threat is not nukes made by terrorists but rather nukes made by rogue nations."[16] Approximately a decade later, government policy is gradually shifting to agree with this trend in academic thinking, with the most recent *National Defense Strategy* emphasizing state-actors—instead of terrorists—as the leading threats currently facing the United States.[17] With this shift in emphasis from unconventional, terrorist threats back to conventional, state threats, so has the concern for the domestic nuclear threat returned largely to conventional weapons.[18]

Coinciding with the debate over the nature of the domestic nuclear attack threat, many academics have questioned the accuracy of military damage and casualty predictions for domestic nuclear detonations. Although much of government response doctrine is based in Samuel Glasstone and Phillip Dolan's "The Effects of Nuclear Weapons," Robert Harney argues that military modeling based on optimum altitude airbursts has blown

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[13] Matthew Bunn, *The Risk of Nuclear Terrorism—and Next Steps to Reduce the Danger: Testimony for the Committee on Homeland Security and Governmental Affairs* (Washington, DC: U.S. Senate, 2008), https://www.hsgac.senate.gov/imo/media/doc/040208Bunn.pdf.

[14] Joe Kinney et al., *Nuclear Incident Capabilities, Knowledge & Enabler Leveraging* (Aiken, SC: Savannah River Nuclear Solutions, 2011), 1, https://digital.library.unt.edu/ark:/67531/metadc833884/m2/1/high_res_d/1012545.pdf.

[15] Bruce Hoffman, *Inside Terrorism*, 3rd ed. (New York: Columbia University Press, 2017), 296.

[16] Richard A. Muller, *Physics for Future Presidents: The Science behind the Headlines* (New York: Norton, 2009), 41.

[17] Department of Defense, *Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge* (Washington, DC: Department of Defense, 2018), 1, https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf.

[18] Congressional Research Service, *Renewed Great Power Competition: Implications for Defense—Issues for Congress*, CRS Report No. R43838 (Washington, DC: Congressional Research Service, 2021), sec. Summary, https://fas.org/sgp/crs/natsec/R43838.pdf.

damage and casualty predictions drastically out of proportion, as a terrorist or rogue state nuclear attack is most likely to come in the form of a surface blast.[19] He is not the only academic to disagree fundamentally with established military thought, as Lynn Eden blames blinding organizational hubris for the failure to address thermonuclear effects in nuclear defense planning proportionately.[20] However, in a letter to the editor of *Homeland Security Affairs*, Rocco Casagrande et al. challenge Harney's models and casualty estimates by suggesting that the secrecy of federal response plans may have led Harney to incorrect conclusions.[21] Further, in a study sponsored by Lawrence Livermore National Labs, R. E. Marrs, W. C. Moss, and B. Whitlock challenged the idea that the thermal effects of fire can be accurately modeled in urban surface blast detonations.[22] Although many academics have questioned their efficacy, military models of nuclear effects have remained largely unchanged since the advent of nuclear weapons.

Just as predictive discrepancies exist in nuclear detonation modeling, institutional differences exist between civil and military US&R response doctrine for CBRN incidents. According to Tussing and McCreight, CBRN Response Enterprise doctrine focuses on a quick response by operations-level personnel, followed later by technician-level soldiers.[23] In contrast, Federal Emergency Management Agency (FEMA)'s US&R teams respond with highly experienced, technician-level rescuers.[24] As Henry Willis et al. point out in a

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[19] Samuel Glasstone and Phillip J. Dolan, *The Effects of Nuclear Weapons* (Washington, DC: Department of Defense and Department of Energy, 1977); Robert C. Harney, "Inaccurate Prediction of Nuclear Weapons Effects and Possible Adverse Influences on Nuclear Terrorism Preparedness," *Homeland Security Affairs* 5, art. 3 (September 2009), https://www.hsaj.org/articles/97.

[20] Lynn Eden, *Whole World on Fire: Organizations, Knowledge, and Nuclear Weapons Devastation* (Ithaca, NY: Cornell University Press, 2003).

[21] Rocco Casagrande et al., "Letter to the Editor: Federal Nuclear Preparedness and Response Measures Reflect New Modeling Paradigms," *Homeland Security Affairs* 6, art. 9 (January 2010), https://www.hsaj.org/articles/588.

[22] R. E. Marrs, W. C. Moss, and B. Whitlock, *Thermal Radiation from Nuclear Detonations in Urban Environments* (Livermore, CA: Lawrence Livermore National Laboratory, 2007).

[23] Tussing and McCreight, *Introduction to Homeland Defense and Defense Support of Civil Authorities*, 139-65.

[24] John Norman, *Fire Department Special Operations* (Tulsa, OK: PennWell Corporation, 2009), 18-19; Federal Emergency Management Agency, *National Urban Search and Rescue Response System US&R Operations Manual Annex E—Position Descriptions* (Washington, DC: Department of Homeland Security, 2020), 23.

report for RAND, differences in levels of training can cause problems, as can equipment interoperability between departments and agencies.[25] The experts on this topic seem to agree that this converging nexus of structural collapse and hazardous materials response needs to be studied. In *CBRN and Hazmat Incidents at Major Public Events: Planning and Response*, Dan Kaszeta says, "While most USAR efforts acknowledge that hazardous materials of various descriptions may be present in structural-collapse scenarios, not many organizations have taken on the task of both USAR and CBRN concurrently. This area represents an operational-capability deficit in many places."[26]

Accordingly, many military scholars have recognized shortcomings in the CBRN Response Enterprise, particularly in the realm of US&R, and several have made recommendations for improvement. When Kaszeta wrote *CBRN and Hazmat Incidents at Major Public Events: Planning and Response* in 2013, US&R was still a developing concept in the CBRN Response Enterprise. He pointed out the lack of real-world deployments by which to evaluate this endeavor, saying, "In several cases, CERFPs seem to be taking the Urban Search and Rescue mission seriously in CBRN environments, which is a useful development. Just how well the CST and CERFP will perform in a large-scale CBRN incident is a matter of conjecture, but it seems to me that their presence is far better than their absence."[27] While Kaszeta's conclusion was relatively positive, others have arrived at more negative conclusions. In *Reassessing the Chemical, Biological, Radiological, Nuclear Response Enterprise*, Gray Mills concluded the enterprise should "discontinue any technical search and rescue training within the CRE due to duplicate capabilities, specifically the already existent 28 FEMA urban search and rescue task forces and the large number of Type 1 and 2 certified teams within the nation's fire departments."[28]

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[25] Henry H. Willis et al., *Protecting Emergency Responders: Personal Protective Equipment Guidelines for Structural Collapse Events*, vol. 4 (Santa Monica, CA: RAND, 2006), 65-66.

[26] Dan Kaszeta, *CBRN and Hazmat Incidents at Major Public Events: Planning and Response* (Hoboken, NJ: John Wiley and Sons, 2013), 379.

[27] Kaszeta, 181.

[28] Gary Mills, *Reassessing the Chemical, Biological, Radiological, Nuclear Response Enterprise* (Fort Leavenworth, KS: Army School for Advanced Military Studies, 2018), 37, https://apps.dtic.mil/sti/pdfs/AD1071195.pdf.

From perceptions and analyses of the risk of a domestic nuclear attack to the development of response doctrine, a spirited debate has occurred among the CBRN response community about how to prepare for this threat. A lack of consensus has revealed a gap between military and civilian response doctrine, which may render a real-world response unorganized and ineffective. Since it is the DOD's duty to support civil authority-led US&R efforts during a nuclear detonation event, examining the intentions of local and federal civil responders for the employment of DOD US&R capabilities may offer insights that will bridge this gap while allowing the DOD to prepare for its supportive role better.

D. RESEARCH DESIGN

Viewed conventionally, the CBRN Response Enterprise's planned approach to US&R after a nuclear detonation is a matter of military doctrine. This doctrine was built upon decades-old assumptions about nuclear blast effects and how DOD assets would be utilized and integrated into a response. However, as Eden discovered in *Whole World on Fire: Organizations, Knowledge, & Nuclear Weapons Devastation*, such assumptions do not always reflect reality.[29] Therefore, this study investigates the validity of the assumptions that have shaped the enterprise's US&R doctrine and seeks recommendations for improvement.

While policy analysis could have proven beneficial for discovering how the CBRN Response Enterprise's US&R assets could be better integrated into domestic nuclear detonation responses, it would have failed to reflect the dynamic, unprecedented nature of a nuclear detonation accurately. Since an emergency response to a domestic nuclear detonation has never actually occurred, such an event would push even the best conceived emergency response plans to their limits. Lacking a history of responses to draw inferences and lessons from, civil US&R authorities will be left to improvise as unanticipated challenges arise. For this reason, it was deemed more advantageous to speak with the civil authorities that would be leading such a response. To this end, interviews were conducted to assess the needs of civil US&R agencies during a nuclear detonation response. By doing

[29] Eden, *Whole World on Fire*, 283-304.

so, recommendations for improving CBRN Response Enterprise US&R doctrine were ascertained.

As the enterprise must collaborate with both local and federal civil authorities for such a response, interviewees were categorized into two groups, local civil authorities and federal civil authorities. Given the high propensity for damage and casualties, major cities are among the most vulnerable targets to a nuclear attack.[30] Thus, local civil authority interviewees were selected from major metropolitan areas. While this selection limits the implications of the study, as suburban and rural jurisdictions may have vastly different perspectives, capabilities, and needs, it ensures the results are relevant to some of America's most susceptible targets. Further, interviewees in this group were special operations coordinators for fire departments charged with US&R responsibilities in these jurisdictions. This selection ensured the interviewees had direct knowledge of the tactical, operational, and strategic realms of their agency's plans, policies, and response doctrine.

Since FEMA is designated to lead the federal US&R response to any such event, FEMA's National US&R Response System leaders comprised the second group of interviewees.[31] While the system has an oversight office in FEMA headquarters, from which interviewees could have been selected for questions of strategy and policy, the information sought by this study was just as much tactical and operational as it was strategic.[32] Therefore, the FEMA US&R representatives selected for interview held the rank task force leader or program manager. In the event of a nuclear detonation, these leaders would be directly responsible for coordinating tactically and operationally with CBRN Response Enterprise US&R assets, all while considering the strategic aims of the response efforts.

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[30] National Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats, *Planning Guidance for Response to a Nuclear Detonation* (Washington, DC: National Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats, 2010), 8.

[31] Federal Emergency Management Agency, *Emergency Support Function #9—Search and Rescue Annex* (Washington, DC: Department of Homeland Security, 2019), 4, https://www.fema.gov/pdf/emergency/nrf/nrf-esf-09.pdf.

[32] Federal Emergency Management Agency, *National US&R Response System Administrative Manual: Annex A—Advisory Organization* (Washington, DC: Department of Homeland Security, 2014), 1, https://www.responsesystem.org/advisory-orgaization.

Finally, the challenges presented to US&R operations by a post-nuclear detonation environment were examined, particularly within the context of defense support of civil authorities (DCSA) and the CBRN Response Enterprise. The enterprise's ability to overcome these challenges were analyzed to identify both strengths and shortcomings. By taking this systematic, investigatory approach, recommendations were ascertained for maximizing the use of existing CBRN Response Enterprise US&R capabilities to support civil authority–directed lifesaving operations following a domestic nuclear attack.

E. THESIS OVERVIEW

Following this introduction, Chapter II outlines and analyzes the nation's US&R response architecture for domestic nuclear detonations as it pertains to the CBRN Response Enterprise. From this evaluation, gaps are identified in the DOD's understanding of the needs and expectations of civil US&R authorities. Moving forward, Chapter III details the research interviews conducted to begin bridging these gaps in understanding.

Collectively, the findings of Chapters II and III lead into Chapter IV, which takes a deeper look at the challenges presented to military US&R support by post-nuclear detonation environments. After detailing these obstacles, it critically examines the enterprise's ability to overcome them to accomplish its DSCA mission. Finally, based upon the implications of these previous sections, Chapter V draws conclusions and makes subsequent recommendations to the DOD for maximizing the employment of existing CBRN Response Enterprise US&R capabilities to support civil authority–directed lifesaving operations following a domestic nuclear detonation.

II. URBAN SEARCH AND RESCUE RESPONSE AFTER A DOMESTIC NUCLEAR DETONATION

Of each particular thing, ask: What is in it itself, in its own construction?

—Marcus Aurelius

A. INTRODUCTION

The previous chapter of this thesis laid out a road map for following and understanding the progression of this study and identified its objectives and components in sequential order. In keeping with this systematic approach, this chapter outlines the US&R response architecture to domestic nuclear detonations in the United States. It identifies and discusses this system's components at both the federal and local levels by examining them at the strategic, operational, and tactical levels of incident response. By doing so, this chapter exposes the DOD's gap in understanding of the expectations of civil US&R authorities following a domestic nuclear detonation.

B. THE 10 KILOTON DOMESTIC NUCLEAR DETONATION THREAT

As it is the origin of most current emergency planning, preparedness, and response doctrine, the natural starting point for an examination of any component of the domestic nuclear detonation response architecture is the 10 kiloton, surface blast nuclear detonation threat.[33] In the recent past, it was more specifically described as a 10 kiloton improvised nuclear device (IND), which echoed the government concerns of nuclear terrorism after the attacks of September 11, 2001.[34] The precise origin of this policy and doctrine can be found in the Homeland Security Council's National Planning Scenario 1, which addressed a domestic 10 kiloton IND detonation.[35] This scenario served as a starting point for

[33] National Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats, *Planning Guidance for Response to a Nuclear Detonation*, 11.

[34] National Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats, 9; Hoffman, *Inside Terrorism*, 285-87.

[35] Homeland Security Council, *National Planning Scenarios: Executive Summaries* (Washington, DC: Homeland Security Council, 2005), 1-1—1-5, https://ia801603.us.archive.org/23/items/NationalPlanningScenariosExecSummariesVer2/National_Planning_Scenarios_ExecSummaries_ver2.pdf.

preparedness and planning in accordance with Homeland Security Presidential Directive-8, which led it to drive America's domestic nuclear security initiatives.[36]

With the reemergence of great power competition, the domestic nuclear attack threat has shifted back to conventional nuclear weapons.[37] Generally speaking, these weapons are far greater in power.[38] Therefore, it is fair to question if the 10 kiloton, surface blast IND threat is still relevant for domestic planning and preparedness policy. After all, this threat is the center point of response doctrine in the CBRN Response Enterprise.[39]

Emergency Manager Brooke Buddemeier addressed this question in his 2019 FEMA PrepTalk *Saving Lives after a Nuclear Detonation*. A certified health physicist with Lawrence Livermore National Laboratory, Buddemeier has been considered a leading expert on domestic nuclear detonation response and modeling for well over a decade.[40] In his lecture, he compared a 10-kiloton device to a 100-kiloton weapon, stating, "Even when yields change by a factor of 10…blast effect ranges only change by a factor of 2." He concluded, "It's definitely bigger, but the range of effect is only about twice as far."[41] Figure 1 illustrates this proportionality, albeit for detonations smaller in force. While other factors can be considered in answering this question, an in-depth comparative analysis of predictive nuclear effects models is beyond the scope of this thesis. Concerning the matters being examined in this study, it is relatively safe to assume the return of conventional nuclear threats has not necessarily rendered obsolete the policy and doctrine developed over the past decade.

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[36] Homeland Security Council, iii.

[37] Congressional Research Service, *Renewed Great Power Competition*, 4.

[38] Muller, *Physics for Future Presidents*, 32-37; Federal Emergency Management Agency, *Improvised Nuclear Device Response and Recovery: Communicating in the Immediate Aftermath* (Washington, DC: Department of Homeland Security, 2013), 25, https://www.fema.gov/media-library/assets/documents/33036?id=7659G.

[39] United States Northern Command, *USNORTHCOM CONPLAN 3500-14: Defense Support of Civil Authorities Response* (Colorado Springs, CO: United States Northern Command, 2014), C-1—B-30.

[40] "Brooke Buddemeier, CHP, MS, BS," Harvard T. H. Chan School of Public Health, accessed February 18, 2021, https://www.hsph.harvard.edu/ecpe/faculty/brooke-buddemeier/.

[41] "PrepTalks: Brooke Buddemeier "Saving Lives after a Nuclear Detonation,"" February 26, 2019, Federal Emergency Management Agency, video, 23:10, https://www.youtube.com/watch?v=EueJrCJ0CcU.

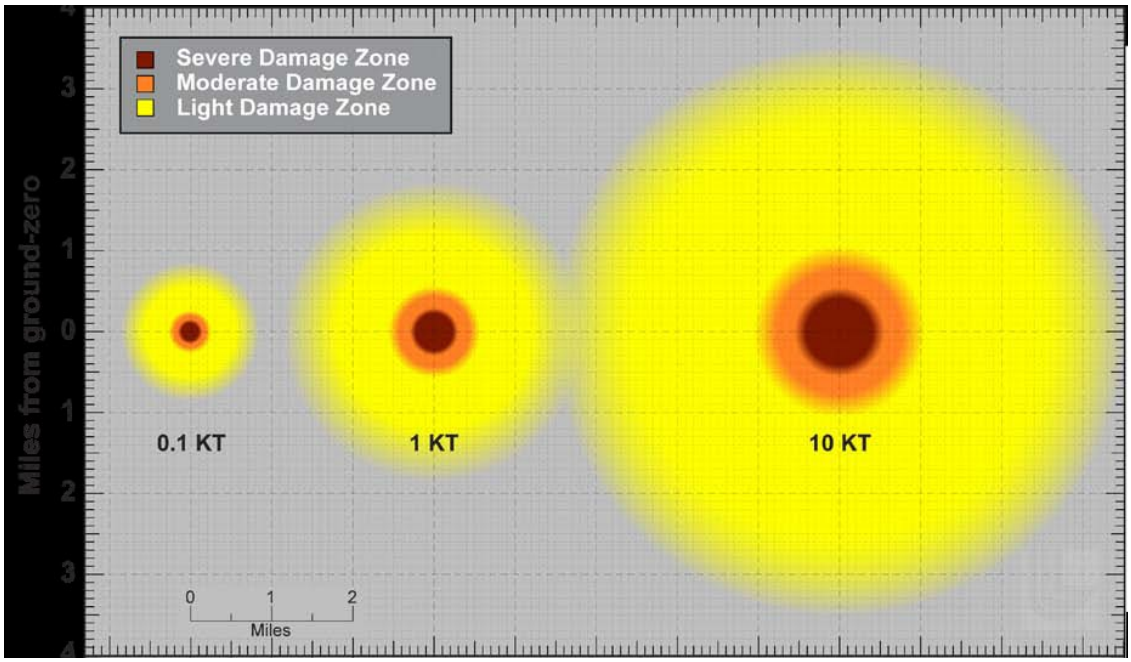

Figure 1. Comparison of Projected Damage Zones.[42]

In the year 2020, it appears the United States must have effective response plans to address both conventional and unconventional nuclear threats, as these threat landscapes undergo cycles. International terrorism has waned for now, apparently taking the IND threat with it. However, the overall domestic nuclear threat has not diminished, with a great power competition renewing Cold War-era concerns of nuclear attack.[43] Fortunately, the response policy and doctrine developed in the age of international terrorism still has some relevance today.

C. THE CBRN RESPONSE ENTERPRISE

Since the purpose of this study is to research ways the CBRN Response Enterprise can maximize the employment of its US&R assets after a domestic nuclear detonation, the enterprise's purpose and organization must next be discussed. Within the DOD, the CBRN Response Enterprise is an amalgam of Title 32 National Guard Bureau and Title 10

[42] Source: National Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats, *Planning Guidance for Response to a Nuclear Detonation*, 20.

[43] Congressional Research Service, *Renewed Great Power Competition*, 4.

NORTHCOM assets that have been organized into a progressive response matrix to assist civil authorities in the event of a CBRN incident within the borders of the United States and its territories, as shown in Figure 2.[44] On the Title 32 side, it is comprised of 57 Weapons of Mass Destruction Civil Support Teams (WMD-CST), 17 CERFPs, and 10 homeland response forces (HRF) that total approximately 56% of the enterprise at 10,595 soldiers and airmen. On the Title 10 side, it is composed of the DCRF and two C2CREs that total 44% of the enterprise at roughly 8,200 soldiers and airmen.[45] Theoretically, this combination of National Guard and active duty resources means Title 32 forces can be mobilized quickly to an event at a state government level, with Title 10 forces sustaining the effort once federal aid is formally requested.[46] Exceptions to this response order do occur, and elements of the enterprise have the ability to respond internationally if requested by the Department of State, but these instances are irrelevant for the purposes of this study.[47]

[44] Joint Chiefs of Staff, *Joint Publication 3-41*, C-1.

[45] Government Accountability Office, *Defense Civil Support*, 6; Joint Chiefs of Staff, *Joint Publication 3-41*, C-2.

[46] Government Accountability Office, 8.

[47] Joint Chiefs of Staff, *Joint Publication 3-41*, I-2.

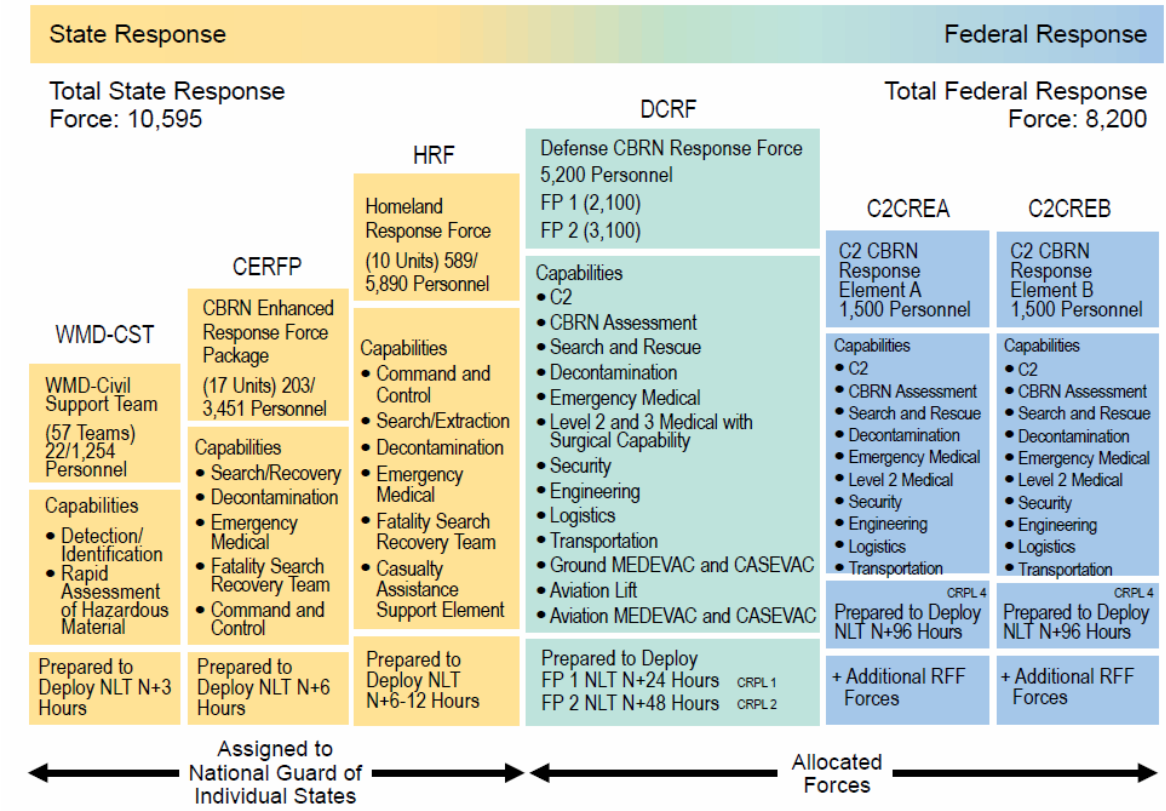

Figure 2. The CBRN Response Enterprise.[48]

According to the response matrix, when CBRN Response Enterprise capabilities are requested for an incident, the first enterprise assets to arrive are usually the WMD-CSTs.[49] Located in each state and three territories, the mission of these small teams during a CBRN event is to determine the nature and extent of the CBRN hazard, called site characterization.[50] In the case of a nuclear detonation, included would be atmospheric monitoring to determine the locations and energy levels of radiation fields.[51] For enterprise

[48] Source: Joint Chiefs of Staff, *Joint Publication 3-41*, C-2.

[49] United States Northern Command, *USNORTHCOM CONPLAN 3500-14*, C-1—B-21.

[50] Headquarters, Department of the Army, *ATP3-11.46/AFTTP 3-2.81: Weapons of Mass Destruction-Civil Support Team Operations* (Washington, DC: Department of the Army, 2014), 1-1, I-2, https://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/ARN20836_ATP_3-11x46%20_C2_FINAL_WEB.pdf; Joint Chiefs of Staff, *Joint Publication 3-41*, C-3.

[51] Federal Emergency Management Agency, *WMD Radiological/Nuclear Course for Hazardous Materials Technicians PER-241: Participant Guide*, 6.4 (Washington, DC: Department of Homeland Security, 2010), 293.

US&R assets, this action helps determine the protective measures to be used during rescue efforts.[52]

The next arriving resources are the CERFPs, composed of search and extraction, decontamination, medical, fatality search and recovery, and command and control elements.[53] Since the WMD-CSTs do not have any US&R capabilities, the search and extraction teams of the CERFPs are the first CBRN Response Enterprise US&R capabilities in the order of arrival.[54] As stated previously, they are trained to at least the operations level (level I) in rope, confined space, and structural collapse rescue.[55]

Following the CERFPs are the HRFs, which are located in each FEMA region of the United States.[56] Each HRF consists of the same elements as a CERFP, plus a regional command and control element and a CBRN assistance and support element, which is responsible for security.[57] The CERFP-related elements of a HRF are called a CBRN Task Force, and they bring additional search and extraction capabilities to the incident.[58]

The first Title 10 resource to arrive is the DCRF, composed of operations, aviation, medical, logistics, and signal task forces.[59] The operations task force is comprised of three battalion-equivalent task forces, including search and rescue personnel trained to the technician level (level 2) in all the US&R disciplines outlined by the National Fire Protection Association (NFPA) to be recognized as a structural collapse technician.[60] These disciplines include rope, confined space, vehicle, machinery, trench, and structural

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52 Headquarters, Department of the Army, *ATP3-11.46/AFTTP 3-2.81*, 1-3—1-4.

53 Department of the Army, *ATP 3-11.47/AFTTP 3-2.79*, 2-2.

54 Joint Chiefs of Staff, *Joint Publication 3-41*, C-2.

55 Department of the Army, *ATP 3-11.47/AFTTP 3-2.79*, E-3.

56 Joint Chiefs of Staff, *Joint Publication 3-41*, C-4.

57 Department of the Army, *ATP 3-11.47/AFTTP 3-2.79*, 2-6.

58 Tussing and McCreight, *Introduction to Homeland Defense and Defense Support of Civil Authorities*, 158-59.

59 Joint Chiefs of Staff, *Joint Publication 3-41*, C-5.

60 Joint Chiefs of Staff, C-5; Chad English, email message to author, May 26, 2020.

collapse rescue.[61] Since active duty units are only assigned to the DCRF on a rotation, it has a full-time command and control headquarters, known as Joint Task Force Civil Support (JTF-CS).[62]

The final resource in the CBRN Response Enterprise's order of arrival is one of two C2CREs, A (Alpha) or B (Bravo). While both of these elements consist of Army Reserve components, C2CRE A has active duty elements, and C2CRE B has National Guard personnel. Both bring similar capabilities as the DCRF to the incident, including search and rescue forces.[63]

It is worth noting that additional resources with similar missions and US&R capabilities as the CBRN Response Enterprise exist within the DOD, namely the United States Marine Corps' Chemical Biological Incident Response Force (CBIRF) and the U.S. Army's 911th Technical Rescue Engineer Company. However, both have special security responsibilities within the National Capital Region. Further, only CBIRF has a formal relationship with the enterprise that lends an Initial Response Force to the DCRF.[64] Regardless, both have a history of responding independently to major disasters and US&R events, including the Fukushima nuclear disaster and the attack on the Pentagon, and can be included in the DOD's response matrix, if deemed necessary.[65]

The CBRN Response Enterprise is a tiered response system that brings Title 32 National Guard and Title 10 federal resources to bear on major domestic CBRN events to assist civil authorities.[66] On the Title 32 end of the spectrum, it is achieved through 57

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61 Homeland Defense Civil Support Office, *Urban Search and Rescuer Course Welcome Letter*, 2.

62 Tussing and McCreight, *Introduction to Homeland Defense and Defense Support of Civil Authorities*, 160.

63 Joint Chiefs of Staff, *Joint Publication 3-41*, C-5.

64 Joint Chiefs of Staff, III-10; Austin Thomas, "911th Technical Rescue Engineering Company Conducts Validation," United States Army, April 5, 2017, https://www.army.mil/article/185365/911th_technical_rescue_engineering_company_conducts_validation; United States Northern Command, *USNORTHCOM CONPLAN 3500-14*, C-1—B-12.

65 "History," Chemical Biological Incident Response Force, accessed February 17, 2021, https://www.cbirf.marines.mil/About-CBIRF/History/; Thomas; Tussing and McCreight, *Introduction to Homeland Defense and Defense Support of Civil Authorities*, 151.

66 Joint Chiefs of Staff, *Joint Publication 3-41*, C-1.

WMD-CSTs, 17 CERFPs, and 10 HRFs. Moving into the Title 10 end, it involves the DCRF and two C2CREs.[67] Within these units, it supplies search and extraction and search and rescue personnel in a progressive manner to assist with the rescue of trapped victims in collapsed buildings after a domestic nuclear detonation.[68]

D. US&R RESPONSE TO A DOMESTIC NUCLEAR DETONATION

With an appreciation for the underlying assumptions of current domestic nuclear detonation preparedness and response policy, and a deeper philosophical understanding of the CBRN Response Enterprise, America's overall US&R response architecture should next be scrutinized. This review can be accomplished by classifying and mapping the types and levels of government US&R authorities, particularly as they relate to the enterprise. From there, the lines of authority can be drawn, relationships between agencies at varying levels of government can be understood, and gaps in doctrine and response philosophy can be identified.

Following a domestic nuclear detonation, all three levels of American government are involved in the response: local, state, and federal.[69] US&R assets exist at all three levels, and state and federal authorities can be further categorized as either civil or military. The Code of Federal Regulations from which they derive their authority, Title 10 and Title 32, as previously discussed, differentiates military entities. Title 32 operates under state authority, while Title 10 is under federal control.[70]

The response policy, doctrine, and philosophies of these organizational categories can also be analyzed within the context of the three levels of emergency incident response: strategy, operations, and tactics. These levels are defined by FEMA's student manual for the *ICS-300: Intermediate ICS for Expanding Incidents Course*. According to the manual,

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67 Joint Chiefs of Staff, C-2.

68 Joint Chiefs of Staff, I-7.

69 National Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats, *Planning Guidance for Response to a Nuclear Detonation*, 8.

70 Title 10 and Title 32, United States Code, Public Law 1082 (1956): 1, https://www.govinfo.gov/content/pkg/STATUTE-70/pdf/STATUTE-70A-Pg1.pdf.

strategy is "the general plan or direction selected to accomplish incident objectives," and tactics are the "deploying and directing resources on an incident to accomplish the objectives designated by the strategy."[71] Operations lie in the middle, as they are "responsible for all tactical incident operations and implementation of the Incident Action Plan."[72]

1. Federal US&R Response

This section examines federal US&R policy and doctrine at the strategic, operations, and tactical levels of emergency response. Comparatively, it includes both the civil and military approaches. By employing this method, it highlights the holes in the DOD's assumptions about the expectations of federal US&R authorities after a domestic nuclear detonation.

a. Strategy

Since strategy sets the overall heading for incident response, it is discussed first.[73] In the case of federal US&R policy and doctrine, it primarily concerns how US&R is defined among the interagency. It also includes the delegation of US&R response authorities and responsibilities, which provides a metric for judging the strategy's implementation. Accordingly, this section examines the strategic components of federal US&R response doctrine.

While no single, overarching definition of US&R in the context of federal government response strategy exists, the definitions of most relevant agencies and documents center around structural collapse events, and lines of authority for domestic US&R operations are clearly drawn among the interagency. In most federal civil response policy and doctrine, US&R is considered a subset of the greater search and rescue mission. Such is the case in the National Response Framework (NRF), the principle document that

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[71] Federal Emergency Management Agency, *ICS-300: Intermediate ICS for Expanding Incidents* (Washington, DC: Department of Homeland Security, 2008), G-14.

[72] Federal Emergency Management Agency, G-11.

[73] Federal Emergency Management Agency, G-14.

outlines the authority of federal response agencies during national disasters.[74] The *Emergency Support Function #9—Search and Rescue Annex* of the framework lists US&R as the first of three search and rescue categories, stating, "US&R includes operations for natural and manmade disasters and catastrophic incidents, as well as other structural collapse operations that primarily require DHS/FEMA US&R task force operations."[75] In terms of authority for coordinating these operations, the annex states, "During incidents or potential incidents requiring a unified SAR [search and rescue] response, federal SAR responsibilities reside with ESF #9 primary agencies that provide timely and specialized SAR capabilities. Support agencies provide specific capabilities or resources that support ESF #9."[76] Clearly, in the case of US&R and structural collapse events, FEMA and its parent organization—the Department of Homeland Security (DHS)—are recognized as the primary agencies.[77]

The *Search and Rescue Annex* is synchronized with the *U.S. National Search and Rescue Plan* (NSP), developed by the National Search and Rescue Committee, a conglomerate of eight federal agencies with search and rescue capabilities under the coordination of the U.S. Coast Guard's Office of Search and Rescue.[78] The annex states, "The Federal US&R Response System integrates DHS/FEMA task forces in support of unified search and rescue operations conducted following the U.S. National Search and Rescue Plan (NSP). (The NSP is the policy guidance of the signatory Federal departments and agencies for coordinating SAR services to meet domestic needs and international

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[74] Federal Emergency Management Agency, *Introducing...National Response Framework* (Washington, DC: Department of Homeland Security, 2008), 2, https://www.fema.gov/pdf/emergency/nrf/about_nrf.pdf; Federal Emergency Management Agency, *National Response Framework*, 4th ed. (Washington, DC: Department of Homeland Security, 2019), 2-4, https://www.fema.gov/sites/default/files/2020-04/NRF_FINALApproved_2011028.pdf.

[75] Federal Emergency Management Agency, *Emergency Support Function #9*, 1.

[76] Federal Emergency Management Agency, 1.

[77] Federal Emergency Management Agency, 4.

[78] "U.S. Coast Guard Office of Search and Rescue (CG-SAR-2)," United States Coast Guard, accessed December 23, 2020, https://www.dco.uscg.mil/Our-Organization/Assistant-Commandant-for-Response-Policy-CG-5R/Office-of-Incident-Management-Preparedness-CG-5RI/US-Coast-Guard-Office-of-Search-and-Rescue-CG-SAR/CG-SAR-2/.

commitments.)"[79] While the NSP defines US&R as "the location, rescue (extrication), and initial medical stabilization of survivors trapped in confined spaces," failing to mention structural collapses specifically, it goes on to pair US&R with collapsed structure events when defining the document's scope. Further, it, too, recognizes FEMA as both the coordinating agency during catastrophic events and the overseer of the National US&R Response System.[80] Although worded differently, this synchronization prevents ambiguity and fosters unity of effort across the civil interagency during US&R incidents.

With these two documents confirming FEMA's status as the primary agency for domestic US&R events, the DOD has adopted a supportive posture towards such incidents under the concept of DSCA. *Joint Publication 3-28: Defense Support of Civil Authorities* defines this concept; it states:

> Defense support of civil authorities (DSCA) is support provided by federal military forces; Department of Defense (DOD) civilians; DOD contract personnel; and DOD component assets, to include National Guard (NG) forces (when the Secretary of Defense [SecDef], in coordination with the governors of the affected states, elects and requests to use and fund those forces in Title 32, United States Code [USC], status), in response to a request for assistance (RFA) from civil authorities for domestic emergencies, cyberspace incident response, law enforcement support, and other domestic activities or from qualifying entities for special events. DSCA includes support to prepare, prevent, protect, respond, and recover from domestic incidents.[81]

This supportive approach is further supported by American legal principles. Although the *Posse Comitatus Act* restricts the use of military forces domestically for law enforcement purposes, CBRN incidents are considered an exception.[82] As such, a

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[79] Federal Emergency Management Agency, *Emergency Support Function #9*, 1.

[80] U.S. Coast Guard National Search and Rescue Committee, *National Search and Rescue Plan of the United States* (Washington, DC: United States Coast Guard, 2016), 4, https://www.dco.uscg.mil/Portals/9/CG-5R/manuals/National_SAR_Plan_2016.pdf.

[81] Joint Chiefs of Staff, *Joint Publication 3-28: Defense Support of Civil Authorities* (Washington, DC: Joint Chiefs of Staff, 2018), ix, https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_28.pdf.

[82] "Emergency Situations Involving Chemical or Biological Weapons of Mass Destruction," Armed Forces, Code of Federal Regulations, title 10 (2006 comp.): 382, https://www.govinfo.gov/content/pkg/USCODE-2006-title10/pdf/USCODE-2006-title10-subtitleA-partI-chap18-sec382.pdf.

framework for employing DOD assets during disasters is outlined by the *Stafford Act*.[83] Still, because domestic deployment of military forces tends to evoke mixed feelings among Americans, the DSCA concept formally underscores the philosophy that civil authorities take the lead during domestic incidents.

Despite civil authorities having this leading role in domestic disaster responses, and the primarily supportive mission of the military, the DOD has its own internal framework for responding to domestic incidents. Much like any other department in the Executive Branch, authority to engage in domestic CBRN response is passed down from the DOD's agency executives. In the case of the DOD, it is the Secretary of Defense and the Chairman of the Joint Chiefs of Staff.[84] *Chairman of the Joint Chiefs of Staff Instruction 3125.01D: Defense Response to Chemical, Biological, Radiological, and Nuclear (CBRN) Incidents in the Homeland* is the chief policy document that outlines the DOD's overarching role in domestic nuclear detonation response.[85] While it only mentions search and rescue activities once, it is cited by the joint publications that define related DOD doctrine.[86] This limitation can be attributed, in part, to the fact the DOD is an incredibly large agency, the largest department in the federal government.[87] Further, military culture is characterized by clear chains of command and strict adherence to rules of discipline and order. While federal civilian agencies are no less organized, civilian culture tends to be far more informal.

Consequently, a dichotomy occurs between the underlying philosophies of civil and military US&R policy and doctrine. While the *Search and Rescue Annex* of the NRF and

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[83] Federal Emergency Management Agency, *Stafford Act, as Amended, and Related Authorities* (Washington, DC: Department of Homeland Security, 2019), 31-32, https://www.fema.gov/media-library-data/1582133514823-be4368438bd042e3b60f5cec6b377d17/Stafford_June_2019_508.pdf.

[84] "Our Leaders: DOD's Top Leaders," Department of Defense, accessed February 17, 2021, https://www.defense.gov/our-story/meet-the-team/.

[85] Joint Chiefs of Staff, *Chairman of the Joint Chiefs of Staff Instruction 3125.01D*, CJCSI 3125.01D (Washington, DC: Joint Chiefs of Staff, 2015), 1, https://www.jcs.mil/Portals/36/Documents/Library/Instructions/3125_01.pdf?ver=7vpntUK9kYgjWqyrDMf0jg%3d%3d.

[86] Joint Chiefs of Staff, *Joint Publication 3-41*, II-1.

[87] "About," Department of Defense, accessed December 23, 2020, https://www.defense.gov/our-story/#:~:text=The%20Department%20of%20Defense%20is,and%20ensure%20our%20nation's%20security.

NSP speak to US&R in general terms of building collapses, they make no mention of US&R in the context of domestic nuclear detonations. Rather, they approach US&R in an all-hazards manner. As the website of the National US&R Response System states:

> Urban search and rescue is considered a 'multi-hazard' discipline, as it may be needed for a variety of emergencies or disasters, including earthquakes, hurricanes, typhoons, storms, tornadoes, floods, dam failures, technological accidents, terrorist activities, and hazardous materials releases. The events may be slow in developing, as in the case of hurricanes, or sudden, as in the case of earthquakes.[88]

Military US&R response policy and doctrine, on the other hand, centers almost entirely around response to domestic nuclear detonations. In fact, military US&R largely lies under the umbrella of CBRN response, while federal civil US&R doctrine makes no mention of CBRN incidents or considerations. *Joint Publication 3-41: Chemical, Biological, Radiological, and Nuclear Response* is the principal guiding document for the DOD's planned response to any such incident. In defining the purpose of its US&R elements, it states:

> These elements support all capabilities necessary to search for and rescue casualties from a contaminated or hazardous environment. Casualties are usually decontaminated prior to transit from the incident site. A SAR element requires specialized technical rescue training to support the rescue of personnel and equipment from a CBRN environment using unique SAR equipment for an urban and structural collapse environment.[89]

This disparity in emphasis makes the efficacy of the military's overarching response model questionable, as an obvious gap exists in strategic policy and doctrine. Although the NSP declares that "military support to US&R" during collapsed structure events is within its scope, and the military acknowledges the supportive nature of its role in such incidents, its strategic policy and doctrine is not aligned with that of its federal civil authority partners.[90] Gary Mills also concluded this sentiment in his article *Reassessing*

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88 "Urban Search and Rescue," National Urban Search and Rescue Response System, 2017, https://www.responsesystem.org/usr-information.

89 Joint Chiefs of Staff, *Joint Publication 3-41*, I-7.

90 U.S. Coast Guard National Search and Rescue Committee, *National Search and Rescue Plan of the United States*, 6.

the Chemical, Biological, Radiological, Nuclear Response Enterprise. Mills concluded, "Currently, there is a distinct difference between the way the military plans, prepares, and trains for a CBRN incident and that of an 'all hazards' incident."[91]

b. Operations

Since tactics are coordinated in the operational domain of incident response to implement strategies, the operational plans of federal US&R response entities is the next logical point for analysis.[92] Thus, this section examines the implementation and response plans of relevant federal US&R agencies. In doing so, it identifies the gaps in planning and doctrine between civil authorities and the CBRN Response Enterprise.

As previously noted, both the *Search and Rescue Annex* of the National Response Framework and *U.S. National Search and Rescue Plan* name FEMA as the primary agency in structural collapse events.[93] FEMA is thus named because it maintains and administrates the National Urban Search and Rescue Response System, a confederation of 28 US&R teams located throughout the continental United States.[94] Similar to the supportive role of the military's DSCA concept, the mission of the National US&R Response System is to supplement—not replace—local, regional, and state US&R teams. According to FEMA, the task forces deploy to "provide assistance in structural collapse rescue."[95]

While the system takes an "all hazards" approach to US&R philosophically, and despite the apparent waning of the nuclear terrorism threat, the National US&R Response System has been planning its response to an IND attack in a major city as late as 2017.[96] As shown in Figure 3, proposals for this plan call for the heavy use of military Title 32 and

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91 Mills, *Reassessing the Chemical, Biological, Radiological, Nuclear Response Enterprise*, 35.

92 Federal Emergency Management Agency, *ICS-300*, G-11.

93 Federal Emergency Management Agency, *Emergency Support Function #9*, 4; U.S. Coast Guard National Search and Rescue Committee, *National Search and Rescue Plan of the United States*, 4.

94 National Urban Search and Rescue Response System, "Urban Search and Rescue."

95 "Urban Search & Rescue," Federal Emergency Management Agency, November 4, 2020, https://www.fema.gov/emergency-managers/national-preparedness/frameworks/urban-search-rescue.

96 Mike Cayse, *FEMA US&R IND ConOps* (Washington, DC: Federal Emergency Management Agency, 2018), 2.

Tile 10 forces. Specifically, Title 32 CERFPs and CBRN Task Forces would be deployed to the moderate damage zone, while Title 10 DCRF and C2CRE forces would collaborate and integrate with FEMA US&R task forces in the light damage zone.[97]

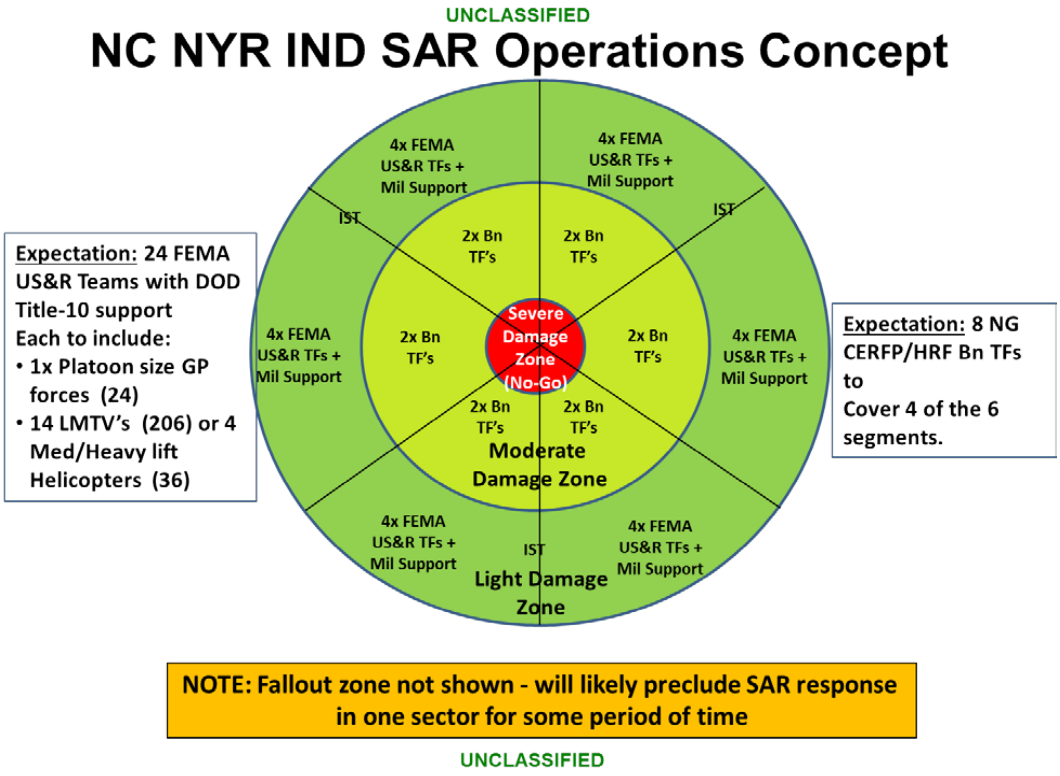

Figure 3. National US&R Response System's IND Concept of Operations.[98]

These zones are the predicted areas of destruction following a nuclear detonation in a major American city, as outlined in the National Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats' *Planning Guidance for Response to a Nuclear Detonation* (illustrated in Figure 4).[99] The Department of Health and Human Services' Radiation Emergency Medical

[97] Cayse, 9.

[98] Source: Cayse, 21.

[99] National Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats, *Planning Guidance for Response to a Nuclear Detonation*, 40.

Management has developed guidance on these zones into a table. According to this table, in regards to the moderate damage zone, "Rescues here will focus on victims with urgent needs who are unable to self-evacuate." It also states, "Urban search and rescue will be most efficient and effective in non-radiologically contaminated areas of this zone." As for the light damage zone, "Most of the injuries in this zone are not expected to be life threatening," and, "injuries are expected to be associated with flying glass and debris from the blast wave and traffic accidents."[100]

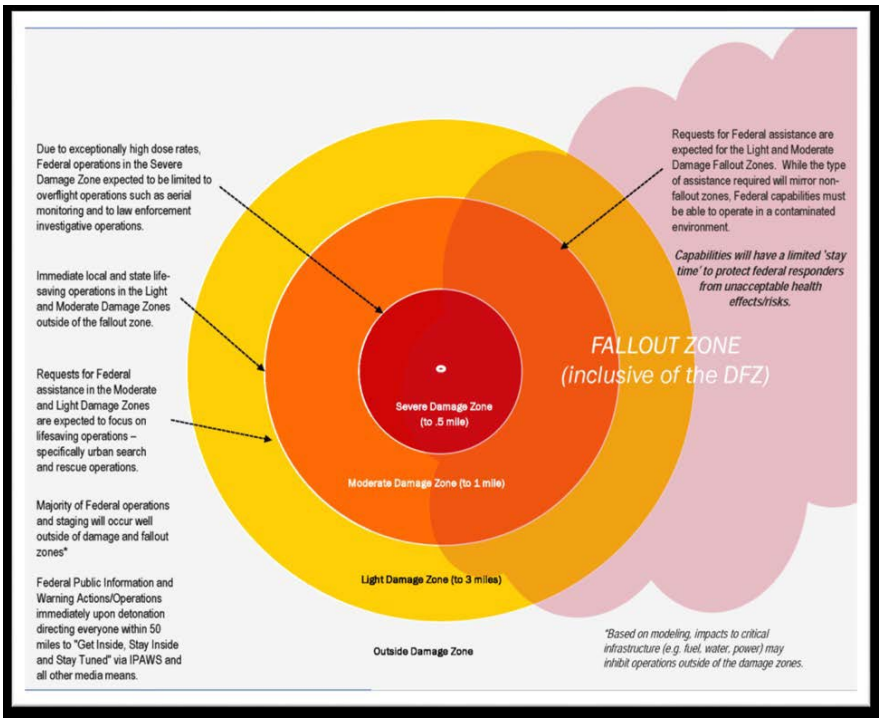

Figure 4. Damage Zones following an IND Detonation.[101]

According to *Appendix E: Search and Extraction* of *ATP 3-11.47/AFTTP 3–2.79: Chemical, Biological, Radiological, Nuclear, and High-Yield Explosives Enhanced*

100 "Damage Zones, Radiations Zones and Likely Rescue Activities after a Nuclear Detonation: Table," U.S. Department of Health and Human Services Radiation Emergency Medical Management, accessed January 23, 2021, https://www.remm.nlm.gov/zoned_approach_table.htm.

101 Source: Department of Homeland Security, *Nuclear/Radiological Incident Annex to the Response and Recovery Federal Interagency Operational Plan*s, 119.

Response Force Package (CERFP)/Homeland Response Force (HRF) Operations, the CERFP and CBRN Task Force search and extraction teams are well-designed to tackle the US&R mission in the moderate damage zone. The publication specifies:

> The organization of the National Guard CERFP and HRF includes a search and extraction element. This capability is focused on the response to a CBRN incident and differs from traditional urban search and rescue capabilities such as FEMA task forces. The search and extraction element is designed to respond quickly with a relatively light equipment package and to operate at structural-collapse incidents or ordinary construction incidents as described in National Fire Protection Association (NFPA) 1670.[102]

However, while confidently describing its operational US&R capabilities, the publication also states that these teams are not designed to work entirely independent of close civil authority guidance. In outlining their proficiencies, it clarifies, "When deployed, the search and extraction element reports through appropriate channels to the local incident commander and provides a unique capability to local and state response agencies."[103] As far as independent operations, it states, "The search and extraction element typically receives direction in the hot zone from local agencies, although internal reporting requirements and directives can be expected to remain in place."[104]

This posture contradicts the expectations described in the proposed National US&R Response System's *IND Response Concept of Operations*. While it appears that FEMA expects the DOD's search and extraction teams to perform US&R operations independently in the moderate damage zone, the CBRN Response Enterprise's operational plan stresses that its role is simply to compliment the efforts of local civil authorities. It declares, "While it is important to describe capabilities under the National Incident Management System compliant terminology, it is fully understood and accepted that search

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[102] Department of the Army, *ATP 3-11.47/AFTTP 3-2.79*, E-1.

[103] Department of the Army, E-2.

[104] Department of the Army, E-1.

and extraction element capability was designed to augment state and local emergency response assets."[105]

Furthermore, the CBRN Response Enterprise's overall response matrix does not align with the FEMA US&R *IND Response Concept of Operations* in the context of the *Planning Guidance for Response to a Nuclear Detonation*'s damage zone predictions. The medium damage zone is predicted to be the area in most need of aggressive US&R capabilities, but this area of responsibility has been assigned solely to the lesser operations-trained CERFP and CBRN Task Force elements.[106] After all, these elements are expected to be the first US&R-capable components of the enterprise to arrive. Paradoxically, the technician-level trained Title 10 US&R forces are dedicated to the light damage zone, where they will partner and collaborate with the technician-level trained teams of the National US&R Response System.[107]

Although the operational capabilities statement of the search and extraction teams differentiates them from standard FEMA US&R teams based on CBRN capabilities, it also acknowledges their limitations.[108] Only wholesomely trained to the operations-level of response in three US&R disciplines, the search and extraction teams are intended to be a force multiplication force, not a stand-alone element.[109] These mismatches in operational intentions and real world planning reveal a misunderstanding of civil authorities' expectations, and the DCSA mandate places responsibility for rectifying these miscommunications on the CBRN Response Enterprise.

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[105] Department of the Army, E-2.

[106] U.S. Department of Health and Human Services Radiation Emergency Medical Management, "Damage Zones, Radiations Zones and Likely Rescue Activities after a Nuclear Detonation: Table"; Cayse, *FEMA US&R IND ConOps*, 9.

[107] Cayse, 9.

[108] Department of the Army, *ATP 3-11.47/AFTTP 3-2.79*, E-1.

[109] Department of the Army, E-1—E-3.

c. Tactics

Since tactics are the direct employment of resources to accomplish incident response objectives, it is the final tier for this analysis.[110] A domestic nuclear detonation has never occurred to test the US&R tactics of civil US&R authorities or the CBRN Response Enterprise, so the best place to examine relevant response doctrine within this realm is training. Therefore, this section examines federal civil and military US&R training policy and doctrine and identifies opportunities for improvement for the CBRN Response Enterprise.

Training standards for all domestic US&R operations are driven primarily by two consensus standards: *NFPA 1006: Standard for Technical Rescue Personnel Professional Qualifications* and *NFPA 1670: Standard on Operations and Training for Technical Search and Rescue Incidents*.[111] Additionally, the *29th Volume, Code of Federal Regulations 1910.120(q)* regulates the training standards for rescuers operating in a hazardous material, or contaminated, environments.[112] This document is supported by *NFPA 472: Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents* and *NFPA 473: Standard for Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents*.[113] These standards and regulations are the foundation for all US&R training publications, both civil and military.

Still, like most DOD entities, the CBRN Response Enterprise produces its own unique training doctrine. While acknowledging the supportive nature and mandate behind its role in domestic CBRN incident response, it is a blending of military and civilian response principles. Published in August 2020, *Training Circular Number 3–37.51: Urban Search and Rescue* provides the training curriculum for all search and extraction and search

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110 Federal Emergency Management Agency, *ICS-300*, G-14.

111 Department of the Army, *Training Circular Number 3-37.51*, 1-3—1-4.

112 "1910.120—Hazardous Waste Operations and Emergency Response," United States Occupational Safety and Health Administration, accessed February 17, 2021, https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.120.

113 Homeland Defense Civil Support Office, *Urban Search and Rescue Common Core Student Handout* (Fort Leonard Wood, MO: Department of the Army, 2019), 11.

and rescue courses within in the CBRN Response Enterprise. It states, "This training circular helps the Chemical, Biological, Radiological, and Nuclear Response Enterprise task force level units conducting US&R/urban search and extraction missions and below to prepare their training plan for the unit's specific mission to the defense support of civil authorities."[114] However, it goes on to affirm adherence to underlying military doctrine and principles. It states:

> The US&R training circular serves as one module of the common operational doctrine for the defense CBRN response force and the entire CRE. Its central idea, adapted to the unique conditions of the homeland operational environment, represents the Army's unique contribution to civil support. It will support our doctrine, our training, and our leader professional development programs.[115]

This blending of doctrine leaves the CBRN Response Enterprise open to misconceptions about the needs of civil US&R authorities, considering the differences in civil rescuer and military philosophies of response. In *CBRN and Hazmat Incidents at Major Public Events: Planning and Response*, Kaszeta explores the implications of this conundrum for both groups. He observes, "Military CBRN defense doctrine seeks to provide for the minimal degradation to operations. This precept, in turn, drives the design and specification of equipment and the development of tactics, techniques, and procedures."[116] Conversely, civilian rescuers have vastly different approaches to domestic incident response. Kaszeta states, "In most places, the fire services operate under a much more rigid risk philosophy than that which prevails on military battlefields."[117] These differences are reflected in the way these entities tactically train and prepare.

While development of and adherence to organizational doctrine is important for managing large organizations like the CBRN Response Enterprise and greater DOD, this pledge can be detrimental when the mission is to support other government agencies, particularly civil US&R authorities. As Eden discovers in *Whole World on Fire*, blind

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114 Department of the Army, *Training Circular Number 3-37.51*, vi.

115 Department of the Army, sec. Foreword.

116 Kaszeta, *CBRN and Hazmat Incidents at Major Public Events*, 33-34.

117 Kaszeta, 30.

obedience to doctrine can be harmful to a large organization's efforts, especially when its basic assumptions are false.[118] Therefore, to prevent misconceptions, the CBRN Response Enterprise needs to engage civil US&R authorities in an open dialog. To this end, it should inquire what training should be provided to enterprise US&R forces to make them most helpful to civil authorities following a domestic nuclear attack.

2. Local US&R Response

Local US&R response in the United States is a much more decentralized enterprise, as is planning and doctrine for a domestic nuclear detonation. Therefore, while the previous section examined federal US&R capabilities in fine detail, analyzing them in the three domains of incident response, this segment takes a more wholesome approach. By doing so, it highlights the necessity for a better understanding of the expectations of local civil US&R authorities after a domestic nuclear detonation by the CBRN Response Enterprise.

As previously established, civilian government agencies hold the authority for domestic disaster responses in the United States.[119] This rule is especially true at the state and local levels of government, and a nuclear detonation is no exception. However, it runs contrary to popular belief, as the military is often portrayed as rushing in to save the day during major incidents in film and popular culture.[120] Concerningly, this myth persists in the minds of some state and local emergency mangers, planners, and responders. In a 2019 FEMA PrepTalk, physicist and nuclear emergency researcher Brooke Buddemeier speaks of his experience asking state and local emergency managers what they need from the federal government following a nuclear detonation. Paraphrasing one of the most common

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[118] Eden, *Whole World on Fire*, 283-304.

[119] Department of Homeland Security, *NIMS: Frequently Asked Questions* (Washington, DC: Department of Homeland Security, n.d.), 2, accessed December 15, 2020, https://www.fema.gov/pdf/emergency/nims/nimsfaqs.pdf.

[120] *Britannica*, s.v. "discover the threat of nuclear warfare portrayed in books, movies, and television programs reflect popular culture," accessed February 26, 2021, https://www.britannica.com/video/186543/overview-atomic-bomb-threat-warfare-culture-television.

reactions to his question, Buddemeier quips, "Nuclear detonation? That's a fed thing, right? Wait for the guys in green to save the day?"[121]

While mildly sarcastic, Buddemeier's observation highlights the decades-old debate over who is truly responsible for leading the response after a domestic nuclear detonation, the affected local and state agencies, or the federal government. Since it is unprecedented and would be so catastrophic, some believe that a nuclear detonation is an exigent circumstance warranting or requiring total federal response oversight.[122] In its drafted 2017 IND Operations Concept, the National US&R Response System is doubtful an effective local response is even possible. It states, "A coordinated local response is unlikely in an event of this magnitude. Local infrastructure will have been severely impacted. The detonation will have severely impacted the overall continuity of operation."[123] Agreeing, Buddemeier admits, speaking of state and local authorities, "Nobody really has a plan for the aftermath of a nuclear detonation."[124] Reflecting on his observations, he marvels, "In fact, there's a lot of uncertainty about what the response needs even are, and what the role of federal, state, and local agencies is."[125]

Although the myth persists locally that the federal government will assume command of any incident involving a nuclear attack, federal doctrine is more supportive than controlling, assuming that all emergencies are ultimately managed locally. According to the Department of Homeland Security and the National Incident Management System (NIMS), "A basic premise of NIMS is that all incidents begin and end locally. NIMS does not take command away from state and local authorities."[126] This philosophy is echoed in DOD doctrine, with *Joint Publication 3-28* declaring, "Response begins at the local level

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121 Federal Emergency Management Agency, "PrepTalks: Brooke Buddemeier "Saving Lives after a Nuclear Detonation."‟

122 "Brooke Buddemeier, Nuclear Detonation in a Major City," June 21, 2011, centerforhealthsecurity, video, 35:04, https://www.youtube.com/watch?v=ttv1NLf6Cs4.

123 Cayse, *FEMA US&R IND ConOps*, ll, 108-109.

124 Federal Emergency Management Agency, "PrepTalks: Brooke Buddemeier "Saving Lives after a Nuclear Detonation."‟

125 Federal Emergency Management Agency.

126 Department of Homeland Security, *NIMS: Frequently Asked Questions*, 2.

with public officials and responders at the county, city, municipality, or town affected by the incident."[127] Furthermore, according to *Publication 3–41*, CBRN incidents, including nuclear detonations, are no special exception. It states, "Domestic CBRN response is managed at the lowest possible level, with DOD providing support as directed."[128] Buddemeier goes on to underscore the importance of this supportive posture during a domestic nuclear detonation, warning, "The most important life-saving decisions are those made in the first few minutes and hours of the event. Those are not going to be coming from Washington, D.C."[129]

Despite this supportive attitude, military doctrine has failed to identify and address the specific needs of local civil authorities after a nuclear detonation, specifically in terms of US&R. *Joint Publication 3-41* acknowledges the importance of augmenting local response efforts, stating:

> For CBRN response forces, the most critical operational decision in the first 24 hours will be determination of how and where to employ life-saving (search and extraction, decontamination, and medical triage and emergency medical) capabilities. The most likely employment of forces is at the upwind or crosswind points either reinforcing local responders or establishing additional search and extraction, decontamination, and medical triage and emergency medical sites at upwind and crosswind points that local responders do not have the capability to cover.[130]

While this statement outlines the importance of being responsive to the needs of local civil authorities during such an event, understanding these needs is not mentioned in the special considerations sections of *Joint Publication 3-4*1 or any other relevant DOD doctrine.[131]

One reason for this gap in understanding may be the decentralized nature of US&R response policy and doctrine for a domestic nuclear detonation among state and local civil authorities. Emergency services in the United States are a decentralized enterprise, and

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[127] Joint Chiefs of Staff, *Joint Publication 3-28*, xi.

[128] Joint Chiefs of Staff, *Joint Publication 3-41*, x.

[129] Federal Emergency Management Agency, "PrepTalks: Brooke Buddemeier "Saving Lives after a Nuclear Detonation."‟

[130] Joint Chiefs of Staff, *Joint Publication 3-41*, II-18.

[131] Joint Chiefs of Staff, II-31—II-33.

varying levels of laws, regulations, capabilities, and coordination exist across these jurisdictions. According to the NFPA's 2018 U.S. Fire Department Profile, "There were 29,705 fire departments in the United States in 2018. Of these, 18% were all career or mostly career departments and protected 68% of the U.S. population."[132] This decentralization is reflected in state and local US&R capabilities, with different authorities having varying models of US&R delivery. Consequently, it is much more difficult to ascertain the specific US&R needs of local civil authorities.

Another reason may be the disconnected, and occasionally strained, relationship between local and military response authorities, particularly in the realm of CBRN response. Differences in philosophy, doctrine, and mission exist between civil and military responders that can create gaps in communication and understanding when the two entities operate together, and these differences can devolve into animosity. As Kaszeta points out in *CBRN Incidents at Major Public Events: Planning and Response*, "A lot of mistrust was sown in the late 1990s when the U.S. Army attempted to lecture local emergency responders on the CBRN threat. In reality, it had a lot that it needed to learn from the civil-sector responders."[133] The strain in this relationship is compounded by unfavorable cultural views of DOD support among local authorities. Kaszeta also observes, "In many places, military support is considered a last resort or a heavy-handed tool to be called in when things get bad. This often means that military planners are left out of the planning stages for major events because the arrival of military support is, in some people's minds, an admission of failure."[134]

Regardless, it is the mandate of the DOD to prepare the CBRN Response Enterprise better to support local US&R authorities following a domestic nuclear attack, and accomplishing this mission requires a better understanding of their needs. The search and extraction and search and rescue elements of the enterprise are doctrinally designed to

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[132] Ben Evarts and Gary Stein, *U.S. Fire Department Profile 2018* (Quincy, MA: National Fire Protection Association, 2020), 1, https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/Emergency-responders/osfdprofile.pdf.

[133] Kaszeta, *CBRN and Hazmat Incidents at Major Public Events*, 33.

[134] Kaszeta, 187.

augment and integrate with local US&R units, as illustrated in enterprise doctrine. Specifically, the *Search and Extraction Appendix* of *ATP 3-11.47/AFTTP 3–2.79: Chemical, Biological, Radiological, Nuclear, and High-Yield Explosives Enhanced Response Force Package (CERFP)/Homeland Response Force (HRF) Operations* states, "It is feasible that extraction personnel work hand in hand with local authorities; firefighters; hazmat teams; and other local, state, and federal agencies."[135] According to Buddemeier, failing to address these issues could lead to "an apathy in planning that could get hundreds of thousands of people killed or injured."[136]

E. CONCLUSION

The DSCA mission allows the DOD to support civil authorities following domestic nuclear detonations, which is accomplished through the CBRN Response Enterprise. Particularly in the realm of US&R, the enterprise employs its Title 32 search and extraction teams and Title 10 search and rescue elements to augment the life-saving efforts of both federal and local civil agencies during such events. As with any other emergency, this aid is delivered at the strategic, operational, and tactical levels of incident response.

However, gaps exist between military and civilian US&R planning, policy, and doctrine in all three domains, and they manifest at both the federal and local levels of government. These holes are indicative of a lack of understanding of the expectations of civil US&R authorities following a domestic nuclear attack on the part of the DOD. Allowed to persist, they could render a real-world response unorganized and ineffective.

Since it is the DOD's duty to support civil authority-led rescue efforts during such an event, investigating the intentions of local and federal civil responders for the employment of DOD US&R capabilities could offer insights that would bridge these gaps in understanding. Further, it could empower the DOD to prepare for its supportive role better. Therefore, the following chapter details the research interviews conducted to achieve these ends.

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135 Department of the Army, *ATP 3-11.47/AFTTP 3-2.79*, E-1.

136 Federal Emergency Management Agency, "PrepTalks: Brooke Buddemeier "Saving Lives after a Nuclear Detonation."‘

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III. UNDERSTANDING THE EXPECTATIONS OF CIVIL URBAN SEARCH AND RESCUE AUTHORITIES AFTER A DOMESTIC NUCLEAR DETONATION

> The fact of the matter is that we cannot function without admitting the limits of our knowledge and trusting in the expertise of others.
>
> —Tom Nichols

A. INTRODUCTION

In the context of US&R, the previous chapter analyzed the layers of systems and authorities for responding to a domestic nuclear detonation. It identified gaps and holes in the overarching response architecture, most notably the DOD's lack of understanding of the needs and expectations of civil US&R authorities during such an incident. This gap is particularly concerning, considering CBRN incident response falls under the silo of DSCA.[137]

While the DOD's role in domestic response is primarily supportive, the development and organization of the CBRN Response Enterprise has largely occurred without the direct input of federal or local civil authorities, particularly in the realm of US&R. Consequently, the enterprise's US&R doctrine is largely based in assumption. Challenging these assumptions, research interviews were conducted to understand the expectations of civil US&R authorities better after a domestic nuclear detonation. From these interviews, recommendations for improving CBRN Response Enterprise US&R doctrine were ascertained.

This chapter describes the research interviews, as well as their findings. It begins with a description of their design and structure, followed by a report on their outcomes. Then, it concludes with a comparative analysis between the two groups interviewed. By following this systematic flow, the reader will understand how the US&R elements of the CBRN Response Enterprise can accomplish the DSCA mission better following a domestic nuclear detonation.

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137 Joint Chiefs of Staff, *Joint Publication 3-41*, ix.

B. RESEARCH INTERVIEWS' DESIGN AND STRUCTURE

As previously established, the CBRN Response Enterprise supports the lifesaving US&R efforts of civil authorities after a domestic nuclear detonation.[138] These authorities fall within two categories, federal and local. Comparatively, these groups are different, with unique missions, authorities, cultures, structures, and capabilities. Specifically, in regards to nuclear detonation response, they have diverging degrees of awareness, planning, and expectations. Therefore, respondents from both groups were interviewed.

Given the high propensity for damage and casualties, major cities are among the most vulnerable targets to a nuclear attack.[139] Thus, local civil authority interviewees were selected from three metropolitan statistical areas, as defined by the United States Census Bureau. While the implications of the study are thus limited, as suburban and rural jurisdictions may have vastly different perspectives, capabilities, and needs, it ensured the results are relevant to some of America's most susceptible targets. Further, interviewees in this group were special operations coordinators for fire departments charged with US&R responsibilities in these jurisdictions. This requirement ensured the interviewees had direct knowledge of the tactical, operational, and strategic realms of their agency's US&R plans, policies, and response doctrine.

Since FEMA is designated to lead the federal US&R response to any such event, FEMA's National US&R Response System leaders comprised the second group of interviewees.[140] While the system has an oversight office in FEMA headquarters, from which interviewees could have been selected for questions on strategy and policy, the information sought by this study was just as much tactical and operational as it was strategic.[141] Therefore, the FEMA US&R representatives selected for interview held the rank task force leader or program manager. In the event of a nuclear detonation, these

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[138] Department of the Army, *Training Circular Number 3-37.51*, sec. Foreword.

[139] National Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats, *Planning Guidance for Response to a Nuclear Detonation*, 8.

[140] Federal Emergency Management Agency, *Emergency Support Function #9*, 4.

[141] Federal Emergency Management Agency, *National US&R Response System Administrative Manual: Annex A*, 1.

leaders would have direct responsibility for coordinating tactically and operationally with CBRN Response Enterprise US&R assets, while considering the strategic aims of the response efforts.

According to the World Population Review, as of 2020, 66 American cities have a population of over 300,000 people, and 200 cities have a population of over 142,000.[142] Most of these cities have their own local fire departments with varying degrees of US&R capabilities and degrees of planning and preparation, in addition to the resources provided by the 50 state governments, plus Washington, DC. In comparison, only 28 US&R teams are spread throughout the United States in the FEMA National US&R Response System, but they have a higher degree of tactical, operational, and strategic continuity between them.[143] Therefore, an even spread between local and federal interviewees was deemed appropriate, with three selected from local fire departments and three from the FEMA National US&R System.

Interviews were conducted in person, when possible, and over the phone. With permission, all were recorded and transcribed. While academic, investigative, and orderly, all were conducted as a conversation, with interviewees encouraged to explore potential problems and gaps within the context of their agency's policies and doctrine. It should be noted that a Naval Postgraduate School Institutional Review Board (IRB) determined that the content of the interviews did not constitute human subjects research, so associated IRB control measures were not deemed necessary.

Thirteen questions were asked in sequential order, with follow-up questions and requests for expounding interjected as the natural flow of the interview allowed, including: How often do your urban search and rescue units conduct training for structural collapse events? What are your organization's expectations of CBRN Response Enterprise urban search and rescue personnel during a nuclear detonation response? How will your organization employ CBRN Response Enterprise urban search and rescue personnel to

142 "The 200 Largest Cities in the United States by Population 2020," World Population Review, 2020, https://worldpopulationreview.com/us-cities.

143 National Urban Search and Rescue Response System, "Urban Search and Rescue."

augment life-saving urban search and rescue efforts during a nuclear detonation response? What kind of training has your organization found would best prepare CBRN Response Enterprise urban search and rescue personnel to support life-saving urban search and rescue efforts during a nuclear detonation response? The Appendix has a complete list of the questions.

Since many civil authorities have not collaborated with the military during a major response, it was not assumed that the interviewees were entirely familiar with the CBRN Response Enterprise's US&R capabilities. To prevent them from having to speak blindly, they were provided a standard outline describing the enterprise, its response matrix, and its US&R capabilities before the interview. This outline empowered the respondents to provide informed, thoughtful, and calculated answers to the questions. It also allowed them to deeply consider the limitations and potential gaps in an interagency response to a domestic nuclear detonation within the context of their agency policies, response plans, doctrine, and capabilities.

Within the context of the study, a significant question that could be asked is the type and yield of nuclear detonation being investigated. Unlike conventional bombs, nuclear weapons can have yields from the kiloton to the megaton range.[144] Further, they can be detonated in the air over a target, as is often the case with missiles and strategic weapons, or near the surface of the earth, as may more likely be the case with an IND or terrorist weapon.[145]

While any nuclear detonation would presumably be a catastrophic event that would challenge the US&R response capabilities of civil responders, variations in these factors could potentially change the resulting patterns of damage, injury, and overall severity of the event.[146] Therefore, it would be fair to ask what particular type of nuclear detonation,

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144 *Britannica*, s.v. "the effects of nuclear weapons," accessed February 17, 2021, https://www.britannica.com/technology/nuclear-weapon/The-effects-of-nuclear-weapons; Eden, *Whole World on Fire*, 15-16.

145 Harney, "Inaccurate Prediction of Nuclear Weapons."

146 Harney.

strategic or IND, and what yield is examined in this study. After all, US&R needs in a post-blast environment are largely dependent upon these factors.

Although the original focus of the CBRN Response Enterprise was a 10 kiloton, surface-blast IND detonation as an act of terrorism, great power competition has renewed concerns about strategic nuclear weapons, which gives the results of this study a wider range of applicability.[147] Therefore, whenever possible, respondents were encouraged to consider a range of events, and relevant evidence was analyzed in such fashion. However, whenever analysis required a more specific event, a 10 kiloton, surface-blast IND was the assumed event. As explored in the previous chapter, such an event is still the foundation behind most nuclear detonation response planning and doctrine.

C. INTERVIEWS OF FEDERAL CIVIL US&R AUTHORITIES

As previously stated, one task force leader and two program managers from the National US&R Response System were interviewed as representatives of the federal civil US&R authority category. Their names and agency affiliations are as follows:

- Jeff Sanders, Director, Texas Task Force 1 (TXTF-1)
- Thomas (Tom) Neal, Program Manager, Indiana Task Force 1 (INTF-1)
- Mike Kenny, Task Force Leader, New York Task Force 1 (NYTF-1)

Naturally, some common themes emerged from the insights provided by the respondents. These themes were consistent with gaps and holes these professionals' agencies have encountered over years of planning and coordinating US&R responses and trainings, particularly in partnership with the military.

Unlike their local civil authority counterparts (which are discussed in the following section), these US&R professionals were all well versed in the capabilities of the CBRN Response Enterprise. The FEMA US&R System has conducted extensive training with the enterprise's US&R elements, particularly at the Title 32 level. According to the interview

147 United States Northern Command, *USNORTHCOM CONPLAN 3500-14*, C-1—B-30; Congressional Research Service, *Renewed Great Power Competition*, 4.

with Neal, annual exercises are included, such as the United Front Exercise between INTF-1 and Indiana's CERFP. Further, based on the interviews with Sanders and Neal, many teams in the system have partnered with the National Guard during several real-world incidents, such as the federal response to Hurricane Florence.

Across the domains of incident response, the concept of force multiplication was cited by all three interviewees when asked how the CBRN Response Enterprise could best deploy and integrate with their US&R units following a domestic nuclear detonation. Specifically, Kenny of NYTF-1 recommended the direct integration of operations level-trained military US&R personnel into FEMA US&R rescue squads to create "super squads." According to the interview with Kenny, this concept involves allowing the more experienced rescuers of the FEMA US&R Response System to provide direct operational and tactic level guidance and leadership to lesser experienced CBRN Response Enterprise personnel.

Keeping with this theme, according to all three interviewees, the respondents also noted the importance of manpower to US&R in post-nuclear detonation environments. As Neal of INTF-1 pointed out, a significant challenge is keeping rescuers' exposure to radiation low, as it requires frequent cycling of teams operating in contaminated areas. Sanders of TXTF-1 echoed this observation, also noting the added challenge of heat stress to responders working for long periods in PPE. From their agencies' perspectives, the large number of troops the CBRN Response Enterprise can deploy during such an event is invaluable.

Still, all three respondents felt operations-level training is both sufficient and ideal for enterprise US&R elements. The National US&R Response System is comprised of experienced professional rescuers considered subject matter experts in various fields of emergency response.[148] Furthermore, all three noted that their task forces dedicated countless hours to US&R relevant training annually. Conversely, as Kenny pointed out, US&R is collateral duty for many soldiers and airmen of the CBRN Response Enterprise.

[148] Federal Emergency Management Agency, "Urban Search & Rescue"; "US&R System Advisory Organization," National Urban Search and Rescue Response System, accessed February 17, 2021, https://www.responsesystem.org/advisory-orgaization.

Consequently, they are less experienced, and they would benefit from direct oversight by FEMA personnel.

Despite their limited experience, the interviewees maintained that CBRN Response Enterprise Response US&R elements would be welcome in their agencies' response plans for domestic nuclear detonations. Sanders emphasized their potential role in wide area search, which is the process of "systematic searches over a large affected area" to locate the victims of a disaster.[149] According to Sanders, this activity is labor intensive, requiring large numbers of personnel, but less technical in nature. Kenny added that tool-familiarity training would also be beneficial, as enterprise US&R personnel would make excellent runners and support staff for active task force rescue squads.

D. INTERVIEWS OF LOCAL CIVIL US&R AUTHORITIES

Following the interviewees from the National US&R Response System, three representatives from the local level of emergency response were interviewed. All three were career firefighters from major metropolitan areas with authority for US&R response within their jurisdictions, and each was responsible for the planning and execution of domestic nuclear detonation-related US&R response policy and doctrine within their organizations. Furthermore, all three were highly experienced in the field of US&R. Although accessibility to the author influenced their specific selection, and they were a small sample, they represented the mean state of knowledge among local officials serving in similar capacities. Their names and agency affiliations are as follows:

- Kevin Jones, Division Chief of Special Operations, Indianapolis Fire Department
- Jacob (Jake) Hoffman, Private, Special Operations Bureau, Toledo Fire & Rescue Department

[149] Urban Search & Rescue, *Wide Area Search: (PER213)* (College Station, TX: Texas Engineering Extension Service, n.d.), 2, accessed January 20, 2021, http://www.riccorp.com/psani/Ric5.pdf.

- Craig Cooper, Battalion Chief of Special Operations, Las Vegas Fire & Rescue

Compared to those of the federal civil authority classification, some very different themes emerged from the responses of this group. Most notably, all three respondents admitted that their agencies had given very little thought to their US&R needs following a domestic nuclear detonation. In fact, their agencies had few formal plans for such a response at all. Consequently, they had virtually no official plans, policy, or doctrine for partnering or integrating with the CBRN Response Enterprise to achieve response objectives following a domestic nuclear detonation.

Furthermore, none of the respondents was intimately familiar with the US&R response capabilities of the CBRN Response Enterprise prior to the interview. Two of them spoke at length about the highly visible WMD-CSTs; Cooper stated he has worked with these teams extensively during special events, as did Hoffman. However, beyond these teams, their knowledge of the grander enterprise was extremely limited. Both were vaguely familiar with the US&R elements of the CBRN Response Enterprise's Title 32 forces, but none of the interviewees had knowledge of the Title 10 DCRF or C2CREs. Put simply, the respondents knew very little about the US&R capabilities of the CBRN Response Enterprise.

Consequently, all three respondents struggled to answer questions about how the CBRN Response Enterprise's US&R elements fit into their post-nuclear detonation plans. This was just as much due to a lack of overall nuclear detonation response planning as it was unfamiliarity with the enterprise. While all three did their best to answer the questions from the standpoints of their agencies' policies and procedures, they conceded that the interviews had exposed a major gap in their major incident planning and preparedness.

Still, some important insights were discovered during these interviews, particularly in regards to US&R skill exposure. Most notably, these respondents' agencies conduct hours of US&R continuing education annually. While this training is not necessarily conducted within the context of a domestic nuclear detonation, as it is within the CBRN Response Enterprise, it is vastly more frequent. Furthermore, these agencies benefit from

the repetition of frequent real-world US&R responses. It is also worth noting they do not frequently train on wide area search techniques, which reveals a potential gap.

Additionally, in the event of a domestic nuclear detonation, the respondents stated their agencies would rely heavily on the DOD for technical expertise. In the absence of exhaustive planning, Jones expressed a need for military help across all domains incident response. Similarly, Cooper articulated an intent to capitalize on the DOD's community of collective knowledge.

However, to make the most of military support during such an event, Cooper also spoke of the importance of pre-emptive relationship-building. Such efforts build trust, which has been vital to interagency cooperation during past major incidents in his jurisdiction. In the case of the CBRN Response Enterprise and its US&R capabilities, his agency expects a domestic nuclear detonation would be no different.

E. COMPARATIVE ANALYSIS

When examined comparatively, a dichotomy emerges between the expectations of federal and local civil US&R authorities after a domestic nuclear detonation in the context of military support. As the interviews demonstrated, these two groups have very different takes on both DOD US&R support and the greater domestic nuclear detonation threat. Consequently, they answered the research questions quite differently, and these responses can be compared and contrasted.

Overall, the National US&R Response System has given much thought to the domestic nuclear attack threat, and it is well versed in the military's supportive capabilities. As a result, the task force leader and program managers interviewed were able to articulate their expectations of the CBRN Response Enterprise's US&R elements clearly and concisely. Specifically, they expect the enterprise to adopt a more supportive role under their guidance.

Conversely, local authorities do not dedicate as many planning and preparedness resources to such a lofty threat. Furthermore, they receive much less exposure to the

enterprise's US&R forces, so they are far less familiar with their capabilities. As a result, their needs are more general and ambiguous.

Despite these differences, common themes exist between these two groups. Most notably, both local and federal civil authorities are much more thoroughly trained and experienced in US&R than CBRN Response Enterprise forces. Regardless, both recognize the vitality of military support following a domestic nuclear detonation, and they view the DOD and the enterprise as partners in response.

F. CONCLUSION

Since the DOD's role after a domestic nuclear detonation is supportive of civil US&R authorities, it is important to understand their expectations. This must occur at both the federal and local levels of response, as their perspectives and needs are vastly different. To achieve this end, research interviews were conducted with representatives of both groups. These interviews demonstrated the need for better civil-military US&R synchronization on the part of the enterprise, particularly on matters of response structure, training, and outreach. Also, it revealed a topic worthy of further investigation: the challenges presented to US&R efforts by post-nuclear detonation environments. Moving forward, the next chapter will describe how the CBRN Response Enterprise can overcome these challenges to meet the expectations of civil US&R authorities.

IV. CHALLENGES PRESENTED TO URBAN SEARCH AND RESCUE SUPPORT BY POST-NUCLEAR DETONATION ENVIRONMENTS

> Survival is adaptation, and adaptation is change, but it is change based on a true reading of the environment.
>
> —Laurence Gonzales

A. INTRODUCTION

Given the persistent gaps in understanding between the CBRN Response Enterprise and civil US&R authorities, the previous chapter of this thesis detailed research interviews that were conducted to begin bridging this divide. These interviews indicated that one significant challenge to achieving this end is the post-nuclear detonation environment. For example, according to Sanders and Neal, when conducting US&R in such an environment, the hazards presented by radiation exposure and heat stress require large numbers of personnel to accomplish the mission successfully, and the resulting additional layers of complexity challenge the skills of even best trained and most experienced rescuers. These factors call into question the efficacy of the enterprise's current response model, which makes them worthy of further investigation.

However, this research is not the first publication to identify the fact that added challenges are presented to US&R operations by CBRN environments, nor is it the first to question the CBRN Response Enterprise's ability to face these obstacles in delivering US&R support to civil authorities. In *CBRN and Hazmat Incidents at Major Public Events: Planning and Response*, Kaszeta states, "there are some situations where USAR may be necessary in contaminated environments."[150] Under a picture of two enterprise rescuers working in PPE, he adds, "Structural collapse in a contaminated environment adds a layer of complexity to rescue operations."[151]

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150 Kaszeta, *CBRN and Hazmat Incidents at Major Public Events*, 382.

151 Kaszeta, 380.

In this same piece, he also gives a brief overview of these issues as they relate to the National Guard's CERFPs. He states, "In several cases, CERPs seem to be taking the Urban Search and Rescue mission seriously in CBRN environments, which is a useful development." However, he concludes, "Just how well the CST and CERFP will perform in a large-scale CBRN incident is a matter of conjecture, but is seems to me that their presence is far better than their absence."[152]

While Kaszeta was instrumental in establishing one of the early, hazardous materials response-centric WMD-CSTs, the search and extraction concept of the CERFPs was still in its infancy when his book was published in 2013.[153] Only 12 such teams were in existence, but today they number 17, plus 10 more embedded within the CBRN Task Forces of the HRFs.[154] However, even with the passing of time, Kaszeta's question of efficacy remains largely unanswered. As of 2018, the CBRN Response Enterprise has still never deployed to a domestic nuclear detonation or any other major CBRN incident.[155]

Therefore, this chapter builds upon the previous chapter's findings by examining the challenges presented to CBRN Response Enterprise US&R efforts by post-nuclear detonation environments. Furthermore, it investigates how the enterprise can overcome these challenges to accomplish its DSCA mission. By doing so, it attempts to identify additional ways the DOD can maximize the employment of CBRN Response Enterprise US&R capabilities to support civil authority–directed lifesaving operations following a domestic nuclear detonation.

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152 Kaszeta, 181.

153 Kaszeta, 181.

154 Kaszeta, 181; Fort Leonard Wood, *National Guard (NG) CBRN Response Enterprise (CRE) Overview* (Fort Leonard Wood, MO: United States Army, 2020), 7, https://home.army.mil/wood/application/files/4015/9352/6672/T32CRE.pdf.

155 Mills, *Reassessing the Chemical, Biological, Radiological, Nuclear Response Enterprise*, 60.

B. HAZARDS PRESENTED TO RESCUERS BY POST-NUCLEAR DETONATION ENVIRONMENTS

Upon detonation, a nuclear weapon causes a variety of effects, including blast pressure, thermal radiation, ionizing radiation, optical effects, and electromagnetic pulses.[156] These effects can be classified as either prompt or delayed, depending upon when they occur in relationship to the detonation. Certain effects—such as ionizing radiation—exist in both categories. As explained in the *Nuclear/Radiological Incident Annex to the Response and Recovery Federal Interagency Operational Plans*:

> Nuclear detonations produce 'prompt' effects that radiate outward from the detonation location and 'delayed' effects. Prompt effects usually occur within the first minute after a detonation and include an intense flash of light, blast shockwave, extreme heat, prompt radiation, and Source Region Electromagnetic Pulse. The delayed effects are primarily the neutron-activated debris around the detonation site and the atmospherically dispersed radioactive fallout.[157]

Figure 5 provides an approximated timeline for the presentation and duration of these effects and their associated hazards following a 10-kiloton IND detonation, and Figure 6 illustrates their distributive impact.

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[156] Department of Homeland Security, *Nuclear/Radiological Incident Annex to the Response and Recovery Federal Interagency Operational Plans* (Washington, DC: Department of Homeland Security, 2016), 112-13, https://www.remm.nlm.gov/NRIA_FINAL_110216.pdf.

[157] Department of Homeland Security, Branch 1-Page 26.

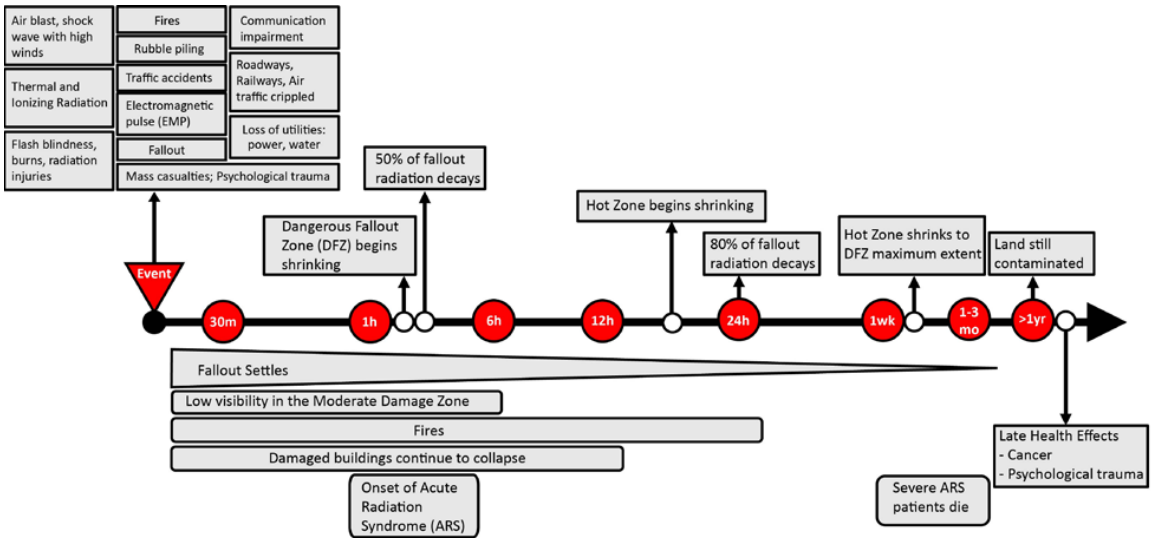

Figure 5. Expected Timeline of Events for a 10-kiloton Improvised Nuclear Device Detonation.[158]

Since they would arrive to the scene well after the detonation, of most concern to US&R responders is the delayed effects and their associated hazards. As seen in Figure 5, these hazards can be defined as secondary structural collapse, radiation, and fire. In this order, the following section examines each of these hazards through the lens of US&R response.

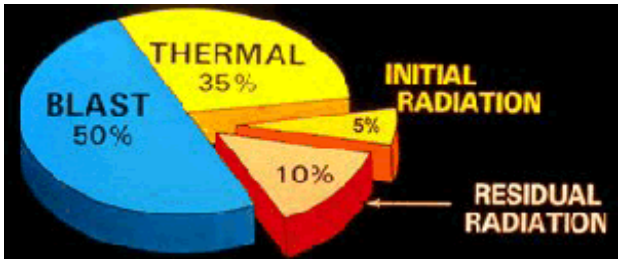

Figure 6. Approximate Distribution of Nuclear Weapons Effects.[159]

[158] Source: Department of Homeland Security, Branch 1-Page 26.

[159] Source: "Nuclear Detonation: Weapons, Improvised Nuclear Devices," U.S. Department of Health & Human Services Radiation Emergency Medical Management, last updated February 17, 2021, https://www.remm.nlm.gov/nuclearexplosion.htm#blast.

1. Secondary Structural Collapse

As previously established, the prompt effect of blast pressure is what causes buildings to collapse and entrap victims, which then requires a US&R response.[160] In the immediate hours after the detonation, the threat of additional and progressive collapse in structurally compromised buildings is also possible, called secondary collapse.[161] However, this collapse is a standard, anticipated hazard in any structural collapse emergency, and it is normally be mitigated by standard US&R practices, primarily shoring.[162]

2. Nuclear Fallout

The effect of ionizing radiation makes US&R efforts in post-nuclear detonation environments unique. According to the Centers for Disease Control and Prevention, "Ionizing radiation is a form of energy that acts by removing electrons from atoms and molecules of materials that include air, water, and living tissue. Ionizing radiation can travel unseen and pass through these materials."[163] This ability to affect living tissue makes ionizing radiation hazardous. At certain dosages, it can cause serious acute and delayed health effects.[164]

Again, since they would arrive to the scene after the prompt effects have occurred, ionizing radiation's delayed effects and associated hazard of radioactive fallout are most precarious to US&R responders. Lingering long after the initial event, this residual radiation is found both deposited around the blast site—called groundshine—and suspended in the air, which makes it environmental and atmospheric in nature. While

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160 Department of Homeland Security, *Nuclear/Radiological Incident Annex to the Response and Recovery Federal Interagency Operational Plans*, Branch 1-Page 27.

161 Norman, *Fire Department Special Operations*, 282.

162 Norman, 301.

163 "The Electromagnetic Spectrum: Ionizing Radiation," Centers for Disease Control and Prevention, December 7, 2015, https://www.cdc.gov/nceh/radiation/ionizing_radiation.html#:~:text=Ionizing%20radiation%20is%20a%20form%20of%20energy%20that%20acts%20by,and%20pass%20through%20these%20materials.

164 "Radiation Exposure: Diagnose and Manage Acute Radiation Syndrome (ARS)," U.S. Department of Health and Human Services Radiation Emergency Medical Management, December 16, 2020, https://www.remm.nlm.gov/exposureonly.htm#skip.

airborne fallout can be spread by wind, groundshine is initially more hazardous.[165] Figure 7 illustrates the standard predictive model of effects and hazards for a 10 kiloton, surface blast nuclear detonation, including prompt radiation and fallout.

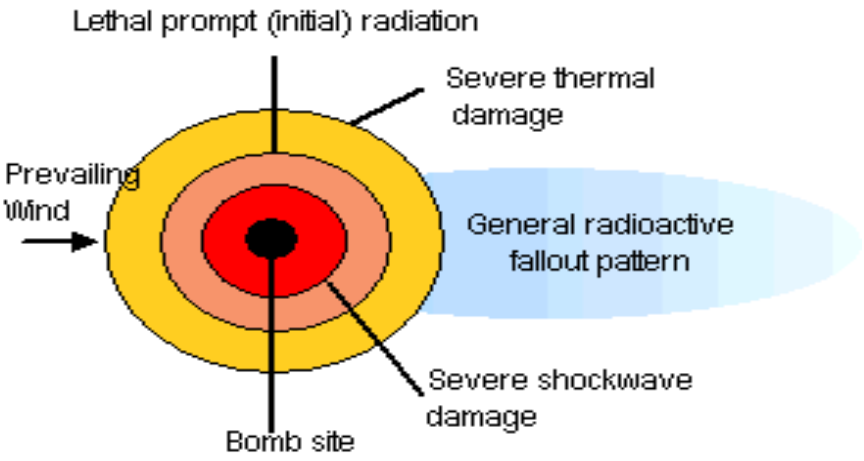

Figure 7. Patterns of Effects and Hazards for a 10 Kiloton, Surface Blast Nuclear Detonation.[166]

To ensure the health, safety, and effectiveness of US&R responders, they must be protected from fallout exposure and contamination. According to the Department of Health and Human Services' Radiation Emergency Medical Management webpage, "Radiation exposure occurs when all or part of the body absorbs penetrating ionizing radiation from an external radiation source."[167] Conversely, "Contamination results when a radioisotope (as gas, liquid, or solid) is released into the environment and then ingested, inhaled, or

[165] U.S. Department of Health and Human Services Radiation Emergency Medical Management, "Nuclear Detonation: Weapons, Improvised Nuclear Devices."

[166] Source: Radiation, Emergency, Medical Management, U.S. Department of Health & Human Services.

[167] "Radiation Exposure—Animations," U.S. Department of Health and Human Services Radiation Emergency Medical Management, October 26, 2020, https://www.remm.nlm.gov/exposureimage_top1.htm.

deposited on the body surface."[168] Therefore, the time responders spend in radiation fields must be limited, and PPE must be used to prevent radioactive material from contacting and remaining on their bodies.

Radiation exposure in humans is measured as a dose, and the primary tool for minimizing an emergency responder's dose is the principle of as low as reasonably achievable (ALARA).[169] As illustrated in Figure 8, ALARA calls for minimizing time around, maximizing distance from, and using barriers as shielding against sources of radioactivity.[170] Additionally, CBRN incident response agencies should set total dose limits for emergency operations. As an example, the Environment Protection Agency recommends responders not be permitted to receive more than a 25 roentgen equivalent man once-in-a-lifetime dose in lifesaving operations, except on a voluntary basis.[171] However, the National US&R Response System has set a single deployment radiation dose limit of 50 roentgen equivalent man.[172]

As previously stated, US&R responders must be protected from fallout contamination, and it must be done with consideration for the routes of exposure: inhalation, absorption, ingestion, direct contact, and injection.[173] In a post-nuclear detonation environment, it is achieved using PPE. Respirators, eye protection, over garments, gloves, and boots are generally sufficient for a radiation field.[174] However, since

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168 "Radiation Contamination—Animations," U.S. Department of Health and Human Services Radiation Emergency Medical Management, October 26, 2020, https://www.remm.nlm.gov/contamimage_top2.htm.

169 United States Environmental Protection Agency, *PAG Manual: Protective Action Guides and Planning Guidance for Radiological Incidents* (Washington, DC: United States Environmental Protection Agency, 2017), 34, www.epa.gov/radiation/protective-action-guides-pags.

170 "ALARA—As Low as Reasonably Achievable," Centers for Disease Control and Prevention, accessed November 12, 2019, https://www.cdc.gov/nceh/radiation/alara.html.

171 United States Environmental Protection Agency, *PAG Manual*, 34-35.

172 US&R HazMat Advisory Subgroup, *US&R Radiological Response Recommendations* (Washington, DC: United States National Urban Search and Rescue Response System, Federal Emergency Management Agency, 2019), 4.

173 Gregory G. Noll and Michael S. Hildebrand, *Hazardous Materials: Managing the Incident*, 4th ed. (Burlington, MA: Jones & Bartlett Learning, 2014), 33-34.

174 Technical Resources Group, *Radiation Specialist* (Idaho Falls, ID: Technical Resources Group, 2016), 16-9—16-10.

collapsed buildings typically present with sharp steel and other injection hazards, US&R work in such an environment calls for more robust, penetration resistant PPE.[175]

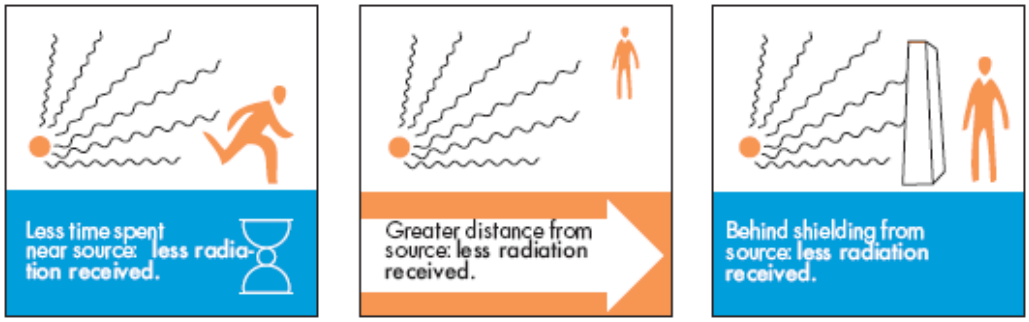

Figure 8. Time, Distance, and Shielding.[176]

3. Fire

A second, and often less emphasized, hazard to US&R responders following a nuclear detonation is fire. As is the case with ionizing radiation-related hazards, fire is the result of both prompt and delayed effects.[177] In *Whole World on Fire*, Eden describes how the prompt effects of blast pressure and thermal radiation—called nuclear flash—result in fires following a hypothetical 300 kiloton, near-surface blast nuclear detonation near the Pentagon in Arlington, VA.[178] She says:

> At this [3.5 miles] and greater ranges from the detonation, fire ignitions would result from the tremendous release of thermal energy, which would deposit radiant light and heat on exposed surfaces, causing the simultaneous combustion of many surfaces and structures. Ignitions would also be caused by the breakup of structures from the blast wave and accompanying winds. Structural breakup would cause fires by releasing flammable materials (such as gas, chemicals, and other hazards as gas lines and industrial processes were disrupted), by exposing and shorting electrical lines and

175 Kaszeta, *CBRN and Hazmat Incidents at Major Public Events*, 379.

176 Source: Centers for Disease Control and Prevention, "ALARA."

177 Department of Homeland Security, *Nuclear/Radiological Incident Annex to the Response and Recovery Federal Interagency Operational Plans*, Branch 1-Pages 26-27.

178 Department of Homeland Security, 112.

> equipment, and by exposing additional ignitable surfaces. Such fires are called "blast disruption" fires.[179]

However, these types of fires are not necessarily uncommon to routine structural collapse incidents. In fact, structural collapse is a common occurrence secondary to large fires in buildings, as is believed to have been the case at the World Trade Center on September 11, 2001.[180] Even in the absence of fire as the impetus, disruptions to utilities and stored hazardous materials create serious fire hazards in most instances of building collapse.[181] In *Fire Department Special Operations*, Retired Deputy Assistant Chief John Norman of the Fire Department of the City of New York discusses the routine threat of fire in relationship to additional collapse hazards at structural collapse incidents. He warns, "While secondary collapse is a major threat, it is not the only danger we face at these events. Fire and explosion are serious threats at any collapse scene, due to the likelihood of ruptured gas and electric lines within the remains of the structure, as well as any occupancy hazards that may be present, such as storage of gasoline, propane cylinders, or other flammables."[182]

Like nuclear fallout, the phenomenon of mass fire is unique to post-nuclear detonation environments. In *Whole World on Fire*, Eden goes on to describe how delayed atmospheric effects can subsequently result in mass fires following a nuclear detonation. She states:

> Within tens of minutes after the cataclysmic events associated with the detonation, a mass of buoyantly rising fire-heated air would signal the start of a second and distinctly different event – the development of a mass fire of gigantic scale and ferocity. This fire would quickly increase in intensity. In a fraction of an hour it would generate ground winds of hurricane force with average air temperatures well above the boiling point of water (212°F, 100°C). This would produce a lethal environment over a vast contiguous

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179 Eden, *Whole World on Fire*, 25.

180 Norman, *Fire Department Special Operations*, 292; Thomas Eagar and Christopher Musso, "Why Did the World Trade Center Collapse? Science, Engineering, and Speculation," *JOM* 53, no. 12 (December 2001): 8-11.

181 Norman, 284.

182 Norman, 284.

> area. The character of mass fire results from the simultaneous combustion of a large area containing a fuel load typical of a city or suburb.[183]

It should be noted that scientists and scholars, especially in comparison to blast effects, have passionately debated the occurrence and extent of a mass fire event following a nuclear detonation.[184] As the *Nuclear/Radiological Incident Annex to the Response and Recover Federal Interagency Operations Plans* states, "The likeliness of a firestorm is unknown in an urban environment; some theories suggest modern construction and designs may buffer the fire's ability to grow uncontrollably."[185] Indeed, like any other effect, thermal effects are largely dependent upon a variety of factors. These factors include height of the detonation in relationship to the surface of the earth, energy of the weapon in question, and shielding.[186] Regardless, Eden found that "the uncertainty in the range of damage associated with mass fire can be estimated and modeled, and is not greater than the uncertainty associated with blast damage."[187] Further, she concluded, "For nuclear weapons of approximately 100 kilotons or more, the range of devastation from mass fire will generally be substantially greater than from blast."[188]

Regardless of the impetus, fire effects and their associated hazards must be addressed for US&R efforts to be successful in post-nuclear detonation environments. Even in the absence of a mass fire event, fires secondary to the prompt effects of thermal radiation and blast disruption will burn long after the detonation.[189] As the *Planning Guidance for Response to a Nuclear Detonation* warns, these fires "pose a direct threat to

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[183] Eden, *Whole World on Fire*, 25.

[184] Eden, 27.

[185] Department of Homeland Security, *Nuclear/Radiological Incident Annex to the Response and Recovery Federal Interagency Operational Plans*, Branch 1-Page 27.

[186] Marrs, Moss, and Whitlock, *Thermal Radiation from Nuclear Detonations in Urban Environments*; Department of Homeland Security, Branch 1-Page 27.

[187] Eden, *Whole World on Fire*, 29.

[188] Eden, 27.

[189] Department of Homeland Security, *Nuclear/Radiological Incident Annex to the Response and Recovery Federal Interagency Operational Plans*, Branch 1-Pages 26-27.

survivors and responders."[190] This threat is especially true for those trapped and operating in collapsed buildings. As Norman points out in *Fire Department Special Operations*, both rescuer and victim safety and survival depends upon the mitigation of such fires. He states, "At fires that result from explosions or collapses, it is critical to conduct fire suppression efforts simultaneously with rescue efforts."[191]

As Figure 9 illustrates, the previously listed hazards of secondary collapse, nuclear fallout, and fire must be addressed in concert for US&R lifesaving efforts to be successful after a domestic nuclear detonation. Each presents a life safety threat to both victims and responders that requires appropriate consideration and mitigation. Accordingly, the next segment of this thesis examines the implications of this unique overlapping of hazards for US&R in post-nuclear detonation environments, particularly on the matter of radiological contamination.

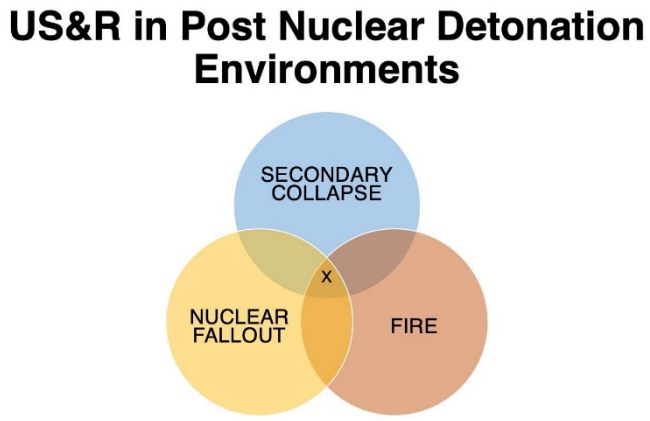

Figure 9. Hazards Presented to US&R by Post-nuclear Detonation Environments.

[190] National Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats, *Planning Guidance for Response to a Nuclear Detonation*, 24.

[191] Norman, *Fire Department Special Operations*, 300.

C. URBAN SEARCH AND RESCUE IN RADIOLOGICALLY CONTAMINATED ENVIRONMENTS

Analyzed independently, US&R is a task-heavy discipline. Mastery requires proficiency in a wide range of rescue skillsets, including rope, confined space, trench, vehicle, machinery, and structural collapse rescue, each of which requires extensive training.[192] As demonstrated by the research interviews with Cooper, Kenny, and Sanders in Chapter III, professional firefighters and rescuers spend years attending courses to obtain these qualifications, and proficiency and expertise is built through years of responses to real US&R incidents.

As the discipline of CBRN response is also task-heavy and complex, the threat of radiation from nuclear fallout adds additional layers of complexity to US&R in post-nuclear detonation environments. In *CBRN and Hazmat Incidents at Major Public Events: Planning and Response*, Kaszeta addresses these additional layers of complexity in the general context of radiologically contaminated environments. Towards the end of this work, he presents case studies of "practical scenarios" related to CBRN incident responses and identifies common problems and potential solutions. Scenario M, titled *The "Dirty Bomb" and Structural Collapse*, describes a hypothetical terrorist attack on a large meeting of global financial and political leaders with a radiological dispersal device (RDD). As Kaszeta describes it, "This scenario addresses two potentially overlapping situations, the radiological-dispersal device (RDD)—the so-called 'dirty bomb'—and the possibility of structural collapse, requiring sophisticated urban search and rescue (USAR) methods."[193]

While this scenario presents the hazard of radiation exposure and contamination, it should be noted that an RDD attack is vastly different from a domestic nuclear detonation in both physics and magnitude. An RDD is a conventional explosive device that simply spreads a radioactive contaminant upon its detonation, which makes it much smaller in force and effect than a nuclear weapon.[194] Further, while conventional explosions do have

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192 National Fire Protection Association, *NFPA 1670*, 16.

193 Kaszeta, *CBRN and Hazmat Incidents at Major Public Events*, 379.

194 Federal Emergency Management Agency, *WMD Radiological/Nuclear Course for Hazardous Materials Technicians PER-241*, 53.

thermal effects, they are usually not nearly as serious or self-perpetuating as nuclear detonations.[195]

Still, Kaszeta's case study highlights the additional challenges presented to US&R efforts by radiologically contaminated environments. He observes:

> Structural collapse after a terrorist bombing adds USAR issues to the already complicated issues of postblast investigations and CBRN contamination. While most USAR efforts acknowledge that hazardous materials of various descriptions may be present in structural-collapse scenarios, not many organizations have taken on the task of both USAR and CBRN concurrently.[196]

He concludes, "Structural Collapse in a contaminated environment adds a layer of complexity to rescue operations."[197] This layer of complexity is the result of additional considerations that must be accounted for during such a response, including work/rest cycles, diminished dexterity and vision, and stay times.

1. Work/Rest Cycles

On the matter of simple rescues in CBRN environments, Kaszeta points out, "Rescue is only made complicated in the presence of contamination or of a percutaneous hazard, thus forming an acute hazard to unprotected responders."[198] Nuclear fallout is such a contaminant, which requires the use of CBRN PPE.[199] However, using PPE during periods of high work volume or high stress situations can induce heat stress on responders that requires frequent rest periods and worker rotations.[200] Planning for these work cycles

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195 Federal Emergency Management Agency, *Incident Response to Terrorist Bombings: Resident Course PER 230-1 Participant Guide* (Washington, DC: Department of Homeland Security, 2010), 3-34.

196 Kaszeta, *CBRN and Hazmat Incidents at Major Public Events*, 379.

197 Kaszeta, 380.

198 Kaszeta, 174.

199 Federal Emergency Management Agency, *WMD Radiological/Nuclear Course for Hazardous Materials Technicians PER-241*, 297.

200 Noll and Hildebrand, *Hazardous Materials*, 282; Kaszeta, *CBRN and Hazmat Incidents at Major Public Events*, 170.

becomes exponentially complex when the factors of PPE donning and doffing time and decontamination are considered.[201]

2. Diminished Dexterity and Vision

Additionally, PPE reduces responders' dexterity and limits their fields of vision.[202] This reduction is concerning when performing a task-heavy discipline like US&R, which requires fine motor skills and a high degree of situational awareness. According to Norman in *Fire Department Special Operations*:

> Technical rescue signifies the involvement of a more complex operational environment that often requires specialized tools or equipment as well as a higher degree of know-how to achieve a successful outcome. Another term that has come to signify the tasks involved is Urban Search and Rescue or USAR. The urban environment is where most (but not all, by far) of the more complex accidents occur.[203]

In the *National Park Service Technical Rescue Handbook*, Ken Phillips agrees by stating that technical rescue work is a very dangerous activity.[204] Mistakes can be fatal, and most are the result of human error.[205]

3. Stay Times

The final consideration is stay times in radiation fields, which was alluded to in the previous section. According to FEMA, "Stay time is the amount of time a responder is allowed to operate in a radiation field before a predefined dose limit is reached."[206] Above certain doses, radiation exposure can result in acute radiation syndrome, an increased

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201 Kaszeta, 170.

202 Mehdi Pourmoghani, "Effects of Gloves and Visual Acuity on Dexterity," *Scholar Commons*, April 9, 2004, https://scholarcommons.usf.edu/cgi/viewcontent.cgi?article=2204&context=etd; Arthur Johnson, "Respirator Masks Protect Health but Impact Performance: A Review," *Journal of Biological Engineering* 10, no. 4 (February 9, 2016), https://jbioleng.biomedcentral.com/articles/10.1186/s13036-016-0025-4.

203 Norman, *Fire Department Special Operations*, 5.

204 Ken Phillips, *National Park Service Technical Rescue Handbook*, 11th ed. (Washington, DC: Department of the Interior, 2014), i.

205 Phillips, i, 12.

206 Federal Emergency Management Agency, *WMD Radiological/Nuclear Course for Hazardous Materials Technicians PER-241*, 123.

propensity to contract cancer in the future, or death.[207] Therefore, dose limits must be established for US&R responders. By dividing this dose limit by a given dose rate, stay times can be calculated, as shown in Figure 10.[208]

$$Stay\ Time = \frac{Allowed\ Dose}{Dose\ Rate}$$

Figure 10. Calculating Stay Time.[209]

Stay times provide timeframes that prevent overexposure of workers operating in radiation fields, as would be the case for US&R in a post-nuclear detonation environment.[210] As FEMA explains, "By knowing this 'stay time' time based on the predefined dose, responders can make a knowledgeable decision about their own safety from radiation, and they can perform their response tasks. In hazardous materials response terminology, this is referred to as 'work mission duration.'"[211] Based upon these stay times, US&R responders should be rotated out of the radiation field and relieved by fresh forces in a post-nuclear detonation environment, as failing to do so could jeopardize their safety and operational effectiveness. As Kaszeta explains, "If you do not monitor the accumulated dose of your responders, you may ruin them for future work incidents. Monitor the dose closely and rotate teams to make sure people do not reach their exposure limits."[212]

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[207] Federal Emergency Management Agency, 80-97.

[208] Federal Emergency Management Agency, 122.

[209] Source: Lesley Hines, "Chapter III: University of Florida Radiation Short Course," University of Florida, August 25, 2014, https://www.slideserve.com/keahi/chapter-iii-university-of-florida-radiation-short-course-lesley-hines-lhines-ehs-ufl.

[210] United States Environmental Protection Agency, *PAG Manual*, 1-2, 52.

[211] Federal Emergency Management Agency, *WMD Radiological/Nuclear Course for Hazardous Materials Technicians PER-241*, 124.

[212] Kaszeta, *CBRN and Hazmat Incidents at Major Public Events*, 383.

D. ANALYSIS OF THE CBRN RESPONSE ENTERPRISE

Given the hazards that must be addressed for lifesaving efforts to be effective in a post-nuclear detonation environment, the added complexities of relevant mitigation tactics, and the expectations of civil US&R authorities, it is appropriate to use the previous sections as a lens for evaluating the CBRN Response Enterprise. More specifically, it can be used to analyze the enterprise's ability to face the relevant challenges and support the lifesaving efforts of civil US&R authorities. Similar to the approach of Chapter II, this examination can occur at the strategic, operational, and tactical levels of incident response.

1. Strategy

Since the US&R doctrine of the CBRN response enterprise is oriented specifically towards supporting the lifesaving efforts of civil authorities after a nuclear detonation, it is strategically well prepared to address the hazards posed to US&R efforts by post-nuclear detonation environments.[213] Granted, this approach is vastly different from that of civil authorities, who generally take a "multi-hazard" or "all hazards" approach to US&R.[214] This approach is reflected in *Annex B Concept of Operations: US&R Operations in a Contaminated Environment (US&R Hazmat Operations)* of the *National US&R System Response Manual*, a component of the National Response Framework's Emergency Support Function 9. It declares, "Consistent with FEMA's 'All Hazards' approach, and as an integral part of the response to incidents caused by man or nature, US&R teams are expected to be equipped, trained, and prepared to operate in a contaminated environment."[215] While this statement affirms that the National US&R Response System's preparedness to handle a myriad of technical rescue scenarios in the presence of contamination, it also suggests an overall lack on emphasis on any one threat, including a domestic nuclear detonation. The CBRN Response Enterprise's singular focus on this threat implies that, while it may be only good at handling one variety of incident (which

213 Department of the Army, *Training Circular Number 3-37.51*, sec. Foreword.

214 National Urban Search and Rescue Response System, "Urban Search and Rescue."

215 Federal Emergency Management Agency, *National US&R Response System Operations Manual Annex B Concept of Operations: US&R Operations in a Contaminated Environment* (US&R Hazmat Operations) (Washington, DC: Department of Homeland Security, 2013), 9.

may lead to a strategic gap in understanding the expectations of civil US&R authorities, as identified in Chapter II), it does so very well.

Still, there is room for improvement. While possessing the proper strategic alignment on paper, the CBRN Response Enterprise must ensure it is prepared physically to integrate and follow the lead of civil US&R authorities during an actual incident. To achieve this end, enterprise leadership should consider the results of the research interviews outlined in Chapter III.

2. Operations

Hazards of secondary collapse, nuclear fallout, and fire must be effectively addressed at the operations level of incident response for lifesaving US&R efforts to be effective in a post-nuclear detonation environment. Further, since the CBRN Response Enterprise's mission is supportive in nature, its efforts to achieve these ends must align with those of civil US&R authorities. After all, according to Kenny, these authorities—especially at the federal level of government—expect the enterprise to integrate with and provide manpower to their forces, such as in the form of "super squads."

Theoretically, the CBRN Response Enterprise is operationally well prepared to address the hazards of secondary collapse and nuclear fallout during a domestic nuclear detonation. As previously stated, Title 32 National Guard search and extraction forces receive training in rope, confined space, and structural collapse rescue operations.[216] Additionally, Title 10 search and rescue forces receive training to become full structural collapse rescue technicians.[217] This training is modeled after the same training received by civilian US&R responders.

However, some serious gaps exist in operational planning and doctrine that affect the enterprise's ability to address the threat of fire. Foremost, unlike the National US&R Response System—that pulls its members largely from fire departments—the CBRN

[216] Department of the Army, *ATP 3-11.47/AFTTP 3-2.79*, E-3.

[217] Chad English, email message to author, May 26, 2020; Homeland Defense Civil Support Office, *Urban Search and Rescuer Course Welcome Letter*, 2.

Response Enterprise is composed of soldiers and airmen, who may or may not have any structural firefighting training.[218] While such training is not recommended by the NFPA to certify structural collapse rescuers at any level, fire is a common hazard at every structural collapse event.[219] Furthermore, the threat of fire is exponentially larger after a nuclear detonation.[220] While it is not necessarily the role or expectation of collapse rescuers to engage in fire suppression activities, this lack of firefighting knowledge could render enterprise US&R responders ineffective. As Kaszeta points out, "The structural-collapse problem may be even more of a safety hazard in situations where CBRN/ HAZMAT response-team members may not come from a fire-service background…"[221] While Kaszeta made this statement in the context of the collapse problem, it reveals an additional role structural firefighting experience plays in US&R after CBRN events.

Furthermore, Title 32 search and extraction forces do not possess the necessary respiratory PPE to conduct US&R operations in the moderate damage zone—as the proposed plan of the National US&R Response System intends—under the threat of fire.[222] Again, while it may not be expected that these forces engage in fire suppression efforts, fire and the toxic byproducts of combustion will more than likely be present in this area of operation. According to the *Nuclear/Radiological Incident Annex to the Response and Recover Federal Interagency Operations Plans*, "The Moderate Damage Zone is most at risk for firestorms caused by nuclear flash and secondary ignition sources."[223]

Search and extraction elements are only equipped with air purifying respirators and powered air-purifying respirators; these respirators are not suitable for respiratory protection in active fire environments, with their efficacy questionable even in post-fire

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218 Norman, *Fire Department Special Operations*, 18-19; Joint Chiefs of Staff, *Joint Publication 3-41*, C-1.

219 National Fire Protection Association, *NFPA 1006: Standard for Technical Rescue Personnel Professional Qualifications* (Quincy, MA: National Fire Protection Association, 2020), 27-32; Norman, 284.

220 Eden, *Whole World on Fire*, 25-32.

221 Kaszeta, *CBRN and Hazmat Incidents at Major Public Events*, 171.

222 Cayse, *FEMA US&R IND ConOps*, 9.

223 Department of Homeland Security, *Nuclear/Radiological Incident Annex to the Response and Recovery Federal Interagency Operational Plans*, 112.

environments.[224] This lack of suitability occurs because CBRN filters are generally not effective against carbon monoxide, one of the most prevalent toxic gases in fire smoke.[225] Only Title 10 search and rescue forces are equipped with self-contained breathing apparatuses, but they are intended to arrive later in the event and theoretically committed to the light damage zone.[226]

3. Tactics

The factors of work/rest cycles, diminished dexterity and vision, and stay times are tactical issues for military US&R support in post-nuclear detonation environments, and the CBRN Response Enterprise's ability to address them has a split scorecard. In reaching this conclusion, work/rest cycles and stay times were paired for analysis, as both are functions of time. Consequently, the challenges of diminished dexterity and vision are in a category of their own.

On the matter of work/rest cycles and stay times, the enterprise is well prepared to perform and support civil authorities. Since both mandate the rotation of response personnel, they require large numbers of rescuers for proper implementation. At approximately 18,795 soldiers and airmen strong, with 27 search and extraction teams at the Title 32 level alone, the enterprise has more than enough rescuers to sustain US&R efforts under these constraints in a post-nuclear detonation environments.[227]

However, the challenge of diminished dexterity and vision presents a serious gap in tactical ability for the enterprise's US&R elements, specifically in the realm of training. As previously stated, US&R is a highly technical discipline that requires a high degree of

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[224] Department of the Army, *ATP 3-11.47/AFTTP 3-2.79*, E-2; Jennifer Currie, Delayne Caseman, and Renee Anthony, "The Evaluation of CBRN Canisters for Use by Firefighters during Overhaul," *The Annals of Occupational Hygiene* 53, no. 5 (July 2009): 537.

[225] Currie, Caseman, and Anthony; Yves Alarie, "Toxicity of Fire Smoke," *Critical Reviews in Toxicology* 32, no. 4 (September 29, 2008): 259.

[226] William E. Sumner, email message to author, February 12, 2020; "Chemical, Biological, Radiological, Nuclear Dismounted Reconnaissance Sets, Kits, and Outfits (CBRN DR SKO)," United States Army Acquisition Support Center, accessed February 13, 2021, https://asc.army.mil/web/portfolio-item/cbd-cbrn-dr-sko/; Cayse, *FEMA US&R IND ConOps*, 9.

[227] Joint Chiefs of Staff, *Joint Publication 3-41*, C-2.

situational awareness, without the added limitations incurred by the use of CBRN PPE. As such, it requires a high degree of mastery for rescuers to perform safely and optimally, which can only be obtained through rigorous training and experience.[228]

Despite these requirements, the required continuing education for the enterprise's US&R elements is generally limited to collective training events, 24–36-month external evaluations, and large exercises.[229] Furthermore, initial, individual training is extremely abbreviated, particularly on the Title 32 side of the enterprise. While meeting all the training requirements established by *NFPA 1006: Standard for Technical Rescue Personnel Professional Qualifications* for rope, confined space, and structural collapse rescue operations, the Extractor 1 course is only 12 days in duration.[230] This course is extremely brief compared to many civilian fire service-based US&R and technical rescue courses.

Compared to civil US&R authorities, it could be argued that the DOD's CBRN-centric doctrine compensates for some of the aforementioned-noted pitfalls. This comparison is reflected in the CBRN Response Enterprise's approach to US&R, with search and extraction and search and rescue training geared primarily towards rescuing victims in collapsed structures after a nuclear detonation.[231] However, despite this emphasis in mission, the performance and evaluation of US&R skills in CBRN PPE is not mentioned in *Training Circular Number 3–37.51: Urban Search and Rescue*, the chief US&R training document for the enterprise.[232] In fact, the Extractor 1 course does not offer search and extraction soldiers and airmen the opportunity to practice US&R skills while donning CBRN PPE.[233] Given the limitations presented by such PPE, this exclusion is a major oversight in tactical preparedness. While civilian responders take an all-hazards approach to US&R, they have the benefits of

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228 Norman, *Fire Department Special Operations*, 5-9; Phillips, *National Park Service Technical Rescue Handbook*, i.

229 United States Northern Command, *USNORTHCOM CONPLAN 3500-14*, C-1—B-1-6, C-1—B—1-23.

230 Homeland Defense Civil Support Office, *Urban Search and Rescue Extractor Course Level I Welcome Letter*, 2.

231 Department of the Army, *Training Circular Number 3-37.51*, sec. Foreword.

232 Department of the Army.

233 Homeland Defense Civil Support Office, *Urban Search and Rescue Student Handout* (Fort Leonard Wood, MO: Department of the Army, 2019).

more frequent continuing education and making real-world US&R responses. Such experience would prove invaluable to those operators while performing US&R in CBRN PPE.

E. CONCLUSION

Post-nuclear detonation environments present the hazards of secondary collapse, nuclear fallout, and fire to US&R responders, and each must be properly addressed for US&R efforts to be successful after such an incident. Particularly, protection from the hazard of nuclear fallout presents the added complexity of CBRN PPE usage, which limits responder dexterity and vision and requires work/rest cycles, and radiation exposure, which requires the use of stay times.[234] Given these additional layers of complexity, it is necessary to assess the CBRN Response Enterprise's ability to overcome these challenges in fulfilling its supportive mission following a domestic nuclear detonation.

To accomplish this assessment, the enterprise can be evaluated at the strategic, operations, and tactical levels of incident response. At the strategic level, it is properly oriented to address these challenges, but it should study and understand the stated needs of civil US&R authorities as described in Chapter III. At the operations level, it is not prepared to handle the threat of fire. Finally, at the tactical level, its large numbers make it well equipped to handle the challenges imposed by stay times and work/rest cycles, but training deficiencies make it ill prepared to address the decreases in rescuer dexterity and vision caused by CBRN PPE usage.

However, the challenges presented to military US&R support efforts by post-nuclear detonation environments are only a single piece of this research project. With this in mind, the next section of this thesis synthesizes the implications of this chapter, as well as the others, into a final conclusion. Additionally, it addresses the limitations to this research, and it makes policy recommendations for the CBRN Response Enterprise based upon its findings.

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[234] Pourmoghani, "Effects of Gloves and Visual Acuity on Dexterity"; Johnson, "Respirator Masks Protect Health but Impact Performance"; Noll and Hildebrand, *Hazardous Materials*, 282; Kaszeta, *CBRN and Hazmat Incidents at Major Public Events*, 170; Federal Emergency Management Agency, *WMD Radiological/Nuclear Course for Hazardous Materials Technicians PER-241*, 123-24.

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V. CONCLUSION

> To be fully effective, change must be implemented at the level of knowledge-laden routines, algorithms that both represent problems and embody solutions.
>
> —Lynn Eden

A. INTRODUCTION

The previous chapters of this thesis set out to determine how the DOD can maximize the employment of existing CBRN Response Enterprise US&R capabilities to support civil authority–directed lifesaving efforts following a domestic nuclear detonation. In achieving this end, Chapter II outlined and analyzed the domestic nuclear detonation response architecture, which revealed gaps in the DOD's understanding of the needs of civil US&R authorities after such an event. In an effort to bridge these gaps, Chapter III investigated the expectations of these authorities through research interviews. Chapter IV analyzed the CBRN Response Enterprise's ability to overcome the challenges of post-nuclear detonation environments to meet these expectations, a theme that emerged from the interviews.

Subsequently, this chapter aggregates the findings of the previous chapters to draw conclusions and deliver recommendations to the DOD. Additionally, it acknowledges the limitations of this study, and it identifies areas worthy of further research. By following these recommendations, the CBRN Response Enterprise can begin to maximize the employment of its existing US&R elements to achieve its DSCA mission after a domestic nuclear attack.

B. LIMITATIONS

As with any scientific inquiry, this research has limitations. The foremost limitation to this study is the sample set of the research interviews, particularly in regards to local civil authorities. While the three local response officials selected for the interviews are a good representation of the knowledge base of the greater local response community, they are not exhaustive. Just as perceptions, cultures, policies, doctrine, and response models

can vary widely over large geographical areas, so can the needs and expectations of local civil authorities. While the data gathered is adequate for making recommendations, this limitation must be remembered when considering these conclusions.

Furthermore, the implications of this research are limited primarily to urban areas, as the local responders interviewed were only selected from large cities. While unlikely, it is possible for a domestic nuclear detonation to occur in a more suburban or rural location. However, the needs and expectations of response agencies can also differ greatly between geographical settings. Therefore, it should not be assumed that expectations of local civil US&R authorities expressed in this study are reflective of those in suburban or rural places, and this topic may be worthy of further research.

Additionally, in-depth analysis of nuclear weapons effects modeling is beyond the scope of this study. Consequently, additional factors could be considered when evaluating the relevance of existing doctrine and characterizing post-nuclear detonation environments. Furthermore, the conclusions of many relevant modeling studies are contradictory. For instance, the effect of thermal radiation and phenomenon of mass fire has been the subject of spirited debate.[235] To address this limitation, this study takes a very general approach to hazard mitigation.

Finally, far more complexities are presented to US&R efforts by post-nuclear detonation environments than could be addressed by this study. While the most pressing and prevalent factors are covered, others are worthy of further research. For example, with the National US&R Response System elevating its radiation dose limit for its responders to 50 roentgen equivalent man, a disparity could occur in dose limits between federal civil US&R authorities and the CBRN Response Enterprise.[236]

C. RESEARCH CONCLUSIONS

A domestic nuclear detonation would arguably constitute America's worst day and challenge even the best-devised emergency response plans. As such, mitigation would

[235] Eden, *Whole World on Fire*, 26-36.

[236] US&R HazMat Advisory Subgroup, *US&R Radiological Response Recommendations*, 4.

require a whole-of-government solution and DOD's involvement, especially in the realm of US&R, as it would present unique challenges and overwhelm civilian responders. Put simply, federal and local authorities could not tackle such challenges without military aid.

Still, civil response agencies have the authority to coordinate any such effort at both the federal and local levels of government, so it is imperative for the DOD to embrace its supportive role.[237] To this end, it must have a better understanding of the expectations of civil US&R authorities after such an event. Subsequently, the CBRN Response Enterprise must be tailored to meet these expressed needs. Doing so would allow the civil response agencies to become a force multiplier for civil US&R authorities, which would empower them to lead the effort to save lives after a domestic nuclear detonation.

For federal civil US&R authorities, according to Sanders, Neal, and Kenny, force multiplication means providing capable manpower to sustain US&R efforts in a post-nuclear detonation environment. These responders are well trained and highly experienced and are very capable of coordinating federal response efforts. However, Sanders and Neal stated that the restrictions of work/rest cycles and stay times make US&R extremely labor intensive under such conditions. Consequently, they expect the enterprise to integrate into their response to maintain their battle rhythm.

On the other hand, local civil US&R authorities are less sure of their needs and expectations. They have far less exposure to the CBRN Response Enterprise's US&R elements, and they dedicate fewer planning resources to domestic nuclear detonation response. Regardless, Jones, Hoffman, and Cooper said that they are also highly trained and experienced responders, and they are open to military aid.

Based upon this feedback, the DOD can begin to reshape its US&R response doctrine. However, even with this deeper understanding, the enterprise must address certain conditions presented by post-nuclear detonation environments to render aid effectively. These conditions include the threat of fire and added challenges to the

237 Federal Emergency Management Agency, *Emergency Support Function #9*, 4; Federal Emergency Management Agency, 4; Department of Homeland Security, *NIMS: Frequently Asked Questions*, 2.

performance of US&R skills while utilizing PPE, which can be mitigated by changes in gear and training.

D. RECOMMENDATIONS

Based upon the findings of this research, the DOD should consider the following recommendations.

1. Consider Embracing the "Super Squad" Concept

As the research interviews with Sanders, Neal, and Kenny revealed, federal civil US&R authorities of the National US&R Response System expect the CBRN Response Enterprise's US&R elements to serve as force multipliers for their life-saving efforts following a domestic nuclear detonation. Such efforts are labor intensive and require large numbers of responders to meet the demands of stay times and work/rest cycles.[238] At approximately 18,795 soldiers and airmen strong, the enterprise is well prepared to meet this expectation.[239]

However, the professional rescuers of the National US&R Response System are highly trained and experienced, especially in comparison to the US&R personnel of the CBRN Response Enterprise. As such, Sanders, Neal, and Kenny indicated that they intend to fulfill their coordinating role during such an incident, and they expect the enterprise to integrate with their responders. As suggested by Kenny, one potential way is through the formal development and adoption of the "super squad" concept, which involves the direct embedding of enterprise US&R personnel into National US&R Response System rescue squads.

2. Emphasize Operations-level (Level I) US&R Skills

As previously established, US&R is a highly technical discipline that requires a high degree of competence to perform safely and successfully, and mastery can take years

238 Noll and Hildebrand, *Hazardous Materials*, 282; Kaszeta, *CBRN and Hazmat Incidents at Major Public Events*, 170, 383.

239 Joint Chiefs of Staff, *Joint Publication 3-41*, C-2.

of training and experience.[240] With the added complexities presented to US&R efforts by post-nuclear detonation environments, it should not be assumed that US&R-capable soldiers and airmen will be able to perform at an advanced level after a nuclear attack. Therefore, the enterprise should emphasize the mastery of operations-level (level I) US&R skills among all of its US&R elements.

This is not to suggest that technician-level (level II) training should be completely discarded, as higher levels of training and understanding certainly contribute to a mastery of these skills. However, current training plans are not conducive to maintaining advanced skillsets. Furthermore, with improved integration with National US&R Response System, they may not be necessary.

3. Emphasize Wide Area Search Training

The enterprise should also place greater emphasis on wide area search training, as wide area search is relatively less technical in nature, more suited for light damage zone operations, and a potential gap in preparedness and planning for civil US&R authorities, as also noted in an interview with Sanders.[241] With a large number of personnel, the enterprise is well equipped to fill this void.

4. Require Soldiers and Airmen to Practice US&R Skills in CBRN PPE during Initial, Individual Training

Currently, the Extractor I and Rescuer Courses are taught strictly in accordance with *NFPA 1006: Standard for Technical Rescue Personnel Professional Qualifications*.[242] However, outside of confined space rescue skills, this standard does not require students to perform US&R skills in CBRN PPE.[243] Considering the limitations on

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[240] Norman, *Fire Department Special Operations*, 5-9.

[241] Urban Search & Rescue, *Wide Area Search: (PER213)*; U.S. Department of Health and Human Services Radiation Emergency Medical Management "Damage Zones, Radiations Zones and Likely Rescue Activities after a Nuclear Detonation: Table."

[242] Homeland Defense Civil Support Office, *Urban Search and Rescue Extractor Course Level I Welcome Letter, 2*; *Homeland Defense Civil Support Office, Urban Search and Rescuer Course Welcome Letter*, 2.

[243] National Fire Protection Association, *NFPA 1006*.

dexterity and vision incurred by PPE, CBRN Response Enterprise soldiers and airmen should have the opportunity to practice relevant US&R skills in full PPE during initial training.[244]

5. Issue Self-contained Breathing Apparatuses to all CBRN Response Enterprise US&R Elements

While the likelihood of a mass fire event after a nuclear attack is unclear, the presence of fire hazards in collapsed buildings and post-nuclear detonation environments is certain.[245] Further, Title 32 US&R elements of the CBRN Response Enterprise have the potential to be deployed in the moderate damage zone, where fire is certain to be present.[246] Regardless, only the Title 10 US&R elements are equipped with self-contained breathing apparatuses, which are the appropriate respiratory protection to mitigate smoke exposure.[247] Given the prevalence of fire in this environment, all enterprise US&R forces should have immediate access to self-contained breathing apparatuses.

6. Improve Communication with Federal and Local Civil US&R Authorities

Across all levels of incident response, the CBRN Response Enterprise's US&R capabilities and response doctrine have been misconstrued. Consequently, gaps have occurred in response plans, as highlighted in Chapter II. Since DSCA is the DOD's mandate, it bears the responsibility for engaging these authorities and rectifying any misunderstandings.[248]

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[244] Pourmoghani, "Effects of Gloves and Visual Acuity on Dexterity"; Johnson, "Respirator Masks Protect Health but Impact Performance."

[245] National Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats, *Planning Guidance for Response to a Nuclear Detonation*, 24; Norman, *Fire Department Special Operations*, 284.

[246] Cayse, *FEMA US&R IND ConOps*, 9; Department of Homeland Security, *Nuclear/Radiological Incident Annex to the Response and Recovery Federal Interagency Operational Plans*, 112.

[247] United States Army Acquisition Support Center, "Chemical, Biological, Radiological, Nuclear Dismounted Reconnaissance Sets, Kits, and Outfits (CBRN DR SKO)"; Currie, Caseman, and Anthony, "The Evaluation of CBRN Canisters for Use by Firefighters during Overhaul," 523-38.

[248] Joint Chiefs of Staff, *Chairman of the Joint Chiefs of Staff Instruction 3125.01D*, 2.

Furthermore, the DOD should be more engaging with local-level responders. From the research interviews, it was apparent that local US&R authorities have far less interaction with the enterprise than their federal counterparts do. Consequently, Jones, Hoffman, and Cooper, struggled to articulate their expectations of the DOD, as they had little understanding of its capabilities. Again, it is the DOD's responsibility to rectify this problem, and it should do so quickly. As Cooper of Las Vegas Fire & Rescue pointed out during his interview, the immediate aftermath of domestic nuclear detonation is not the ideal time to begin fostering a professional partnership.

The Mobile Education & Training Team is one potential model the DOD can consider for engaging these authorities, as outlined in a 2008 Naval Postgraduate School thesis by Steven Osterholzer. Upon researching ways NORTHCOM could improve its outreach initiatives with stakeholders and response partners, Osterholzer concluded, "A Mobile Education & Training Team, consisting of subject-matter experts from NORTHCOM Headquarters, should travel to stakeholder locations to execute a customized education package for its critical stakeholders."[249] Employing this approach, such a team could be used to educate local civil US&R authorities about the capabilities of the CBRN Response Enterprise.

E. CONCLUSION

To maximize the use of existing CBRN Response Enterprise US&R capabilities to support civil authority–directed lifesaving efforts following a domestic nuclear detonation, the DOD must understand these authorities' expectations of its US&R elements. To achieve this end, research interviews were conducted with federal and local civil US&R authorities. As a result, according to Sanders, Neal, and Kenny, it was discovered that federal authorities expect the enterprise to serve as a force multiplier. Conversely, Jones, Hoffman, and Cooper said that local authorities are largely unaware of the enterprise's US&R capabilities, but will be more reliant on DOD support.

[249] Steven Osterholzer, "Education in Action: Educating USNORTHCOM's Critical Stakeholders at the Away Game" (master's thesis, Naval Postgraduate School, 2008), 84, https://calhoun.nps.edu/handle/10945/3957.

Additionally, to meet these expectations, the CBRN Response Enterprise must be capable of overcoming the challenges presented to US&R efforts by post-nuclear detonation environments. These challenges include the hazards of secondary collapse, nuclear fallout, and fire.[250] More specifically, mitigation tactics for the hazard of nuclear fallout add the complexities of work/rest cycles, diminished dexterity and vision, and stay times.[251] Upon analysis, the enterprise needs to improve its capabilities to address the threat of fire and the added complexities incurred by CBRN environments.

[250] Department of Homeland Security, *Nuclear/Radiological Incident Annex to the Response and Recovery Federal Interagency Operational Plans*, 111.

[251] Federal Emergency Management Agency, *WMD Radiological/Nuclear Course for Hazardous Materials Technicians PER-241*, 297; Pourmoghani, "Effects of Gloves and Visual Acuity on Dexterity"; Johnson, "Respirator Masks Protect Health but Impact Performance"; Kaszeta, *CBRN and Hazmat Incidents at Major Public Events*, 383.

APPENDIX. INTERVIEW QUESTIONS

The following were the questions asked, in order:

1. How often do your urban search and rescue units conduct training for structural collapse events?
2. How often do your urban search and rescue units conduct training on wide area search techniques?
3. What planning and preparation has your organization done in regards to urban search and rescue during a nuclear detonation response?
4. How will your organization employ urban search and rescue personnel and equipment in contaminated areas during a nuclear detonation response?
5. How do CBRN Response Enterprise urban search and rescue capabilities fit into your organization's nuclear detonation response plans?
6. What are your organization's expectations of CBRN Response Enterprise urban search and rescue personnel during a nuclear detonation response?
7. How does your organization plan to incorporate CBRN Response Enterprise urban search and rescue capabilities to best help achieve nuclear detonation response objectives?
8. How will your organization employ CBRN Response Enterprise urban search and rescue personnel to augment life-saving urban search and rescue efforts during a nuclear detonation response?
9. What specific urban search and rescue tasks would your organization assign to CBRN Response Enterprise urban search and rescue personnel during a nuclear detonation response?
10. How would your organization employ CBRN Response Enterprise operations-level urban search and rescue personnel differently from

technician-level urban search and rescue personnel to augment life-saving search and rescue efforts during a nuclear detonation response?

11. What urban search and rescue tasks would your organization assign to CBRN Response Enterprise urban search and rescue personnel during a nuclear detonation response?

12. How would your organization employ CBRN Response Enterprise urban search and rescue personnel in areas experiencing mass fire events during a nuclear detonation response?

13. What kind of training has your organization found would best prepare CBRN Response Enterprise urban search and rescue personnel to support life-saving urban search and rescue efforts during a nuclear detonation response?

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