

## Assessing United States Army Doctrine for Operations in a Nuclear Weapons Effects Environment

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**Abstract:** The Nuclear Science and Engineering Research Center (NSERC), a field office of the Defense Threat Reduction Agency, partnered with the Systems Engineering Capstone team to address issues surrounding the Army's preparedness to survive, fight and win in a nuclear hazard environment, herein abbreviated NHE. Preparing for operations in a NHE has received less attention since the end of the Cold War and in recent years due in part to a perceived low likelihood of nuclear weapon use in conflicts like Iraq and Afghanistan. The team identified Army doctrine that impacts Soldiers operating in a NHE, focusing on the problem question, "Can the Army Assess Current Doctrine in Relation to Operations in the NHE?" The team created a survey tool to assess a doctrine's effectiveness in a NHE and to find capability gaps. It was administered to subject matter experts for them to assess specific doctrine.

*Keywords:* Nuclear Hazard Environment, Survey, Nuclear Science and Engineering Research Center, Assessment, Evaluation, Doctrine, Nuclear

### 1. Introduction

Nuclear weapons have three principle immediate effects: blast, thermal, and prompt radiation. Delayed effects include fallout and other environmental impacts. The environment created by the combined effects of a nuclear weapon is termed a Nuclear Hazard Environment (Joint Chiefs of Staff [JCS], 2018). Since the end of the Cold War, less emphasis has been placed on preparing for conflict in a NHE and more emphasis placed on countering terrorism and extremist ideologies. A resurgent Russia may be changing this. Reports submitted to Congress accuse Russia of violating the Intermediate Range Nuclear Force Treaty (CRS,2019). While testifying before the Senate Armed Services Committee, former Secretary of Defense James Mattis stated, "I would consider the principal threats [against the U.S.] to start with Russia". He further underscored the importance of ensuring NATO's nuclear deterrence is maintained to counter Russian provocation (Mora, 2017). Additionally, the United States faces nuclear threats from Iran, North Korea, and non-state actors (Trump, 2017). In reaction to the growing nuclear threat, it is imperative the United States Army prepares for combat in the NHE. Adequate preparation for such events acts as a deterrent towards future adversarial nuclear weapon employment and prepares the Army to conduct operations in a post-nuclear incident environment. Demonstrating an ability to survive, fight and win in a NHE assures our allies that we can achieve military and political objectives and deters adversaries from employing nuclear weapons as their affect will not secure military or political advantage. This project aims to increase U.S. Army preparedness by providing an assessment tool for current doctrine focused on operations in a NHE.

#### 1.1 Problem Definition

U.S. Army doctrine specifically dedicated to preparing for and executing operations in a NHE is limited. However, deterrence theory hinges on projecting a credible capability that makes the use of nuclear weapons ineffective. Due to the increasing threat of nuclear violence, it is imperative that the United States Army knows how to survive, fight, and win in a nuclear environment and be able to convincingly demonstrate that knowledge. In the Problem Definition phase, the team concluded that to be a credible deterrent to enemy nuclear weapon use, any soldier task had to be executable in a NHE. The

team decided the best way to assess the Army's effectiveness in a NHE is to provide a tool capable of assessing current doctrine and determining which areas require improvement.

The impacts of this project are that it serves as a start point for identifying potential gaps and acts as a proxy for predicting how effective soldiers will be in a NHE. The assessment tool provides insight to where the doctrine needs to improve, and how the army will have to balance resources to prepare for future threats.

## **2. Background**

The NSERC presented the team with the hypothesis that the Army has capability gaps when operating in a NHE. Part of the basis for this hypothesis is the relative inattention paid to nuclear deterrence following the dissolution of the Soviet Union in 1991. However, nuclear deterrence has gained public attention in recent years due to the increasing threats of nuclear weapons by countries such as North Korea, the Russian Federation, and Iran. To familiarize ourselves with the concept of nuclear deterrence, the team began their project with background research investigating the effects of nuclear weapons. The original problem statement, "Survive, fight, and win in the Nuclear Environment" is broad and as a result, the team spent a great deal of time deliberating on possible ways to turn it into a reality. Through a combination of deliberation, research on nuclear weapons effects, and analysis of current U.S. combat doctrine and procedures, we concluded that the U.S. Army does seem to have capability gaps surrounding operations in a NHE and that the best course of action would be to develop an assessment tool with the goal of quantitatively identifying where those capability gaps exist. The team also researched the relationship between Doctrine and other means to span capability gaps. Additionally, during this process we developed a new problem statement that more accurately defined their purpose. Their current problem statement is, "Assessing US Army Doctrine for Operations in a Nuclear Hazard Environment."

## **3. Methodology**

After extensive research on effects within the NHE, this project focused on developing an assessment tool that could be sent to subject matter experts, to assess the doctrine within their area of expertise. Joint planning guidance states that commanders, "assisted by their staffs and subordinate commanders, along with interagency and multinational partners and other stakeholders, will continuously assess the operational environment and the progress of the operation toward the desired end state in the time frame desired" (JCS, 2011). However, current U.S. Army doctrine, tasks, and procedures rarely touch specifically on operations within the nuclear hazard environment. The Joint Capabilities Integration and Development System (JCIDS) process functions, "to ensure the capabilities required by the joint warfighter are identified, along with their associated performance criteria (requirements)" (JCIDS Process Overview," 2018). The JCIDS process outlines what capabilities are required. A Functional Solutions Analysis approach to capability requirements is doctrine, organization, training, materiel, leadership and education, personnel, facilities and policies (DOTmLPF-P). JCIDS provides the 'what', and DOTmLPF-P provides the 'how'.

The team considered that for any doctrine to be effective, all aspects of DOTmLPF-P should be balanced. That is, if the materiel solution exists but the organizational structure to support it does not, then the results are not an effective deterrent. We developed a survey that, for any given doctrine, examines the relationship of that doctrine to each of the DOTmLPF-P components independently. The Independent Doctrine Evaluation and Assessment (IDEA) tool further subdivided each aspect of DOTmLPF-P into multiple sub-categories, where appropriate. For example, "Organization" is further categorized by "Unit Structure, Joint Organization, and Roles". Figure 1 below displays one section, "Personnel," and its two subsections, "Minimum Personnel Requirements" and "Unique Personnel," from the assessment tool. "Personnel" is just one of the eight sections that comprise IDEA. Each sub-category is assigned a score 0-4, based on a detailed explanation of each scoring criteria. The scoring of each sub-category provides a weighted final score within the DOTmLPF-P components. This allows a subject matter expert (SME) to quantitatively evaluate various components of U.S. Army Doctrine. It is constructed in such a way that each evaluation is considered independently of all others, but all evaluations are combined to show the collective effect.

Personnel	Sub-Category	0	1	2	3	4	SCORE	
	Minimum Personnel Requirements	Unreasonable amounts of additional units are required to assist the decisive operation to accomplish the mission	Many additional units are required to assist the decisive operation to accomplish the mission	A moderate amount of additional units are required to assist the decisive operation to accomplish the mission	Few additional units are required to assist the decisive operation to accomplish the mission	The organic number of personnel in the unit can accomplish the mission		3
	Unique Personnel	Multiple additional technical professionals are needed to accomplish the mission	Many additional technical professionals are needed to accomplish the mission	A moderate amount of additional technical professionals are needed to accomplish the mission	A few additional technical professionals are needed to accomplish the mission	No unique personnel with technical skill sets are required		3

Figure 1. IDEA Tool Example Picture (only one of the eight categories is pictured)

IDEA is used by SMEs to evaluate Army doctrine with which they are most familiar. Upon receipt of IDEA the SME will read the doctrine under assessment and assess a score for each subsection. The subject matter expert may also write comments next to any subsection to provide feedback and thoughts for the assessment. Upon completion of every section, the assessment tool will automatically populate pivot charts and other graphical data analysis visual aids to provide feedback on what sections or subsections scored well or poorly. Once the assessment is completed, the SME will send back the results to the doctrine assessment group. With this data they will be able to visually identify exactly where capability gaps, and shortcomings lie within the written doctrine. If necessary, the group can follow up with the subject matter experts that used the tool. To date, the group has gone to FA-52s, nuclear and counter proliferation experts, to assess nuclear-specific doctrine. We are currently working to expand the analysis with other SMEs in NHE. Also, once this assessment tool has been used on multiple sets of doctrine the Army will be able to compare scores with different sets of doctrine to compare capability gaps and total effectiveness with each set of doctrine.

#### 4. Results & Analysis

IDEA is designed to take the data collected in figure 1 and organize the results in various charts and graphs. The charts and graphs allow the user to see where the doctrine needs improvement. The figures below are the results of an SME’s assessment of FM 3-11.

Figure 2 is a pivot table that uses data gathered from every section of IDEA to display every score. The pivot table is organized by section and broken down into subsection so the score from each subsection can be seen. This makes it clear to see which section or subsection does particularly poor or well. The pivot table allows the party conducting the assessment to quickly determine which section needs improvement. The pivot tables within the tool can also be edited to show specific subsections to display exact data the viewer is interested in.

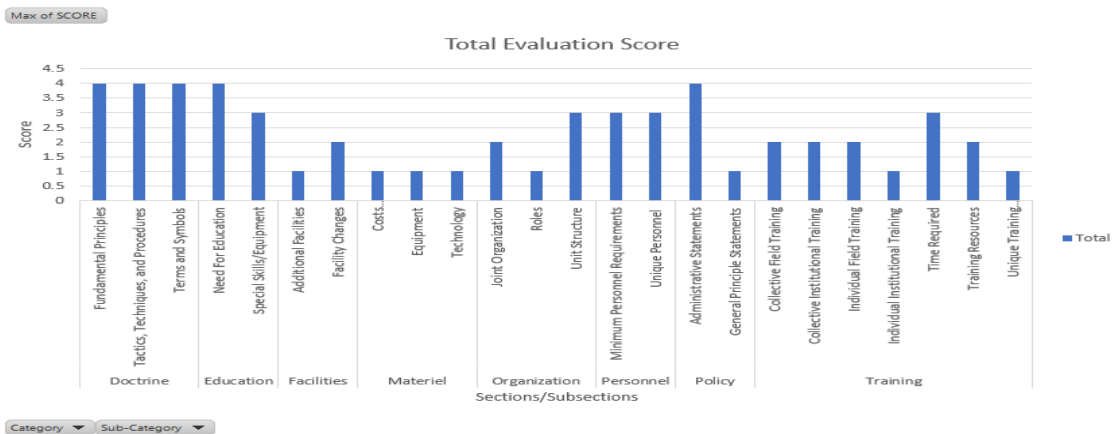


Figure 2. Pivot Table Summarizing Data Collected from a Single SME

Figure 3 below is a radar graph that uses the same data from the pivot table. The radar graph provides an alternate view of the information. Ideally, the graph would show a balanced polygon; that is, all components of capability are synchronized and equally scored. In the graph below, the sharpness of the angles provides a clear view of where the doctrine needs improvement, that is where unbalance exists.

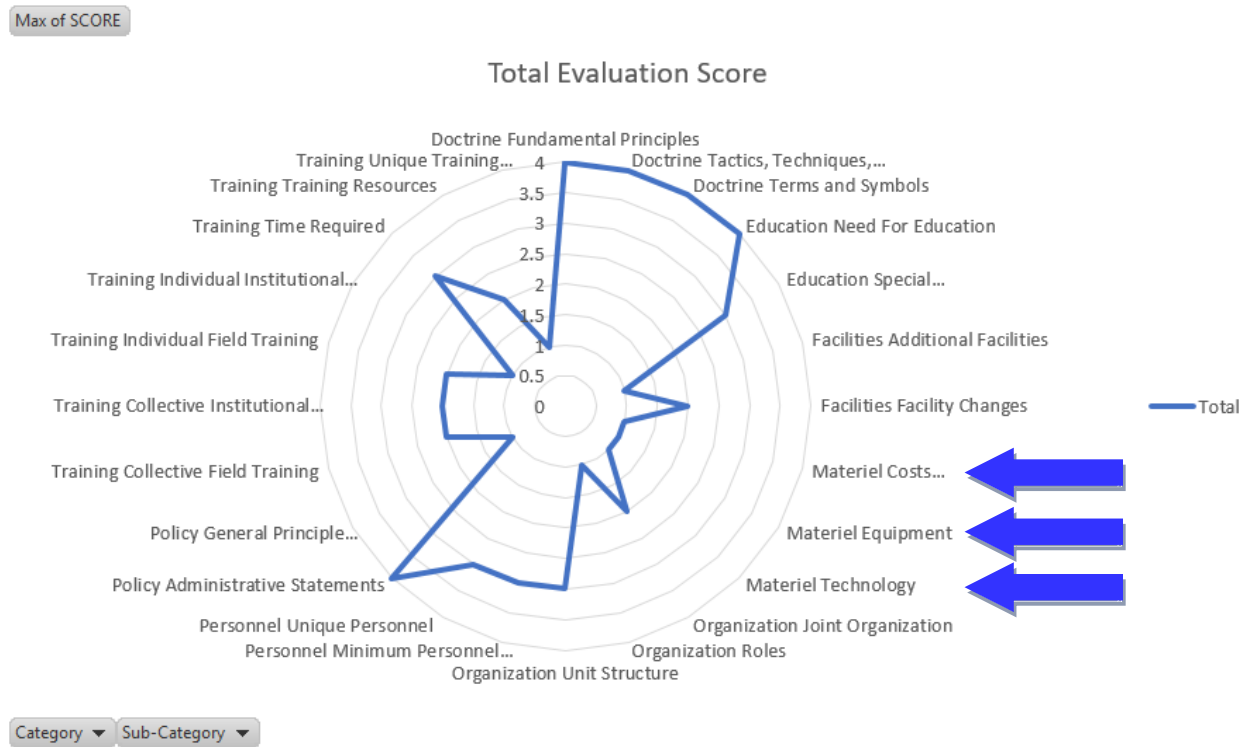


Figure 3. Radar Table Graphically Displaying Total Score

As seen in figures 2 and 3, FM 3-11 is lacking aspects of Materiel to be effective in a nuclear hazard environment. The Materiel category is broken down into three subcategories that better explain where the capability gap exists. The first subcategory is equipment. The grader will rate the FM on a scale of 0-4 based on the equipment that would be needed to operate in a nuclear environment. The subcategory of cost relates to the price in which the equipment would cost, and the subcategory of technology receives a score depending on if the technology needed is available. An interpretation of this result is that the doctrine was developed in response to an identified requirement of the joint warfighter through the JCIDS process. An independent examination of each aspect DOTmLPF-P of this doctrinal response to this requirement indicates that a significant capability gap exists when considered in the NHE. Using these scores, the parties interested will be able to review the doctrine and identify where to improve it.

### 5. Conclusion and Future Work

The United States Army’s doctrine covers nearly every task and mission set; however, the Army does not currently have a way of visually presenting assessments of its doctrine. With our IDEA tool, it is possible to evaluate current doctrine as it applies to a nuclear hazard environment. To continue to improve our model, we will continue to consult additional subject matter experts. We will also improve IDEA by analyzing doctrine across different levels, as well as considering the changes in the environment due to the nature of evolving warfare. Lastly, we are examining how to depict multiple SME responses to the same doctrine to show statistical information, such as average responses and range of responses.

## 6. References

- Bond, Phillip L., Instructor, United States Military Academy. Department of Systems Engineering.
- Heider, Samuel A., Deputy Director for Operations and Joint Service Research, Nuclear Science and Engineering Research Center, Defense Threat Reduction Agency
- Hoak, Steven M., Instructor, United States Military Academy. Department of Systems Engineering.
- JCIDS Process Overview. (2018, 13 November). *AcqNotes Defense Acquisition Made Easy*. Retrieved from <http://acqnotes.com/acqnote/acquisitions/jcids-overview>
- JCIDS Process DOTMLPF-P Analysis. (2018, 15 June). *AcqNotes Defense Acquisition Made Easy*. Retrieved from <http://acqnotes.com/acqnote/acquisitions/dotmlpf-analysis>
- Joint Chiefs of Staff. (2011). *Commander's Handbook for Assessment Planning and Execution*. Version 1.0. Joint Staff, J-7. Joint and Coalition Warfighting. Suffolk, Virginia.
- Joint Chiefs of Staff (29 October 2018). *Operations in Chemical, Biological, Radiological, and Nuclear Environments (JP 3-11)*. Retrieved from [https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3\\_11.pdf?ver=2018-12-07-091639-697](https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_11.pdf?ver=2018-12-07-091639-697)
- Miller, April., Instructor, United States Military Academy. Department of Chemistry and Life Science.
- Miller, Joshua., Instructor, United States Military Academy. Department of Chemistry and Life Science.
- Mora, E. (2017, January 12). Gen. Mattis: 'Principal Threats' Against U.S. 'Start with Russia'.
- United States (2011). *Multi-Service Doctrine for Chemical, Biological, Radiological, and Nuclear Operation: Field Manual 3-11*. Washington, DC: Headquarters, Department of the Army.
- Schwartz, Paul. (2014) Senior Associate, Russia and Eurasia Program, Center for Strategic and International Studies. Russian INF Treaty Violations: Assessment and Response.
- Trump, Donald J. (2017). Preface to National Security Strategy of the United States of America (pp. i-ii). Retrieved from <http://nssarchive.us/wp-content/uploads/2017/12/2017.pdf>
- United States (1996). *Nuclear operations. Field Manual 100-30*. Washington, DC: Headquarters, Department of the Army.