



INSTITUTE FOR DEFENSE ANALYSES

**2016 Review on the Extension of the  
AMedP-8(C) Methodology to New Agents,  
Materials, and Conditions:  
2009–2016 IDA Project Summary**

Carl A. Curling

March 2017

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IDA Document D-8375

Log: H 17-000155

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#### About This Publication

This work was conducted by the Institute for Defense Analyses (IDA) under contract HQ0034-14-D-0001, project CA-6-3079, "CBRN Casualty Estimation and Support to the Medical CBRN Defense Planning & Response Project," for the Joint Staff, Joint Requirements Office (JRO) for Chemical, Biological, Radiological and Nuclear (CBRN) Defense (J-8/JRO) and the US Army Office of The Surgeon General (OTSG). The views, opinions, and findings should not be construed as representing the official position of either the Department of Defense or the sponsoring organization.

#### Acknowledgments

The authors are grateful to Mr. James M. Demyanovich for his careful and thoughtful review of this document, to Ms. Betsy MacCarthy for editing, and to Ms. Amberlee Mabe-Stanberry for producing this document.

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## Executive Summary

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In 2009, in support of the Office of The Surgeon General (OTSG), the Institute for Defense Analyses (IDA) produced the final draft of a North Atlantic Treaty Organization (NATO) planning guide documenting a methodology to estimate casualties from chemical, biological, radiological, and nuclear (CBRN) weapons. That document, *Allied Medical Publication 8 (C): NATO Planning Guide for the Estimation of CBRN Casualties (AMedP-8(C))*, promulgated in March 2011, included the parameters to estimate casualties caused by three chemical agents, five biological agents, seven radioisotopes, nuclear fallout, or prompt nuclear effects.<sup>1</sup> Each year since 2009, OTSG has asked IDA to publish an annual review exploring and recommending extensions of this methodology to new agents, materials, and conditions.

This review provides the OTSG Medical CBRN Defense Staff Officer a summary of the products delivered under Task Order CA-6-3079. This allows OTSG to perform a retrospective review of this task order, and permits this information to be incorporated into future plans for studies and analyses sponsored by OTSG. Budgets constrained by funds, materiel, and manpower may require prioritization of studies against other ongoing programs, and this review could assist in an evaluation of the value of funding such studies compared to other budget priorities. This review does not make any judgments on the value of the products delivered to OTSG relative to other programs, although we affirm that these products are, to the best of our ability, creative, unbiased, and cost-effective responses to the taskings addressed.

This analysis is a review of eight years of studies and analyses performed in support of the OTSG Medical CBRN Defense Staff Officer and the Medical Branch of the Joint Requirements Office for CBRN Defense (JRO-CBRND)/J8. The IDA team reviewed products as reported in 93 monthly reports. Accounting for some redundancy in reporting, we identified 64 formal and 108 informal products. These deliverables included the development and promulgation of new or updated NATO doctrine on CBRN casualty estimation and operational guidance for medical CBRN defense. Fourteen chemical agents and twelve biological agents were added to the CBRN casualty estimation methodology. Table top exercises were developed, executed, and analyzed to evaluate concepts of the CBRN casualty estimation methodology, medical CBRN operations, and the impact of international health regulations. The IDA team reviewed existing and proposed doctrine

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<sup>1</sup> North Atlantic Treaty Organization (NATO), *AMedP-8(C): NATO Planning Guide for the Estimation of CBRN Casualties*, STANAG 2553 (Brussels: NATO, March 2011).

under development by other agencies, and provided comments to OTSG to be considered with respect to those comments provided by the Services, Joint Staff, and Department of Defense (DOD) agencies.

The impact of this multi-year effort of analytic support to the OTSG Medical CBRN Defense Staff Officer and the Medical Branch of the JRO-CBRND can be qualitatively estimated as having provided methodologies, doctrine, and exercise evaluations that would not otherwise have been available, and as such it contributed significantly to improvements in the medical defense capabilities of the U.S. Army, Joint Staff, DOD, and NATO. Still, no software tool exists that implements the CBRN casualty estimation methodology, although several are proposed at the national and Allied level. Without a software tool, the methodology requires unique training and capabilities to account for all of the various factors and parameters that lead to a CBRN casualty estimate.

The bottom line purpose of these analyses, as documented in the products described, is to better prepare U.S. Army, Joint Staff, DOD, and NATO to defend against a CBRN attack, and to operate in that environment to provide medical care for the resulting casualties. CBRN attacks fall into the rubric of “low probability/high impact” events that form the basis of many health, safety, and defense concepts. As resources permit, and in response to national and international priorities, we recommend that medical CBRN defense continue to be a topic for studies and analyses.

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# 1. Introduction

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In 2013, the U.S. Army Office of The Surgeon General (OTSG) asked the Institute for Defense Analyses (IDA) to “Update the annual report on current CBRN [chemical, biological, radiological, and nuclear] medical topics, including extension of the NATO [North Atlantic Treaty Organization] casualty estimation methodology, to address OTSG requirements for medical CBRN defense studies and analyses.”<sup>1</sup> This analysis addresses the specific topic requested for that review and summarizes all of the products delivered under all of the amendments to this task order.

## A. Background

In 2009, in support of the OTSG, IDA produced the final draft of a NATO planning guide documenting a methodology to estimate casualties from CBRN weapons. That document, *Allied Medical Publication 8 (C): NATO Planning Guide for the Estimation of CBRN Casualties, (AMedP-8(C))*, promulgated in March 2011, included the parameters to estimate casualties caused by three chemical agents, five biological agents, seven radioisotopes, nuclear fallout, or prompt nuclear effects.<sup>2</sup> Each year since 2009, OTSG has sponsored IDA to publish an annual review exploring and recommending extensions of this methodology to new agents, materials, and conditions.

Table 1 summarizes the major topics addressed in each of the seven annual reviews published to date, which include potential extensions to the originally published casualty estimation methodology.

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<sup>1</sup> Institute for Defense Analyses Task Order CA-6-3079, “CBRN Casualty Estimation and Support to the Medical CBRN Defense Planning & Response Project,” Amendment 8, Signed 8 December 2015, 4.

<sup>2</sup> North Atlantic Treaty Organization (NATO), *AMedP-8(C): NATO Planning Guide for the Estimation of CBRN Casualties*, STANAG 2553 (Brussels: NATO, March 2011).

**Table 1. Summary of Previous Annual Review Topics**

<b>Year</b>	<b>IDA Publication Number</b>	<b>Focus of Annual Review</b>
2009	IDA Document D-3945	<ul style="list-style-type: none"> <li>• The identification of additional biological or chemical agents from selected national or international lists of agents of concern</li> <li>• Estimation of level of effort to model a subset of identified agents</li> </ul>
2010	IDA Document D-4131	<ul style="list-style-type: none"> <li>• The incorporation of medical countermeasures into the NATO CBRN casualty estimation methodology</li> <li>• Alignment of AMedP-8(C) with Common User Database (CUD)</li> </ul>
2011	IDA Document D-4486	<ul style="list-style-type: none"> <li>• The identification of gaps in our knowledge of human response to CBRN agents, and estimating the effort require to fill those gaps</li> <li>• The gaps identified included additional agents, new medical countermeasures, new outbreak data, and psychological casualties</li> </ul>
2012	IDA Document D-4727	<ul style="list-style-type: none"> <li>• The identification of new data to update existing agents or effects</li> </ul>
2013	IDA Document D-4802	<ul style="list-style-type: none"> <li>• The proposal of a formal prioritization scheme among 14 different future enhancements to the methodology</li> </ul>
2014	IDA Document D-5226	<ul style="list-style-type: none"> <li>• A comparison of the output from the Hazard Prediction and Assessment Capability (HPAC) and the CBRN casualty estimation methodology</li> <li>• A recommendation to change the threshold model in the chemical casualty estimation methodology to a probit model</li> </ul>
2015	IDA Document D-8047	<ul style="list-style-type: none"> <li>• A review of U.S. policy and doctrine for managing “orphan” CBRN materials</li> </ul>

**B. Objective**

The objective of this year’s annual review is to provide the OTSG Medical CBRN Defense Staff Officer a summary of the products delivered under Task Order CA-6-3079. This allows OTSG to perform a retrospective review of this task order, and permits this information to be incorporated into future plans for studies and analyses sponsored by OTSG. Budgets constrained by funds, materiel, and manpower may require prioritization of studies against other ongoing programs, and this review could assist in an evaluation of the value of funding such studies compared to other budget priorities. This review does not make any judgments on the value of the products delivered to OTSG relative to other programs, although we affirm that these products are, to the best of our ability, creative, unbiased, and cost-effective responses to the taskings addressed.

## **C. Scope**

This analysis is a review of eight years of studies and analyses performed in support of the OTSG Medical CBRN Defense Staff Officer and the Medical Branch of the Joint Requirements Office for CBRN Defense (JRO-CBRND)/J8. The IDA team reviewed each of the products reported in 93 monthly reports. Accounting for some redundancy in reporting, we identified 64 formal and 108 informal products. Appendix A provides a listing of formal deliverables under CA-6-3079 (by IDA publication number), and Appendix B provides a listing of informal deliverables (by delivery date).

## **D. Document Organization**

This document contains three chapters. The first provides the background, objectives, and scope of the study. The second provides a review of all topics addressed in the task order as separate sections of this chapter, and identifies the formal products delivered under each subtask.<sup>3</sup> The third and final chapter lays out overarching observations from the summary of products and provides conclusions and recommendations.

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<sup>3</sup> The terms “task order” and “subtask” were used with regard to CA-6-3079 through Amendment 4. Beginning with Amendment 5, the terminology changed to “project description” and “subproject.” These terms may be used interchangeably throughout the remainder of this document.

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## 2. Review of Task Order CA-6-3079

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This task was explicitly planned as a multi-year effort, beginning in Fiscal Year 2009 (FY09)—specifically, April 11, 2009. OTSG asked IDA to assist in integrating AMedP-8(C) methodologies into existing U.S. and NATO doctrine and planning tools that rely upon CBRN casualty estimates. The initial proposal was for IDA to develop a program of study which identified the significant tools and methodologies that use CBRN casualty estimates and the significant agents and materials that must be added to the extant AMedP-8(C) methodology. This work was initially divided into four subtasks, which evolved over the subsequent six years in terms of both the objective and the Statement of Work.

### A. Objective

The objective of project CA-6-3079, as stated in the original task order (Amendment 0) was to advance:

additional in-depth studies on the integration of AMedP-8(C) methodologies into existing U.S. and NATO programs. The effort includes review of the existing series of Allied Medical publications and collection of requirements from U.S. and NATO bodies to scope the integration; development of integrating AMedP-8 methodologies; and, incorporation into existing U.S. and possibly NATO programs to assess CBRN Casualty Estimation of AMedP-8.<sup>4</sup>

Over time, this description evolved to recognize that AMedP-8(C) was ratified and promulgated, and the analytic effort changed from producing the document to identifying the changes that needed to go into the next document, including the development of new AMedP-8(C) methodologies, as well as the integration of CBRN medical support concepts into national and international doctrine and programs. Additionally, NATO's publication numbering scheme changed, and AMedP-8 became AMedP-7.5.

Finally, the most recent amendment objective statement continued with the previous objectives, as they had evolved:

to advance in-depth analysis of the integration and maintenance of CBRN medical support concepts in existing U.S. and NATO programs and to specifically address NATO casualty estimation methodologies. The effort

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<sup>4</sup> IDA Task Order CA-6-3079, Amendment 0, April 2009, 2.

includes ongoing review of existing and revised Allied Medical publications; collection of requirements from U.S. and NATO bodies to integrate NATO casualty estimation methodologies; incorporation of those requirements into existing U.S. and NATO programs to implement the NATO casualty estimation methodologies; and integration of CBRN medical support concepts into national and international doctrine, exercises, and programs.<sup>5</sup>

## **B. Statement of Work**

The Statement of Work changed over time to reflect the completion of analyses for specific topics and the addition of new topics for analysis. This was more than just a specific subject for analysis; rather, it reflected the broader reorganization of priorities of the OTSG Medical CBRN Defense Program.

The initial Statement of Work for this project (in Amendment 0) opened with a paragraph that restated the objective in a manner suitable to organizing the analyses into four subtasks:

This task is planned as a multi-year effort, scheduled to begin in FY09. IDA will assist in integrating AMedP-8(C) methodologies into existing U.S. and NATO doctrine and planning tools that rely upon CBRN casualty estimates. The initial proposal is for IDA to develop a program of study which identifies the significant tools and methodologies which use CBRN casualty estimates and the significant agents and materials which must be added to the current AMedP-8(C) methodology.<sup>6</sup>

In Amendment 4 (FY13), a new subtask was added: “Subtask 4 – Support Development of CBRN Medical Support Doctrine” to reflect a shift in emphasis by OTSG, and the previous Subtask 4 became “Subtask 5 – Medical CBRN Defense Program Review and Analysis.” Finally, the most recent amendment’s (Amendment 8) Statement of Work was the simplified, broad directive that:

IDA will assist in maintaining and integrating NATO casualty estimation methodologies and CBRN medical support concepts into U.S. and NATO doctrine and planning tools that rely upon CBRN casualty estimates. This amendment (amendment 8) revises the prior tasks by identifying new analyses to be performed.<sup>7</sup>

Sections C through G of this chapter discuss each of the five subtasks.

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<sup>5</sup> IDA Project Description CA-6-3079, Amendment 8, 2.

<sup>6</sup> IDA Task Order CA-6-3079, Amendment 0, 2.

<sup>7</sup> IDA Project Description CA-6-3079, Amendment 8, 2.

## C. The NATO CBRN Casualty Estimation Methodology

The first subtask presented is the highest priority and basic purpose of Task Order CA-6-3079. This subtask stated (with some variation over time) that:

IDA will support OTSG as custodian of AMedP-7-5 to assure that the document remains current and acceptable to the allied Nations. This will include proposing revisions to the document, performing studies and analyses which demonstrate the need for document revision, and preparing reports and documentation required to substantiate the required revisions.<sup>8</sup>

The products specified in this subtask varied each year to reflect the specific emphasis required by OTSG to complete AMedP-8(C), propose revisions, and then develop AMedP-7.5. The initial subtask description states that:

[t]he initial product of Subtask 1 will be an analysis of the current state of AMedP-8(C)...and a draft program of work for future revisions of the document. Additional products will include the “in-house” AMedP-8(C) application tool and the drafts of meeting notes, briefings, analytical results, articles prepared for publication as well as additional documentation, memos, and white papers produced as a result of the studies and analyses required.”<sup>9</sup>

This statement evolved through subsequent amendments to list all of the required products to maintain and integrate NATO casualty estimation methodologies and CBRN medical support concepts into U.S. and NATO doctrine and planning tools that rely upon CBRN casualty estimates.

In response to this subtask, IDA produced formal deliverables as the next series of study and ratification drafts to complete AMedP-8(C) and the study drafts that developed AMedP-7.5(A) (now in distribution for ratification). (Please note that Appendix A lists all formal deliverables produced under CA-6-3079, by IDA publication number.) The deliverables are:

- Allied Medical Publication-8(C) *NATO Planning Guide for the Estimation of CBRN Casualties*,
  - Study Draft 4 (AMedP-8(C) SD.4), Archive Copy, IDA NS P-4495, September 2009
  - Study Draft 5 (AMedP-8(C) SD.5), Archive Copy, IDA NS P-4496, November 2009

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<sup>8</sup> Ibid.

<sup>9</sup> IDA Task Order CA-6-3079, Amendment 0, 2.

- Ratification Draft 1 (AMedP-8(C) RD.1), Archive Copy, IDA NS P-4492, February 2010
- Allied Medical Publication-7.5(A), *NATO Planning Guide for the Estimation of CBRN Casualties*,
  - Study Draft 1, IDA NS P-4984, June 2014
  - Study Draft 2 (AMedP-7.5 SD.2), IDA NS P-5154, November 2014
  - Study Draft 3 (AMedP-7.5 SD.3), IDA NS P-5308, December 2015
  - Final Draft (AMedP-7.5 FD), IDA NS D-8181, January 2016

Associated with these deliverables was the documentation of the technical background on how the parameters in the CBRN casualty estimation methodology were developed. This included the technical reference manuals for both AMedP-8(C) and AMedP-7.5(A):

- *Technical Reference Manual: Allied Medical Publication 8(C), NATO Planning guide for the Estimation of Chemical, Biological, Radiological and Nuclear (CBRN) Casualties (AMedP-8(C) TRM)*, IDA D-4082, August 2010
- *Technical Reference Manual to Allied Medical Publication 7.5 (AMedP-7.5) NATO Planning Guide for the Estimation of CBRN Casualties (AMedP-7.5 TRM)*, IDA P-8122, October 2016

In order to support OTSG with implementing AMedP-8(C), an “in-house” Casualty Estimation Tool (CET) that applies the AMedP-8(C) methodology to a wide variety of exposure scenarios was delivered as IDA NS P-4630, while the use of the tool was explained in:

- *IDA Allied Medical Publication-8(C) NATO Planning Guide for the Estimation of CBRN Casualties Casualty Estimation Tool (CET) Reference Notes*, IDA NS D-4154, September 2010

Along the same lines, in order to publicize the methodology behind AMedP-8(C) and educate the NATO CBRNMedWG on how to use AMedP-8(C), a table top exercise was held at the February 2010 working group meeting, and recorded as:

- *Exercise “Dread Night”: Using Allied Medical Publication 8 (AMedP-8(C)) to Estimate CBRN Casualties*, IDA D-4130, August 2010

In order to validate and publicize the methodology behind AMedP-8(C), a series of articles were prepared and submitted for publication in peer-reviewed journals:

- “A New Methodology for CBRN Casualty Estimation Over Time,” *Journal of Defense Modeling & Simulation*, IDA NS-D-3967, July 2010



- “A New Methodology for Estimating Radiological Casualties as a Function of Time,” *Journal of Homeland Security and Emergency Management*, IDA NS D-4058, March 2010 (submitted)
- “A New Methodology for Estimating Nuclear Casualties as a Function of Time,” *Health Physics Journal*, IDA NS D-4059, May 2010 (submitted)
- “A New Methodology for Estimating Nerve Agent Casualties as a Function of Time: Defining the Human Response Injury Profile (HRIP) Nerve Agent Methodology,” *Journal of Chemical Health and Safety*, IDA NS D-4060, September 2011 (submitted)
- “A New Methodology for Estimating Nerve Agent Casualties as a Function of Time: Implementing the HRIP Nerve Agent Methodology,” *Journal of Chemical Health and Safety*, IDA NS D-4146, September 2011 (submitted)
- “A New Methodology for Estimating Blister Agent (Mustard HD) Casualties as a Function of Time,” *Journal of Medical Chemical, Biological and Radiological Defense*, IDA NS D-4061, December 2010 (submitted)
- “A New Methodology for Estimating Non-Contagious Biological Casualties as a Function of Time,” *IMA Journal of Management Mathematics*, IDA NS D-4062, June 2010 (submitted)
- “A New Methodology for Estimating Contagious Biological Casualties as a Function of Time HRIP,” *Mathematical and Computer Modeling*, IDA NS D-4063, September 2010 (submitted)

Finally, we delivered a study on the impact of medical care on the casualty estimate, which had not been considered in AMedP-8(C), and the resulting addendum required to supplement AMedP-8(C):

- *The Impact of Medical Care on Casualty Estimates from Battlefield Exposure to Chemical, Biological and Radiological Agents and Nuclear Weapon Effects*, IDA D-4465, March 2012
- *Addenda to Allied Medical Publication 8, “NATO Planning Guide the Estimation of CBRN Casualties” (AMedP-8(C)) to Consider the Impact of Medical Treatment on Casualty Estimation*, May 2013, IDA D-4466, May 2013

#### **D. Agents/Materials in the NATO CBRN Casualty Estimation Methodology**

The second subtask in the initial Statement of Work directed IDA to provide CBRN casualty estimates for military or domestic CBRN events, and align the AMedP-8 CBRN casualty estimation methodology with the CBRN treatment protocols being developed for

use by the United States and NATO. This subtask also directed IDA to develop the human response parameters used in the NATO CBRN casualty estimation methodology.

IDA will support DOD in its interactions with other federal and international efforts to estimate military and/or domestic casualties resulting from CBRN events. IDA will work to align the AMedP-8 CBRN casualty estimation methodology with the CBRN treatment protocols now being developed by the Defense Medical Standardization Board (DMSB) for use in the U.S. and by the Custodian of AMedP-6 for use in NATO. To this effect, IDA will

- 1) participate in, and present CBRN casualty estimation and modeling efforts at panels, meetings, and working groups, to include the Modeling and Analysis Coordination Working Group;
- 2) develop casualty estimation parameters, as available data permit, for CBRN agents not currently addressed in AMedP-8 but included in the DMSB protocols and/or AMedP-6;
- 3) perform CBRN casualty estimation for military and domestic scenarios as requested;
- 4) identify, research, and document changes to casualty estimation parameters for existing CBRN human response models, including DMSB protocols and AMedP-6, necessary to resolve technical or operational inconsistencies and to ensure applicability to civilian populations;
- 5) publish, for academic and scientific review, CBRN casualty estimation and human response methodologies as set forth for use in AMedP-8(C); and,
- 6) facilitate information sharing and coordination pertinent to CBRN casualty estimation and modeling between the modeling communities within NATO, DOD, DOE, DHHS, DHS, and other federal agencies.”<sup>10</sup>

This subtask continued in all amendments to the task order, although it was greatly simplified to a single statement in Amendment 6: “IDA will define casualty estimation parameters, as available data permit, for CBRN agents/materials not currently addressed in AMedP-7.5, or update existing parameters as significant new data become available.”<sup>11</sup>

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<sup>10</sup> Ibid., 3.

<sup>11</sup> IDA Project Description CA-6-3079, Amendment 6, 2.

In response to this subtask, the resulting products were fundamental to developing the human response parameters for revisions to the NATO CBRN casualty estimation methodology:

- *Parameters for Estimation of Casualties from Exposure to Specified Biological Agents: Brucellosis, Glanders, Q Fever, SEB and Tularemia*, IDA D-4132, November 2010
- *Addenda to Allied Medical Publication 8, NATO Planning Guide for the Estimation of Chemical, Biological, Radiological and Nuclear (CBRN) Casualties (AMedP-8(C)) –Parameters for Estimation of Casualties from Exposure to Specified Biological Agents*, IDA D-4133, January 2011
- *Parameters for Estimation of Casualties from Additional Chemical and Biological Agents*, IDA P-5140, September 2015
- *Parameters for Estimation of Casualties from Ammonia (NH<sub>3</sub>), Tabun (GA), Soman (GD), Cyclosarin (GF), and Lewisite (L)*, IDA P-5158, September 2015
- *ARS and Medical Radiation Countermeasures in a Nuclear Environment*, IDA NS D-5165, March 2014
- *Parameters for Estimation of Casualties from First and Third Degree Flash Burns*, IDA P-8374, March 2017

Military Research Volunteer (MRV) analysis (first listed in Amendment 4) was tasked in multiple years, but because access was delayed and the records were not in a form suitable for analysis, IDA did not produce a formal deliverable, although several informal products (see Appendix B) were provided that described the MRV records as IDA was able to access them. Similarly, derivation and recommendation of human response methodological parameters for psychological casualties in CBRN incidents (first listed in Amendment 5) did not result in a formal product because no data were identified that differentiated psychological casualties in CBRN incidents from those resulting from natural disasters or combat.

Some of these analyses led to other studies, or to presentations to public fora to publicize the results of the analyses:

- *Bioscavengers as Medical Chemical Countermeasures*, IDA P-5157, July, 2014
- *Research and Development Strategies for the Current and Future Medical Treatment of Radiation Casualties*, IDA P-5160, September 2014
- *RITN Overview of Radiological Weapons*, IDA NS-D-5549, June 2015

One product, however, was consistently tasked in each amendment, even though what was included in this product changed from year to year. This was the annual report on the extension of the AMedP-8(C) methodology to new agents, materials, and conditions. The

current summary analysis—as described in the introduction to be a review of all of the publications from analyses performed in 2009–2016—is the eighth and final of those annual reports: the *2016 Review on the Extension of the AMedP-8(C) Methodology to New Agents, Materials, and Conditions: 2009–2016 IDA Project Summary*. Previous versions were:

- *2009 Report on ...*, IDA D-3945, October 2009
- *2010 Review on ...*, IDA D-4131, December 2010
- *2011 Review on ...*, IDA D-4486, December 2011
- *2012 Review on ...*, IDA D-4727, October 2013
- *2013 Review on ...*, IDA D-4802, June 2014
- *2014 Review on ...*, IDA D-5226, August 2015
- *2015 Review on ...*, IDA D-8047, June 2016

## **E. Implementation and Coordination of the NATO CBRN Casualty Estimation Methodology into Medical Planning Architecture**

This subtask, in the initial task order, directed IDA to address CBRN casualty estimation tools and doctrine: “IDA will identify current and proposed National (DOD and other Federal agency) and NATO doctrine and medical planning tools and methodologies which utilize CBRN casualty estimates in order to provide recommendations to DOD on the coordination and synchronization of these with the AMedP-8(C) methodology.”<sup>12</sup>

These “tools” included:

- Joint Medical Analysis Tool (JMAT)
- Nuclear Biological and Chemical Casualty Resource and Estimation Support Tool (NBC CREST)
- Defense Medical Standardization Board (DMSB) Common User Database (CUD, later called CBRN Task-Time-Treater Files (TTTF))
- The NATO Allied Command Transformation (ACT) casualty estimation tool
- The Center for Army Analysis (CAA) CBRN casualty estimation tool
- The U.S. Army Public Health Command (PHC) Military Exposure Guidelines (MEGs)

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<sup>12</sup> IDA Task Order CA-6-3079, Amendment 0, 3.

- The Joint Medical Planning Tool (JMPT)/Tactical Medical Logistics Planning Tool (TML+)
- Other tools in use throughout the federal government, as identified by sponsor

The subtask description was simplified in Amendment 6 to “IDA will support the implementation of the NATO casualty estimation methodology by current and proposed National (Department of Defense (DOD) and other Federal agency) and NATO doctrine, medical planning tools, and methodologies that use CBRN casualty estimates.”<sup>13</sup>

In response to this subtask, the products delivered were the studies and analyses that assess the application of the NATO CBRN casualty estimation methodology into existing or proposed tools and doctrine:

- *Implementation of AMedP-8(C) within the U.S. Military Medical Planning Structure: Tools, Process and Doctrine*, IDA D-3956, October 2009
- *Comparison of Terminology, Parameters and Values Used in FM 300.12, TG 230 and AMedP-8(C)*, IDA D-4134, October 2010
- *The Integration of the AMedP-8(C) Casualty Estimation Model with Medical Logistical Requirements Models*, IDA D-4464, July 2012
- *Comparison of Chemical and Biological Human Response Parameter Values in NATO and U.S. Doctrine*, IDA D-4799, June 2014
- *Allied Joint Medical Doctrine for Support to CBRN Defensive Operations Study Draft 1 (AJMedP-7 SD.1)*, IDA NS P-4872, May 2012
- *Casualty Estimation for Nuclear and Radiological Weapons*, IDA P-5220, June 2016
- *Analysis of NATO Doctrine for Biosurveillance*, IDA D-5224, October 2015
- *The Application of Contagious Disease Epidemiological Models to Known Troop Structure and Movement*, IDA D-5225, March 2016
- *Methodology for the Assessment of the Credibility of Radiological Materials as Weapons*, IDA D-8048, June 2016

Although this constitutes an extensive review of the tools in use in NATO and the United States for CBRN casualty estimation, it is not within the authority of IDA or OTSG to actually revise these tools, and the proponents of these tools have not yet implemented any of the recommended revisions.

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<sup>13</sup> IDA Project Description CA-6-3079, Amendment 6, 3.

## **F. Medical CBRN Defense Program-Specific Reviews and Analysis**

This subtask of CA-6-3079 (originally Subtask 4 but moved to Subtask 5 in Amendment 4) allowed the sponsor to identify topics for analysis as they were identified during the course of time, and according to the priority of the sponsor's requirements:

IDA will provide analyses and studies to OTSG in support of any urgent DOD identified requirement of medical CBRN defense for U.S. and NATO service members in preparation for, during, and recovering from, combat. These studies will include conducting the necessary research and analysis, documenting research findings, briefing and publishing the findings to OTSG, for possible integration of the research findings into the Medical CBRN Program. OTSG recognizes that this effort may displace IDA's efforts on other (perhaps ongoing) aspects of the task to provide analytical support to the Medical CBRN Program. Since access to additional resources may be restricted, OTSG will provide IDA a prioritization schema for current and anticipated tasks relative to required studies.<sup>14</sup>

This subtask allowed considerable discretion on the part of the sponsor to identify and prioritize analyses to address medical CBRN defense. Each amendment allowed the opportunity to specify studies of current interest to the sponsor; for example, the original task order read: "The product of Subtask 4 will be the drafts of meeting notes, briefings, analytical results, articles prepared for publication and additional documentation, memos, and white papers produced as a result of the studies and analyses required."<sup>15</sup> This typically also included specific analyses and studies in support of the Medical CBRN Defense Program.

In response to this subtask, the fundamental products delivered were the analyses and studies in support of urgent DOD-identified requirements for medical CBRN defense:

- *Putting the Puzzle Together: A Comprehensive Study of the Military Medical Management of Nuclear Casualties*, IDA D-4319, July 2011
- *Review of CBRN Terminology in TG316 and AMedP-8(C)*, May 2013, IDA D-4726, May 2013
- *NATO CBRN Medical Working Group Table-top Exercise on International Health Regulations: Documentation and Output*, IDA D-4798, May 2014
- *Consideration of Neutron Radiation Following a Nuclear Detonation*, IDA NS D-8086, June 2016

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<sup>14</sup> IDA Task Order CA-6-3079, Amendment 0, 4.

<sup>15</sup> Ibid.

- *Differentiating Between Naturally Occurring and Intentionally Caused Outbreaks of Disease in Deployed U.S. Forces*, IDA D-8372, March 2017
- *2016 Review on the Extension of the AMedP-8(C) Methodology to New Agents, Materials, and Conditions: 2009–2016 IDA Project Summary*, IDA D-8375, March 2017 (this document)

## **G. CBRN Medical Doctrine**

This subtask, which first appeared in Amendment 4, explicitly separated doctrinal development from the other analyses specified in the task order and directed IDA to “support the integration of CBRN medical support concepts into U.S. and NATO doctrine.”<sup>16</sup> This came about as NATO revised the organization and numbering scheme for their doctrine, and introduced two new publications to serve as overarching guidance for medical CBRN defense. This resulted in four NATO publications for which the OTSG Medical CBRN Defense Officer, as the custodian, was either solely responsible or a significant contributing author:

- Chapter 8, “Medical Support in the CBRN Environment,” of Allied Joint Publication 4-10, *Allied Joint Medical Support Doctrine* (AJP-4.10)
- *Allied Joint Medical Publication 7, Allied Joint Medical Doctrine for Support to Chemical, Biological, Radiological, and Nuclear (CBRN) Defensive Operations* (AJMedP-7)
- *NATO Allied Medical Publication 7.5, NATO Planning Guide for the Estimation of CBRN Casualties* (AMedP-7.5), formerly *Allied Medical Publication 8, NATO Planning Guide the Estimation of CBRN Casualties* (AMedP-8(C)) [Note that this was addressed in Subtask 1 of each amendment.]
- *NATO Allied Medical Publication 7.6, Allied Commanders’ Guidance for Medical Operations in Support of CBRN Defensive Operations* (AMedP-7.6), formerly *Allied Medical Publication-7 Concept of Operations of Medical Support in Chemical, Biological, Radiological, and Nuclear Environments* (AMedP-7(D))

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<sup>16</sup> Ibid., Amendment 4, 4.

In response to this subtask, the formal products delivered were the studies and analyses to support the integration of CBRN medical support concepts into U.S. and NATO doctrine:

- Chapter 8, “Medical Support in the CBRN Environment,” of AJP-4.10, *Allied Joint Doctrine for Medical Support, Study Draft 1 (Ch 8 AJP-4.10 SD.1)*, IDA NS-P-4876, June 2012
- *Allied Joint Medical Doctrine for Support to CBRN Defensive Operations Study Draft 2 (AJMedP-7 SD.2)*, IDA NS-P-4932, October 2012
- *Allied Joint Medical Doctrine for Support to CBRN Defensive Operations Study Draft 3 (AJMedP-7 SD.3)*, IDA NS-P-4933, February 2013
- *Allied Joint Medical Doctrine for Support to CBRN Defensive Operations Study Draft 4 (AJMedP-7 SD.4)*, IDA NS-P-4982, February 2014
- *Allied Concept of Medical Operations in Support to CBRN Defensive Operations Study Draft 1 (AMedP-7(E) SD.1)*, IDA NS-D-4988, February 2013
- *Allied Commanders’ Guidance for Medical Operations in Support of CBRN Defensive Operations, Study Draft 1 (AMedP-7.6 SD.1)*, IDA NS-P-4983, July 2015
- *Allied Joint Medical Doctrine for Support to Chemical, Biological, Radiological, And Nuclear (CBRN) Defensive Operations, Final Draft (AJMedP-7 FD)*, IDA NS-P-5153, July 2014
- *NATO Allied Medical Publication 7.6, Allied Commanders’ Guidance for Medical Operations in Support of CBRN Defensive Operations, Study Draft 2 (AMedP-7.6 SD.2)*, IDA NS-P-5363, June 2016
- *Analysis of Policy and Doctrine Supporting the Management of Operational Exposures to Ionizing Radiation*, IDA D-8020, June 2016
- *Review of CBRN Medical and Operational Terminologies in NATO CBRN Doctrines*, IDA D-8088, August 2016
- *NATO Allied Medical Publication 7.6, Commander's Guide on Medical Support to Chemical, Biological, Radiological, and Nuclear (CBRN) Defensive Operations, Edition A, Final Draft (AMedP-7.6 FD)*, IDA NS D-8254, October 2016
- *Review of Human Factors and Medicine Panel Reports*, IDA D-8371, February 2017
- *Lessons Learned from NATO Exercise Clean Care 2016*, IDA D-8373, March 2017



## H. Informal Products

In addition to the formal deliverables with IDA publication numbers listed above and in Appendix A, IDA also provided informal products, which respond to short-term taskings or ongoing document analyses. These are listed in Appendix B, as they were identified in the monthly reports from IDA to OTSG, in the order of the dates they were delivered. Some of the more significant of the informal products were:

- Internal IDA AMedP-8 Database Tool, November 1, 2009
- NATO Feb 09 TTX, for the NATO CBRN Medical Working Group (CBRNMedWG) Meeting, Brussels, BELGIUM, February 3, 2010
- SharePoint site, <https://collab.ida.org/CBHumanResponseModeling>, to support information exchange on human response to CBRN agents, March 31, 2010
- AMedP-8(C) and MEG Comparison, May 28, 2010
- Poster presentation on the impact of medical countermeasures and treatment on the CBRN casualty estimate, Bundeswehr Medical Biological Defense conference, Munich, GERMANY, October 26, 2011
- PowerPoint presentation, “Human Response Modeling Parameters for Five Additional Non-Contagious Biological Agents: Brucellosis, Glanders, Q Fever, SEB, and Tularemia,” Bundeswehr Medical Biological Defense conference, October 26, Munich, GERMANY, 2011
- PowerPoint presentation, “Five More Bio Agent Parameters,” 33rd CBRNMedWG meeting, Brussels, BELGIUM, February 8, 2012
- Presentation, “Allied Joint Medical Doctrine for Support to CBRN Defensive Operations,” to the NATO Operational Medical Conference (NOMC), Ieper, BELGIUM (AJMedP7 NOMC Brf DRAFT v3a jkb.pptx), October 25, 2012
- IHR TTX Read Ahead.docx, CBRNMedWG meeting, Brussels, BELGIUM, January 18, 2013
- AMedP-6 SD.3 CRM from IDA.xlsx, April 26, 2013
- Presentation, “Seven Bio Agent Parameters\_BioMedAC 2013.pptx,” for 32nd NATO Biological Medical Advisory Committee (BioMedAC) on modeling of new agents for AMedP-8, Munich, GERMANY, October 4, 2013
- Presentation, “Anthrax Infectivity SMO 2014.pptx,” BioMedAC meeting, Ieper, BELGIUM, April 3, 2014
- Presentation, “Bioforensics and the BioMedAC.pptx,” BioMedAC meeting, Ieper, BELGIUM, April 15, 2014

- Parameters for Estimation of Casualties from 10 Additional Chemical and Biological Agents Status Summary.docx and -.ppt, June 30, 2015
- Parameters for Estimation of Casualties from 5 Chemical Agents Status Summary.docx and -.ppt, June 30, 2015
- Casualty Estimation for Nuclear and Radiological Weapons Status Summary.docx and -.ppt, June 30, 2015
- MFR “Analysis of CBRN Psychological Casualties,” October 27, 2015
- Consolidated IDA comments on NATO Allied Medical Publication 7.1, *Medical Management of CBRN Casualties*, Study Draft 4 (AMedP-7.1 SD.4), December 2, 2015
- Afghan Troop Movement Data Feb 2016.xlsx, February 26, 2016
- Scanned and redacted MRV files posted on a shared File Transfer Protocol site, September 6, 2016
- SD 1.45 Analysis.pptx, November 15, 2016
- Index of MRV Records 30 November 2016.xlsx, November 30, 2016

### **3. Observations, Conclusions, and Recommendations**

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#### **A. Summary of Deliverables**

This analysis provides a summary of products as reported in 93 monthly reports. The IDA team identified 64 formal and 108 informal products. These deliverables included the development and promulgation of new or updated NATO doctrine on CBRN casualty estimation and operational guidance for medical CBRN defense. Fourteen chemical agents and twelve biological agents were added to the CBRN casualty estimation methodology. Table top exercises were developed, executed, and analyzed to evaluate concepts of the CBRN casualty estimation methodology, medical CBRN operations, and the impact of international health regulations. IDA reviewed existing and proposed doctrine under development by other agencies and provided comments to OTSG to be considered with respect to those comments provided by the Services, Joint Staff, and DOD agencies. Appendix A provides a listing of formal deliverables under CA-6-3079 (by IDA publication number), and Appendix B provides a list of informal deliverables (by delivery date).

#### **B. Significant Impact of Task Order CA-6-3079**

The impact of this multi-year effort of analytic support to the OTSG Medical CBRN Defense Staff Officer and the Medical Branch of the JRO-CBRND cannot be quantified. A qualitative estimation can be made that this set of analyses has provided methodologies, doctrine, and exercise evaluation that would not otherwise have been available, and as such it contributed significant recommendations for improvements in the medical defense capabilities of the U.S. Army, Joint Staff, DOD, and NATO.

Alternatively, these analyses did not change the response to any significant CBRN incident or attack, because none occurred during the period of the analysis. Further, no software tool exists that implements the CBRN casualty estimation methodology, although several are proposed at the national and Allied level. Without a software tool, the methodology requires unique training and capabilities to account for all of the various factors and parameters that lead to a CBRN casualty estimate. Although highly fortuitous, the lack of any significant CBRN incident or attack somewhat reduces the real value of this analysis: if no attack ever occurs, no analysis is required.

## **C. Recommendations**

The bottom line result of these analyses, as documented in the products described, is that the U.S. Army, Joint Staff, DOD, and NATO are better prepared to defend against a CBRN attack, and to operate in that environment to provide medical care for the resulting casualties. CBRN attacks fall into the rubric of “low probability/high impact” events that form the basis of many health, safety, and defense concepts. As resources permit, and in response to national and international priorities, we recommend that medical CBRN defense continue to be a topic for studies and analyses.

## Appendix A. Documents Delivered

Title	Abstract	IDA Publication Information	Report Date
<b>2009 Report on the Extension of the AMedP-8(C) Methodology to New Agents, Materials, and Conditions</b>	<p>NATO is expected to consider ratification of <i>Allied Medical Publication 8 (C): NATO Planning Guide for the Estimation of CBRN Casualties</i> in 2010. Within AMedP-8(C), the parameters for implementing the human response methodology are presented for only a limited sample of CBRN agents and effects. IDA has reviewed literature relevant to the extension of AMedP-8 to include additional CBRN agents and effects, psychological casualties, and civilian casualty estimation. This document identifies agents, effects, materials, and conditions of interest to DOD (but not currently included in AMedP-8(C)), identifies gaps in available knowledge, and estimates the level of work required to incorporate new agent models into AMedP-8. This document may be considered a supplement to the AMedP-8(C) Technical Reference Manual for U.S. purposes. This report is envisioned as the first in a series of annual reports, updated as new lists of agents of concern are identified and as needed analysis of required effort for development of the AMedP-8(C) parameters.</p>	<p>D-3945 Curling, Carl A., LaViolet, Lucas L., Burr, Julia K. Unclassified 62 p.</p>	<p>10/1/2009</p>
<b>Implementation of AMedP-8(C) within the U.S. Military Planning Structure: Tool, Process and Doctrine</b>	<p>NATO is expected to consider ratification of <i>Allied Medical Publication 8 (C): NATO Planning Guide for the Estimation of CBRN Casualties</i> in 2010. This document describes the implications of ratification and implementation of AMedP-8(C) within the Department of Defense. Specifically, it describes the processes and tools now in place and under development within the</p>	<p>D-3956 Burr, Julia K., Curling, Carl A., LaViolet, Lucas L. Unclassified</p>	<p>10/1/2009</p>

Title	Abstract	IDA Publication Information	Report Date
<b>A New Methodology for CBRN Casualty Estimation Over Time</b>	<p>DOD for chemical, biological, radiological and nuclear casualty estimation, identifies the issues and task needed to support implementation of AMedP-8(C), and makes a limited set of recommendations to DOD on the coordination and synchronization of AMedP-8(C) with other components of the DOD medical planning structure.</p> <p>The Human Response Injury Profile (HRIP) methodology incorporates three different agent-specific approaches to provide an estimate of casualties occurring as a consequence of chemical, biological, radiological, and nuclear (CBRN) attacks against military targets for planning purposes. The three approaches—chemical, radiological, and nuclear (CRN); non-contagious biological; and contagious biological—all develop user-defined, time-based casualty and fatality estimates based on maps, or progressions, of underlying symptoms (and signs for biological agents) and their severity changes over time. This paper provides a general overview of the HRIP as well as of each of the three component approaches, including inputs, human response, and the casualty estimation processes.</p>	<p>34 p.</p> <p>NSD-3967</p> <p>Disraelly, Deena S., Walsh, Terri J., Zirkle, Robert A.</p> <p>Unclassified</p> <p>16 p.</p>	7/1/2010
<b>Methodology for Estimating Casualties in the Aftermath of Radiological Events</b>	<p>Chemical, biological, radiological, and nuclear (CBRN) attacks and disasters, while uncommon, are significant both for the number of fatalities and injuries they produce and for the physical damage they can potentially wreak. As such, military forces perceive that CBRN attacks and disasters may impact them and plan and prepare for these events accordingly. Therefore, it is extremely important for military forces to have a planning methodology that allows them to estimate casualties which might result from these events. To address this issue, the Human Response Injury Profile (HRIP) methodology was developed in support of the North Atlantic Treaty Organization (NATO) to improve its casualty estimation capabilities for planning purposes. HRIP relies on time-based maps, or progressions, of underlying symptoms (and signs for biological agents) and their severity changes over time to determine user-defined casualty estimates following CBRN events. The purpose of this article is to describe one application of that methodology: the HRIP methodology used to estimate casualties following a radiological event.</p>	<p>NSD-4058</p> <p>Zirkle, Robert A., Walsh, Terri J., Disraelly, Deena S., Curling, Carl A.</p> <p>Unclassified</p> <p>16 p.</p>	3/1/2010

Title	Abstract	IDA Publication Information	Report Date
<b>A New Methodology for Estimating Nuclear Casualties as a Function of Time</b>	The Human Response Injury Profile (HRIP) nuclear methodology provides an estimate of casualties occurring as a consequence of nuclear attacks against military targets, for planning purposes. The approach develops user-defined, time-based casualty and fatality estimates based on progressions of underlying symptoms and their severity changes over time. This paper provides a description of the HRIP nuclear methodology and its development, including inputs, human response, and the casualty estimation process.	NSD-4059 Zirkle, Robert A., Walsh, Terri J., Disraelly, Deena S., Curling, Carl A. Unclassified 23 p.	5/3/2010
<b>A New Methodology for Estimating Nerve Agent Casualties as a Function of Time</b>	The Human Response Injury Profile (HRIP) nerve agent methodology provides an estimate, for planning purposes, of casualties occurring following military target exposure to nerve agents. The approach develops user-defined, time-based casualty and fatality estimates based on progressions of symptoms and their severity changes over time. This paper provides a general description of the HRIP nerve agent methodology development and implementation. In addition, the parameters and an illustrative example are described to demonstrate the human response and casualty estimation over time for nerve agents Sarin and VX.	NSD-4060 Disraelly, Deena S., Walsh, Terri J., Zirkle, Robert A., Curling, Carl A. Unclassified 11:00 PM	9/1/2011
<b>A New Methodology for Estimating Blister Agent (Mustard (HD)) Casualties as a Function of Time</b>	The Human Response Injury Profile (HRIP) methodology uses time-based progressions of underlying symptoms and their severity changes over time to determine user-defined casualty and fatality estimates from chemical, biological, radiological, and nuclear (CBRN) events. This paper provides an overview of the HRIP mustard agent (HD) methodology, describing inputs, human response, and the casualty estimation processes. The injury profiles for the HD vapor inhalation, vapor percutaneous, and ocular exposure routes are provided, and examples are provided to show how multiple routes of exposure can be combined to estimate the composite HD injury and resulting casualty effects.	NSD-4061 Disraelly, Deena S., Walsh, Terri J., Zirkle, Robert A., Curling, Carl A. Unclassified 21 p.	12/1/2010
<b>A New Methodology for Estimating Non-Contagious Biological</b>	The Human Response Injury Profile (HRIP) methodology was developed to provide planners with an improved ability to estimate casualties resulting from exposure to a wide range of hazards including chemical agents, contagious and non-contagious biological agents, radiological dispersal	NSD-4062 LaViolet, Lucas L., Curling, Carl A. Unclassified	6/1/2010

Title	Abstract	IDA Publication Information	Report Date
<b>Agent Casualties as a Function of Time</b>	devices, nuclear fallout, and prompt nuclear effects. Casualties are modeled to result solely from the injuries caused by exposure to one of these hazards. The purpose of this article is to describe one application of the new methodology: the HR from inhalation exposure to non-contagious biological agents.	34 p.	
<b>A New Methodology for Estimating Contagious Biological Agent Casualties as a Function of Time</b>	The Human Response Injury Profile (HRIP) methodology uses time-based progressions of underlying symptoms and their severity changes over time to determine user-defined casualty and fatality estimates from chemical, biological, radiological, and nuclear (CBRN) events. This paper provides an overview of the implementation of the HRIP contagious biological agent methodology for use in estimating casualties resulting from plague and smallpox exposure. The article describes inputs, human response, and the casualty estimation processes, as well as the details and parameters used for estimating contagious spread of plague or smallpox using the susceptible, exposed and infected, infectious, removed, and prophylaxis efficacious (SEIRP) model.	NSD-4063 Disraelly, Deena S., Walsh, Terri J., Curling, Carl A. Unclassified 12:00 AM	9/1/2010
<b>Technical Reference Manual: NATO Planning Guide for the Estimation of Chemical, Biological, Radiological, and Nuclear (CBRN), Allied Medical Publication-8(C)</b>	In 2010, a new version of the <i>North Atlantic Treaty Organization (NATO) Allied Medical Publication 8</i> (i.e., AMedP-8(C)), <i>NATO Planning Guide for the Estimation of CBRN [Chemical, Biological, Radiological, and Nuclear] Casualties</i> was distributed for ratification to the Allied Nations. This Technical Reference Manual (TRM) supplements the AMedP-8(C) by documenting the development process, rationales, underlying data, and additional information utilized to establish the calculation of the environments, and the human response and casualty estimation methodologies which comprise the AMedP-8(C) methodology. The IDA study team devised a "General Equation" to calculate the environments by converting an exposure environment to a dose, dosage, or insult and allows for the consideration of breathing rates, shielding, and personal protection, among other factors. The human response and casualty estimation methodologies employ profiles of injury severity over time to describe the human response to agents and insults and then result in an estimate of the casualty's status. The purpose of the TRM is to make the data underlying	D-4082 Curling, Carl A., Burr, Julia K., Danakian, Lusine, Disraelly, Deena S., LaViolet, Lucas L., Walsh, Terri J., Zirkle, Robert A. Unclassified 332 p.	8/2/2010



Title	Abstract	IDA Publication Information	Report Date
<b>Exercise "Dread Night": Using Allied Medical Publication-8(C) to Estimate Chemical, Biological, Radiological, and Nuclear (CBRN) Casualties</b>	<p>the components of the AMedP-8(C) methodology and the process through which it was developed as clear as possible and to enable analysts and modelers to understand and replicate these results and procedures.</p> <p>The U.S. Army Office of the Surgeon General (OTSG) tasked IDA with planning and conducting "Dread Night," a tabletop exercise in which participants were expected to develop a casualty estimate for a planning scenario involving an anthrax attack against NATO forces located in and around Kabul International Airport in Afghanistan. The exercise was designed to promote familiarity with and understanding of the casualty estimation methodology contained in <i>Allied Medical Publication 8(C): NATO Planning Guide for the Estimation of CBRN Casualties</i> (AMedP-8(C)). This exercise was conducted as part of the 31st meeting of the NATO Military Committee Medical Standardization Board Chemical, Biological, Radiological and Nuclear (CBRN) Medical Working Group, held 1-3 February 2010 at NATO headquarters in Brussels, Belgium. This paper documents IDA's work in the development of the exercise, the conduct of the exercise itself, and the results. Exercise scripts, worksheets, background materials, and outputs are provided as Appendices.</p>	<p>D-4130</p> <p>Burr, Julia K., Curling, Carl A., LaViolet, Lucas L.</p> <p>Unclassified</p> <p>124 p.</p>	8/2/2010
<b>2010 Review on the Extension of the AMedP-8(C) Methodology to New Agents, Materials, and Conditions</b>	<p>This is the second in a series of annual reviews on the extension of the casualty estimation methodology described in <i>Allied Medical Publication 8(C): NATO Planning Guide for the Estimation of CBRN Casualties</i> in 2010 (AMedP-8(C)). While the 2009 report focused on prioritizing additional agents to be modeled, this review describes the manner in which medical countermeasures would be incorporated into AMedP-8(C) models for agents of various types and considers the level of effort required to do so. It focuses on those agents included or proposed for inclusion in the Common User Database, a collection of chemical, biological, radiological, and nuclear (CBRN) treatment protocols and estimated personnel and material requirements developed and maintained by the Defense Medical Standardization Board.</p>	<p>D-4131</p> <p>Curling, Carl A., LaViolet, Lucas L., Burr, Julia K.</p> <p>Unclassified</p> <p>24 p.</p>	12/1/2010

Title	Abstract	IDA Publication Information	Report Date
<b>Parameters for Estimation of Casualties from Exposure to Specified Biological Agents: Brucellosis, Glanders, Q Fever, SEB and Tularemia</b>	<p>The U.S. Army Office of The Surgeon General (OTSG) tasked IDA with developing human response models for five prospective non-contagious biological warfare agents, using the methodology contained in <i>Allied Medical Publication 8(C): NATO Planning Guide for the Estimation of CBRN Casualties</i> (AMedP- 8(C)). The five agents considered in this document are brucellosis, glanders, Q fever, staphylococcal enterotoxin B (SEB), and tularemia. For each agent, the authors propose parameters and values for models of infectivity, lethality, incubation period, and duration of illness. The authors also describe profiles of illness over time for each agent based on symptoms and their associated severity, using the scale developed in AMedP-8(C). The work described in this document is based on an extensive review of available literature and subsequent evaluation of existing models, experimental data sets--both human and animal--and clinical case studies.</p>	<p>D-4132 Curling, Carl A., Burr, Julia K., Hebner, Margaret C., LaViolet, Lucas L., Lee, Preston J., Bishop, Kristen A. Unclassified 200 p.</p>	<p>11/1/2010</p>
<b>Addenda to Allied Medical Publication 8, "NATO Planning Guide for the Estimation of Chemical, Biological, Radiological, and Nuclear (CBRN) Casualties" (AMedP-8(C)) -- Parameters for Estimation of Casualties from Exposure to Specified Biological Agents</b>	<p>The <i>North Atlantic Treaty Organization (NATO) Allied Medical Publication 8(C), NATO Planning Guide for the Estimation of CBRN Casualties</i> (AMedP-8(C)) currently describes a methodology for estimating the numbers of persons developing illness or dying from anthrax, botulism, Venezuelan equine encephalitis, plague, and smallpox. Five additional biological warfare agents have recently been modeled according to the same methodology; these consist of the causative agents of brucellosis, glanders, Q fever, and tularemia, as well as the biotoxin staphylococcal enterotoxin B. Incorporating these five agents into the published NATO guide will require substantial changes to several chapters of the document as well as three of its annexes.</p> <p>This document presents the text, tables, and figures that will need to be added to AMedP-8(C) if these agents are integrated into the document. Each chapter of this document contains the addenda to one chapter or annex in AMedP-8(C), and sections are written to be consistent with the existing contents of the NATO document. In addition to the addenda themselves, this document provides instructions on where to add each new</p>	<p>D-4133 Curling, Carl A., Burr, Julia K., LaViolet, Lucas L., Lee, Preston J., Bishop, Kristen A. Unclassified 68 p.</p>	<p>1/3/2011</p>

Title	Abstract	IDA Publication Information	Report Date
<b>Comparison of Terminology, Parameters and Values Used in FM 300.12, TG 230 and AMedP-8(C)</b>	<p>section to facilitate the process of updating AMedP-8(C) with the five recently modeled agents.</p> <p>This document reviews three documents and explains disparities in terminology, parameters and values, among them: <i>FM 3-100.12, Risk Management</i>; <i>USACHPPM Technical Guide 230, Chemical Exposure Guidelines for Deployed Military Personnel</i> (TG 230); and <i>Allied Medical Publication 8(C): NATO Planning Guide for the Estimation of CBRN Casualties</i> (AMedP-8(C)). Each of these documents describes a methodology that incorporates one or more scales of severity associated with the outcome of an attack against military forces. While TG 230 and AMedP-8(C) both assign dose/dosage values to various points along these scales, there are clear and obvious differences between them. There are three main reasons for these differences. First, the values are derived from different sources. Second, the TG 230 and AMedP-8(C) values differ in their fundamental scope. Third, the AEGLs on which the TG 230 are based include consideration of toxic load phenomena—the ability of the body to clear toxins over time—whereas AMedP-8(C) does not. Yet despite their differences, use of the two approaches may in certain cases result in a similar outcome depending on assumptions made about how severe an individual's injuries would be before they entered the medical system.</p>	<p>D-4134</p> <p>Burr, Julia K., Curling, Carl A., LaViolet, Lucas L.</p> <p>Unclassified</p> <p>36 p.</p>	9/1/2010
<b>A New Methodology for Estimating Nerve Agent (Sarin (GB)/VX) Casualties as a Function of Time: Implementing the Human Response Injury Profile Nerve Agent Methodology</b>	<p>The Human Response Injury Profile (HRIP) nerve agent methodology provides an estimate, for planning purposes, of casualties occurring following military target exposure to nerve agents. The approach develops user-defined, time-based casualty and fatality estimates based on progressions of symptoms and their severity changes over time. This paper provides a general description of the HRIP nerve agent methodology development and implementation. In addition, the parameters and an illustrative example are described to demonstrate the human response and casualty estimation over time for nerve agents Sarin and VX.</p>	<p>NSD-4146</p> <p>Disraelly, Deena S., Walsh, Terri J., Zirkle, Robert A., Curling, Carl A.</p> <p>Unclassified</p> <p>5:00 PM</p>	9/1/2011

Title	Abstract	IDA Publication Information	Report Date
<b>IDA Allied Medical Publication-8(C) NATO Planning Guide for the Estimation of CBRN Casualties Casualty Estimation Tool (CET) Reference Notes</b>	<p>The IDA AMedP-8(C) Casualty Estimation Tool (CET) is an electronic implementation of the Allied Medical Publication AMedP-8(C) methodology, described in the IDA document <i>AMedP-8(C) NATO Planning Guide for the Estimation of CBRN Casualties Ratification Draft 1</i> (NSP-4492). IDA researchers can use the tool to support analyses requiring estimates of chemical, biological, radiological, or nuclear (CBRN) casualties. IDA developed the CET in order to have a tool for use in analyses based upon, and in verification of, the AMedP-8(C) methodology. The CET is a Microsoft Access® 2003 database application with a menu-driven user interface and can also be run under Microsoft Access® 2007. It is designed to output data to an AMedP-8-style set of casualty tables. The CET can provide results for five biological agents (Anthrax, Botulism, Plague, Smallpox, and VEE), three chemical agents (GB, VX, and HD), three nuclear effects (radiation, blast, and thermal fluence), and radiological exposure scenarios. Finally, the CET can be used to compute exposure to nuclear effects for 22 nuclear scenarios. The purpose of these reference notes is to provide brief instructions for using the CET.</p>	<p>NSD-4154 Curling, Carl A., Flythe, Mary Catherine Unclassified 46 p.</p>	<p>9/1/2010</p>
<b>Putting the Puzzle Together: A Proposal for a Comprehensive Study of the Military Medical Management of Nuclear Casualties</b>	<p>This document proposes a study to assess the capabilities of the U.S. military health care system to meet the medical management requirements that would result from the use of a nuclear weapon against U.S. military forces in a foreign theater of war. The proposed study would provide policy makers and planners with recommendations to address shortfalls and utilize the optimum strategies for the management of nuclear casualties. The study concept is to identify both the required and available capabilities to manage the patient stream resulting from a nuclear attack, to determine at what point the required capabilities exceed those available, and to quantify and narrow the gap between the two cases. Capability includes both medical resources (e.g., supplies, equipment, and personnel) and the processes by which those resources are brought to bear. The study plan considers medical management capabilities to include, at minimum, those needed for the collection, evacuation, decontamination, triage, stabilization, and treatment of casualties, as well as the associated medical logistics.</p>	<p>D-4319 Curling, Carl A., Burr, Julia K., LaViolet, Lucas L., Lee, Preston J. Unclassified 50 p.</p>	<p>7/1/2011</p>

Title	Abstract	IDA Publication Information	Report Date
<b>The Integration of the AMedP-8(C) Casualty Estimation Model with Medical Logistical Requirements Models</b>	<p>The main objective of this study is to link the <i>Allied Medical Publication 8(C): NATO Planning Guide for the Estimation of CBRN Casualties</i> (AMedP-8(C)) to the Common User Database (CUD). To fully implement the AMedP-8(C) casualty estimation methodology, the casualty estimate must be integrated into the medical logistical models and tools used by medical planners providing medical support to the chemical, biological, radiological, and nuclear (CBRN) battlefield. The CUD provides an authoritative data-set of clinical and medical logistics data used by the Department of Defense (DOD). The casualty estimate must be able to act as an input to the medical logistical tools, and the medical logistical tools (and their underlying models and databases) must be able to effectively use the casualty estimate. By comparing the parameters and outputs of AMedP-8(C) with the parameters and inputs of the CUD, this study attempts to link all possible outputs of AMedP-8(C) to patient condition codes in the CUD and corresponding treatment briefs and it suggests changes or modifications to facilitate the unity of both sources.</p>	<p>D-4464 Curling, Carl A., Burr, Julia K., LaViolet, Lucas L. Unclassified 98 p.</p>	7/2/2012
<b>The Impact of Medical Care on Casualty Estimates from Battlefield Exposure to Chemical Biological and Radiological Agents and Nuclear Weapon Effects</b>	<p>This study analyzed the impact of medical care on the chemical, biological, radiological, and nuclear (CBRN) casualty estimation methodology described in <i>Allied Medical Publication 8 (AMedP-8(C)): NATO Planning Guide for the Estimation of CBRN Casualties</i>. This document proposes the AMedP-8(C) patient estimation methodology (P8PEM) as an extension of the AMedP-8(C) casualty estimation methodology (P8CEM). Starting with the products of the P8CEM, specifically the estimate of the Wounded in Action (WIA) casualties entering the medical system, the P8PEM characterizes these casualties using parameters that allow the user to consider the effect of medical treatment. The P8PEM both identifies the WIA casualties as patients within the medical system and estimates the time at which they progress to other casualty categories including Died of Wounds (DOW), Return to Duty (RTD), and Convalescent. By contrasting the outputs of the P8PEM with those of the P8CEM, users can easily quantify the benefit of medical care to patients and estimate the burden to the medical system. Including the results of this study within the current</p>	<p>D-4465 Curling, Carl A., Burr, Julia K., LaViolet, Lucas L., Bishop, Kristen A., Lee, Preston J. Unclassified 120 p.</p>	3/1/2012

Title	Abstract	IDA Publication Information	Report Date
<p><b>Addenda to Allied Medical Publication 8, "NATO Planning Guide for the Estimation of Chemical, Biological, Radiological, and Nuclear (CBRN) Casualties" (AMedP-8(C)) to Consider the Impact of Medical Treatment on Casualty Estimation</b></p>	<p>medical planning and logistical tools and architecture will improve the medical planning process.</p> <p>The North Atlantic Treaty Organization (NATO) <i>Allied Medical Publication 8, NATO Planning Guide for the Estimation of CBRN Casualties</i>, referred to as (AMedP-8(C)), describes a methodology for estimating casualties resulting from chemical, biological, radiological, or nuclear (CBRN) attacks on military populations. In anticipation of a future expansion of the scope of AMedP-8(C), the Institute for Defense Analyses (IDA) has recently revised the methodology to account for care provided to patients entering the medical system. Incorporating medical care parameters into the published NATO guide will require substantial changes to several chapters of the publication, as well as three of its annexes. This document presents the text, tables, and figures that will need to be added to AMedP-8(C) if medical care is integrated into the document. Each chapter of this document contains the addenda to one chapter or annex in AMedP-8(C), and sections are written to be consistent with the existing contents of the NATO document.</p>	<p>D-4466</p> <p>Curling, Carl A., Burr, Julia K., LaViolet, Lucas L., Lee, Preston J., Bishop, Kristen A.</p> <p>Unclassified</p> <p>174 p.</p>	5/1/2013
<p><b>2011 Review on the Extension of the AMedP-8(C) Methodology to New Agents, Materials, and Conditions</b></p>	<p>This review is the third in a series of annual reviews on the extension of the casualty estimation methodology described in <i>Allied Medical Publication 8 (C): NATO Planning Guide for the Estimation of CBRN Casualties</i> (AMedP-8(C)). The first two reviews focused on (1) prioritizing additional agents to be modeled and (2) describing a methodology and estimated level of effort for incorporating medical countermeasures into AMedP-8(C) models for agents of various types. The 2011 review focuses on the effort required to meet the priorities evinced in discussions with sponsors within the Office of the Surgeon General (OTSG) and the Joint Staff. These priorities include (1) updating existing models by incorporating new data from ongoing medical countermeasure research programs and from recent large-scale disease outbreaks; (2) extending AMedP-8(C) to fill identified gaps in areas where the Common User Database (CUD) incorporates patient conditions that have no corollary within AMedP-8(C); (3) developing new human response models for agents of interest, as required; (4) incorporating</p>	<p>D-4486</p> <p>Curling, Carl A., LaViolet, Lucas L., Burr, Julia K.</p> <p>Unclassified</p> <p>32 p.</p>	12/1/2011

Title	Abstract	IDA Publication Information	Report Date
<b>AMedP-8(C) NATO Planning Guide for the Estimation of CBRN Casualties Ratification Draft 1</b>	<p>chemical human response models developed by Applied Research Associates (ARA); and (5) extending AMedP-8(C) to include psychological casualty estimates.</p> <p><i>Allied Medical Publication 8(C) -- NATO Planning Guide For The Estimation of CBRN Casualties Ratification Draft 1 (AMedP-8(C) RD.1)</i> is the first of the draft documents prepared for ratification and implementation of AMedP-8(C). This document presents a casualty estimation methodology in three parts—estimation of dose/dosage/insult, human response calculation, and casualty estimation—for 3 chemical agents, 5 biological agents, nuclear effects, and both radiological dispersal device isotopes and radiological fallout. Also included in the document are required and recommended implementation parameters, illustrative examples, and a glossary of new terms.</p>	<p>NSP-4492</p> <p>Curling, Carl A., Burr, Julia K., Danakian, Lusine, Disraelly, Deena S., Grotte, Jeffrey H., LaViolet, Lucas, L., Walsh, Terri J., Zirkle, Robert A.</p> <p>Unclassified</p> <p>276 p.</p>	2/1/2010
<b>AMedP-8(C) NATO Planning Guide for the Estimation of CBRN Casualties Study Draft 4</b>	<p><i>Allied Medical Publication 8(C) -- NATO Planning Guide For The Estimation of CBRN Casualties Study Draft 4 (AMedP-8(C) SD.4)</i> is the fourth in a series of developmental draft documents prepared in the development and update of the AMedP-8(C). This document presents a casualty estimation methodology in three parts—estimation of dose/dosage/insult, human response calculation, and casualty estimation—for 3 chemical agents, 5 biological agents, nuclear effects, and both radiological dispersal device isotopes and radiological fallout. Also included in the document are required and recommended implementation parameters, illustrative examples, and a glossary of new terms.</p>	<p>NSP-4495</p> <p>Curling, Carl A., a S., LaViolet, Lucas L., Walsh, Terri J., Zirkle, Robert A.</p> <p>Unclassified</p> <p>348 p.</p>	9/1/2009

Title	Abstract	IDA Publication Information	Report Date
<b>AMedP-8(C) NATO Planning Guide for the Estimation of CBRN Casualties Study Draft 5</b>	This document provides a methodology for estimating casualties that occur over time following a chemical, biological, radiological, or nuclear (CBRN) attack. Previous versions of AMedP-8(C) provided three separate chemical, biological, and nuclear documents with tabular casualty estimates for 7 specified brigade-size units, postures, and weapon sizes or yields. AMedP-8(C) consolidates CBRN 8 agents and effects into a single document and allows the estimation of personnel status within user-specified scenarios.	NSP-4496 Curling, Carl A., Burr, Julia K., Danakian, Lusine, Disraelly, Deena S., LaViolet, Lucas L., Walsh, Terri J., Zirkle, Robert A. NATO UNCLASSIFIED 368 p.	11/2/2009
<b>Review of Chemical, Biological, Radiological, and Nuclear (CBRN) Terminology in Technical Guide 316 (TG 316) and Allied Medical Publication 8(C) (AMedP-8(C))</b>	The implementation of <i>Allied Medical Publication 8(C): NATO Planning Guide for the Estimation of CBRN Casualties</i> (AMedP-8(C)) within the United States requires coordination and alignment with related guidance and doctrine within the Department of Defense (DOD). The Institute for Defense Analyses (IDA) was asked by the U.S. Army Office of the Surgeon General (OTSG) to compare the terminology used in AMedP-8(C) and <i>Technical Guide 316: Microbial Risk Assessment for Aerosolized Microorganisms</i> (TG 316) for consistency. AMedP-8(C) is a North Atlantic Treaty Organization (NATO) standardization agreement (STANAG) that provides a methodology for estimating medical casualties at varying severity levels as a result of a chemical, biological, radiological, and nuclear (CBRN) attack. Both methodologies can support medical and operational planning. The casualty estimates obtained through implementation of the AMedP-8(C) methodology can be used by several communities to aid in their planning efforts. The Biological Military Exposure Guidelines (BMEG) derived in TG 316 can be used by military health risk assessors, medical planners, operational planners, and defense system developers to characterize the health hazards and operational risks associated with exposure to bioaerosols. Although both methodologies ultimately aid in	D-4726 Kelley, Audrey C., Burr, Julia K., Curling, Carl A. Unclassified 38 p.	5/1/2013



Title	Abstract	IDA Publication Information	Report Date
<b>2012 Review on the Extension of the AMedP-8(C) Methodology to New Agents, Materials, and Conditions</b>	<p>medical and operational planning, the two approaches may, in certain cases, result in different outcomes.</p> <p>This is the fourth in a series of annual reviews on the extension of the casualty estimation methodology described in <i>Allied Medical Publication 8 (C): NATO Planning Guide for the Estimation of CBRN Casualties (AMedP-8(C))</i>. This annual review focuses primarily on newly available data that can be used to update existing agents or effects in the methodology. A literature review was conducted to (1) identify data sources immediately useful for updating AMedP-8(C) human response parameters or otherwise modifying the methodology and (2) help inform future analyses and serve as a starting point for related search efforts. Topics for future analysis were identified, and the level of effort to carry out each analysis was estimated. Recommended future efforts fell into three broad groups: editorial changes to the text of future versions of AMedP-8 or related documents, the incorporation of new data into existing AMedP-8(C) models, and the comparison of AMedP-8(C) models to other published models for validation or revision.</p>	<p>D-4727</p> <p>LaViolet, Lucas L., Burr, Julia K., Curling, Carl A.</p> <p>Unclassified</p> <p>90 p.</p>	<p>10/1/2013</p>
<b>NATO CBRN Medical Working Group Table Top Exercise on International Health Regulations: Documentation and Output</b>	<p>At the annual meeting of the NATO Chemical, Biological, Radiological and Nuclear Medical Working Group (CBRNMedWG) in February 2013, IDA conducted a table top exercise to provide national representatives with a mechanism for understanding new international disease reporting requirements contained in the World Health Organization's (WHO) International Health Regulations of 2005 (IHR (2005)). The objectives were (1) to assess the need for NATO to develop guidance for its Joint Force Commanders on their responsibilities to report public health events of international concern; and (2) if such a need was determined, to provide the broad tenets of that guidance. A number of recommendations emerged from the exercise: (1) NATO should work with WHO to coordinate the development of guidance; (2) NATO should designate an IHR national focal point to serve as a conduit for reporting; (3) reporting within the normal chain of command must continue, to include notification of all nations involved; (4) NATO has specialized capabilities that may be called upon to</p>	<p>D-4798</p> <p>Curling, Carl A., Burr, Julia K., Kelley, Audrey C.</p> <p>Unclassified</p> <p>50 p.</p>	<p>5/1/2014</p>

Title	Abstract	IDA Publication Information	Report Date
<b>Comparison of Chemical and Biological Human Response Parameter Values in NATO and U.S. Doctrine</b>	<p>assist WHO in its response to public health events, and NATO should consider revising the tactics, techniques, and procedures associated with these capabilities to provide for ongoing coordination with WHO.</p> <p>This analysis comprises a comparison of the chemical and biological (CB) human response parameter values reported in existing and upcoming Department of Defense (DOD) and North Atlantic Treaty Organization (NATO) doctrine, other commonly used sources such as U.S. Army Medical Research Institute of Infectious Diseases' (USAMRIID) Blue Book and the Textbooks of Military Medicine, and recent research publications, with recommendations about which specific parameter values the CB community should use. For chemical agents, the effort begun by Reutter and Wade in the 1990s led to widely accepted toxicity estimates for many chemical agents, and a known authority for producing new and updated estimates. Accordingly, there is good agreement among doctrine, and the authors' recommendations for chemical agents largely fall in line with toxicity estimates published by the recognized experts at Edgewood Chemical Biological Center. For biological agents, there has been no "Reutter-Wade" type work, and as a result, human response parameter value estimates are scattered, with no authority for defining best values. Accordingly, agreement among doctrine is poor for some agents, and the authors' recommendations, which mostly align with previous Institute for Defense Analyses (IDA) work, are accompanied by confidence assessments pointing to the need for a Reutter-Wade analog for biological agents.</p>	<p>D-4799</p> <p>Oxford, Sean M., Kelley, Audrey C., Curling, Carl A.</p> <p>Unclassified</p> <p>132 p.</p>	6/30/2014
<b>2013 Review on the Extension of the AMedP-8(C) Methodology to</b>	<p>This is the fifth in a series of annual reviews on the extension of the casualty estimation methodology described in <i>Allied Medical Publication 8 (C): NATO Planning Guide for the Estimation of CBRN Casualties (AMedP-8(C))</i>. The objective of this document, the 2013 review, is to provide a</p>	<p>D-4802</p> <p>LaViolet, Lucas L., Curling, Carl A.</p> <p>Unclassified</p>	6/2/2014

Title	Abstract	IDA Publication Information	Report Date
<b>New Agents, Materials, and Conditions</b>	framework to assess the relative costs and benefits of potential modifications to the AMedP-8(C) methodology to inform the prioritization of future efforts. The IDA team identified 14 potential enhancements to the methodology and heuristically assessed their implications, by ranking their impact and the level of effort required to implement them on an ordinal three point scale (high, medium, or low). The IDA team then described four schemes based on these ratings that could be used to prioritize the possible enhancements to the methodology and recommended that the sponsors select one of the four schemes based on their preferences and available resources.	56 p.	
<b>Allied Joint Medical Doctrine for Support to CBRN Defensive Operations Study Draft 1 (AJMedP-7 SD.1)</b>	<p>Chemical, biological, radiological and nuclear (CBRN) weapons produce battlefield conditions not found in conventional warfare. The presence of contaminants, the types and times of injuries, and the scale of CBRN weapon effects are such that conventional planning processes will be inadequate to address the CBRN challenge. The consideration of the unique aspects of CBRN conditions on the medical planning process are such that a clearly articulated doctrine is required to enable medical support to CBRN defensive operations.</p> <p><i>The aim of AJMedP-7, Allied Joint Medical Doctrine for Support to CBRN Defensive Operations, is to bridge the foundational medical support doctrine in AJP 4.10, Allied Joint Medical Support Doctrine and the specific requirements for medical support to CBRN defensive operations now found within advisory and technical publications. This publication is principally for use by North Atlantic Treaty Organization (NATO) commanders and their medical staffs in the planning and conduct of medical support operations for which the threat and/or risk of intentional or accidental use of CBRN substances are either assessed or exist.</i></p>	<p>NSP-4872 Curling, Carl A., Burr, Julia K. NATO UNCLASSIFIED 60 p.</p>	5/1/2012
<b>Chapter 8, Medical Support in the CBRN Environment, of AJP-</b>	Chemical, biological, radiological and nuclear (CBRN) weapons produce battlefield conditions not found in conventional warfare. The presence of contaminants, the types and times of injuries, and the scale of CBRN	<p>NSP-4876 Curling, Carl A., Burr, Julia K.</p>	6/1/2012

Title	Abstract	IDA Publication Information	Report Date
<b>4.10, Allied Joint Doctrine for Medical Support, Study Draft 1 (Ch 8 AJP-4.10 SD.1)</b>	<p>weapon effects are such that conventional planning processes will be inadequate to address the CBRN challenge. The consideration of the unique aspects of CBRN conditions on the medical planning process are such that a clearly articulated doctrine is required to enable medical support to CBRN defensive operations.</p> <p>The aim of <i>AJMedP-7, Allied Joint Medical Doctrine for Support to CBRN Defensive Operations</i>, is to bridge the foundational medical support doctrine in <i>AJP 4.10, Allied Joint Medical Support Doctrine</i> and the specific requirements for medical support to CBRN defensive operations now found within advisory and technical publications. This publication is principally for use by North Atlantic Treaty Organization (NATO) commanders and their medical staffs in the planning and conduct of medical support operations for which the threat and/or risk of intentional or accidental use of CBRN substances are either assessed or exist.</p>	<p>NATO UNCLASSIFIED 18 p.</p>	
<b>Allied Joint Medical Doctrine for Support to CBRN Defensive Operations Study Draft 2 (AJMedP-7 SD.2)</b>	<p>Chemical, biological, radiological and nuclear (CBRN) weapons produce battlefield conditions not found in conventional warfare. The presence of contaminants, the types and times of injuries, and the scale of CBRN weapon effects are such that conventional planning processes will be inadequate to address the CBRN challenge. The consideration of the unique aspects of CBRN conditions on the medical planning process are such that a clearly articulated doctrine is required to enable medical support to CBRN defensive operations.</p> <p>The aim of <i>AJMedP-7, Allied Joint Medical Doctrine for Support to CBRN Defensive Operations</i>, is to bridge the foundational medical support doctrine in <i>AJP 4.10, Allied Joint Medical Support Doctrine</i> and the specific requirements for medical support to CBRN defensive operations now found within advisory and technical publications. This publication is principally for use by NATO commanders and their medical staffs in the planning and conduct of medical support operations for which the threat and/or risk of intentional or accidental use of CBRN substances are either assessed or exist.</p>	<p>NSP-4932 Curling, Carl A., Burr, Julia K. NATO UNCLASSIFIED 64 p.</p>	10/1/2012

Title	Abstract	IDA Publication Information	Report Date
<b>Allied Joint Medical Doctrine for Support to CBRN Defensive Operations Study Draft 3 (AJMedP-7 SD.3)</b>	<p>Chemical, biological, radiological and nuclear (CBRN) weapons produce battlefield conditions not found in conventional warfare. The presence of contaminants, the types and times of injuries, and the scale of CBRN weapon effects are such that conventional planning processes will be inadequate to address the CBRN challenge. The consideration of the unique aspects of CBRN conditions on the medical planning process are such that a clearly articulated doctrine is required to enable medical support to CBRN defensive operations. The aim of the <i>AJMedP-7, Allied Joint Medical Doctrine for Support to CBRN Defensive Operations</i>, is to bridge the foundational medical support doctrine in <i>AJP 4.10, Allied Joint Medical Support Doctrine</i> and the specific requirements for medical support to CBRN defensive operations now found within advisory and technical publications. This publication is principally for use by the North Atlantic Treaty Organization (NATO) commanders and their medical staffs in the planning and conduct of medical support operations for which the threat and/or risk of intentional or accidental use of CBRN substances are either assessed or exist.</p>	<p>NSP-4933 Curling, Carl A., Burr, Julia K. NATO UNCLASSIFIED 60 p.</p>	2/1/2013
<b>Allied Joint Medical Publication 7: Allied Joint Medical Doctrine for Support to CBRN Defensive Operations Study Draft 4 (AJMedP-7 SD.4)</b>	<p>Chemical, biological, radiological, and nuclear (CBRN) weapons produce battlefield conditions not found in conventional warfare. The presence of contaminants, the types and times of injuries, and the scale of CBRN weapon effects are such that conventional planning processes will be inadequate to address the CBRN challenge. Medical support to CBRN defensive operations requires a clearly articulated concept of operations that consider the unique aspects of CBRN conditions on the medical planning process. The aim of <i>AJMedP-7, Allied Joint Medical Doctrine for Support to CBRN Defensive Operations</i>, is to bridge the foundational medical support doctrine in <i>AJP 4.10, Allied Joint Medical Support Doctrine</i> and the specific requirements for medical support to CBRN defensive operations in advisory and technical publications. This publication is principally for use by NATO commanders and their medical staffs in the planning and conduct of medical support operations for which the threat</p>	<p>NSP-4982 Burr, Julia K. NATO UNCLASSIFIED 62 p.</p>	2/3/2014

Title	Abstract	IDA Publication Information	Report Date
<b>Allied Medical Publication AMedP-7.6(A), Commander's Guide to Medical Operations in Support of CBRN Defensive Operations: Study Draft 1</b>	<p>and/or risk of intentional or accidental use of CBRN substances are either assessed or exist.</p> <p>Allied Medical Publication 7.6 (AMedP-7.6) is a NATO Standardization Agreement intended to inform commanders and provide guidance to Allied Medical Advisors, Medical Directors, and medical staff at the Combined Joint Force Component (CJFC) level on the development and execution of chemical, biological, radiological, and nuclear (CBRN) medical courses of action. It explicitly considers the interactions of medical staff elements with operational staff, particularly CBRN defense staff, the role of medical support in CBRN defense courses of action, and the interface with host nations, international and nongovernmental organizations, and member nations. AMedP-7.6 focuses on those operational level aspects of medical support that are unique to CBRN incidents or would differ from conventional medical support when conducted in a CBRN environment.</p> <p>Study Draft 1 is an extensively annotated outline intended to provide Allied nations with information to allow review of the aim, scope, and proposed content of this publication.</p>	<p>NSP-4983</p> <p>Curling, Carl A., Burr, Julia K., LaViolet, Lucas L., Schultz, Douglas P.</p> <p>Unclassified</p> <p>60 p.</p>	7/1/2015
<b>Allied Medical Publication 7.5: NATO Planning Guide for the Estimation of CBRN Casualties Study Draft 1 (AMedP-7.5 SD.1)</b>	<p>This document is the first in a series of developmental draft documents leading to AMedP-7.5(A), the next iteration of the NATO CBRN casualty estimation methodology. This document presents the methodology as comprising four components—user input, estimation of the CBRN challenge, estimation of human response, and casualty estimation. After a general overview and then a detailed look into the user inputs and how the CBRN challenge is estimated, the final document will contain one subsection per agent/effect that describes all additional information needed to estimate casualties for that agent/effect, including required and recommended parameter values for use in the models. The final document will include 8 chemical agents, 17 biological agents, nuclear effects, radiological dispersal device isotopes, radiological fallout, and several illustrative examples.</p> <p>This Study Draft contains a general overview of the methodology, including flowcharts describing how the various parts of the methodology link</p>	<p>NSP-4984</p> <p>Oxford, Sean M., Curling, Carl A.</p> <p>NATO UNCLASSIFIED</p> <p>50 p.</p>	6/2/2014

Title	Abstract	IDA Publication Information	Report Date
<b>Allied Concept of Medical Operations in Support to CBRN Defensive Operations Study Draft 1 (AMedP-7(E) SD.1)</b>	<p>together. Further, it defines the framework for the more detailed look at each portion of the casualty estimation methodology, including example flowcharts for estimating casualties caused by GB and anthrax, as indicators of the content that will be in Study Draft 2.</p> <p>Chemical, biological, radiological and nuclear (CBRN) weapons produce battlefield conditions not found in conventional warfare. The presence of contaminants, the types and times of injuries, and the scale of CBRN weapon effects are such that conventional planning processes will be inadequate to address the CBRN challenge. The consideration of the unique aspects of CBRN conditions on the medical planning process are such that a clearly articulated concept of operations is required to enable medical support to CBRN defensive operations.</p> <p>The aim of <i>AMedP-7, Allied Concept of Medical Operations in Support to CBRN Defensive Operations</i>, is to implement the medical support doctrine in <i>AJMedP-7, Allied Joint Medical Doctrine for Support to CBRN Defensive Operations</i>, and the specific requirements for medical support to CBRN defensive operations now found within advisory and technical publications. This publication is principally for use by NATO commanders and their medical staffs in the conduct of medical support operations for which threat and/or risk of intentional or accidental use of CBRN substances are either assessed or exist.</p>	<p>NSD-4988 Curling, Carl A., Burr, Julia K. NATO UNCLASSIFIED 38 p.</p>	2/1/2013
<b>Parameters for Estimation of Casualties from Phosgene, Chlorine, Hydrogen Cyanide, Cyanogen Chloride, Hydrogen Sulfide, B. pseudomallei, Eastern and Western Equine</b>	<p>The U.S. Army Office of the Surgeon General (OTSG) tasked IDA with developing human response models for five prospective chemical agents and five prospective non-contagious biological agents. The models are intended to be placed in Allied Medical Publication 7.5(A), which will be the doctrinal replacement of <i>Allied Medical Publication 8(C): NATO Planning Guide for the Estimation of CBRN Casualties</i> (AMedP-8(C)), and is currently in development at IDA, also in support of OTSG. The ten agents considered in this document are phosgene, chlorine, hydrogen cyanide, cyanogen chloride, hydrogen sulfide, B. pseudomallei (the causative agent of melioidosis), Eastern and Western equine encephalitis viruses, ricin, and</p>	<p>P-5140 Oxford, Sean M., Kelley, Audrey C., Kneece, R. Royce, Hajduk, Kristen R., Haugh, Brian A., Nunes, Steven M., Patterson, Christina M., Rosenfield, Daniel K., Sneddon,</p>	9/1/2015

Title	Abstract	IDA Publication Information	Report Date
<b>Encephalitis Viruses, Ricin, and T-2 Mycotoxin</b>	T-2 mycotoxin. For each agent, the authors propose or use existing toxicity and lethality estimates, and describe the progression of injury over time and outcome for a person who received no medical treatment. A separate model that includes the effects of medical treatment is also discussed and derived. The work described in this document is based on an extensive review of available literature, including experimental animal data, human case reports, and human disease outbreak reports.	Robert S., Wheeler, Michael O. Unclassified 274 p.	
<b>NATO Allied Joint Medical Publication 7: Allied Joint Medical Doctrine for Support to Chemical, Biological, Radiological, and Nuclear (CBRN) Defensive Operations, Final Draft</b>	Chemical, biological, radiological and nuclear (CBRN) weapons produce battlefield conditions not found in conventional warfare. The presence of contaminants, the types and times of injuries, and the scale of CBRN weapon effects are such that conventional planning processes will be inadequate to address the CBRN challenge. The consideration of the unique aspects of CBRN conditions on the medical planning process is such that a clearly articulated doctrine is required to enable medical support to CBRN defensive operations. <i>The aim of AJMedP-7, Allied Joint Medical Doctrine for Support to CBRN Defensive Operations, is to bridge the foundational medical support doctrine in AJP 4.10, Allied Joint Medical Support Doctrine, and the specific requirements for medical support to CBRN defensive operations now found within advisory and technical publications. This publication is principally for use by North Atlantic Treaty Organization (NATO) commanders and their medical staffs in the planning and conduct of medical support operations for which there is an assessed risk of intentional or accidental use of CBRN substances.</i>	NSP-5153 Curling, Carl A., Burr, Julia K. NATO UNCLASSIFIED 66 p.	7/31/2014
<b>NATO Allied Medical Publication 7.5 Study Draft 2 (AMedP-7.5 SD.2), "NATO Planning Guide for the Estimation of CBRN Casualties"</b>	This document is the second in a series of developmental draft documents leading to AMedP-7.5(A), the next iteration of the NATO CBRN casualty estimation methodology. This document presents the methodology as comprising four components—user input, estimation of the CBRN challenge, estimation of human response, and casualty estimation and reporting. This document fully describes the required inputs, the method of calculating the CBRN challenge, and the estimation and reporting of human response and casualties, including a dedicated section for each agent/effect	NSP-5154 Curling, Carl A., Oxford, Sean M. Unclassified 246 p.	11/3/2014



Title	Abstract	IDA Publication Information	Report Date
<b>Bioscavengers as Medical Chemical Countermeasures</b>	describing how to estimate human response and casualties from that specific agent/effect. To increase user-friendliness, each dedicated section contains a flowchart for that agent effect instructing the user on which equations and lookup tables should be used, and the sequence in which they should be used. As this is a Study Draft, it has a few placeholders for agent-specific models, where model development or revision is ongoing. The final document will include 8 chemical agents, 17 biological agents, nuclear effects, radiological dispersal device isotopes, radiological fallout, and several illustrative examples.	P-5157 Burr, Julia K., Curling, Carl A., Kelley, Audrey C., Smith, Forrest R.	7/31/2014
<b>Parameters for Estimation of Casualties from Ammonia (NH<sub>3</sub>), Tabun (GA), Soman (GD), Cyclosarin (GF), and Lewisite (L)</b>	The U.S. Army Office of The Surgeon General (OTSG) tasked IDA with developing human response models for five prospective chemical agents. The models are intended to be placed in Allied Medical Publication 7.5(A) (AMedP-7.5), which will be the doctrinal replacement to <i>Allied Medical Publication 8(C): NATO Planning Guide for the Estimation of CBRN Casualties</i> (AMedP-8(C)), and is currently in development at IDA, also in support of OTSG. The five agents considered in this document are ammonia, tabun, soman, cyclosarin, and lewisite. For each agent, the authors propose or use existing toxicity and lethality estimates, and describe the progression of injury over time and outcome for a person who received no medical treatment. A separate model that includes the effects of medical treatment is also discussed and derived. The work described in this document is based on an extensive review of available literature, including experimental animal data, human case reports, and human disease outbreak reports.	96 p. P-5158 Kelley, Audrey C., Curling, Carl A. Unclassified 116 p.	9/1/2015

Title	Abstract	IDA Publication Information	Report Date
<b>Research and Development Strategies for the Current and Future Medical Treatment of Radiation Casualties</b>	<p>The U.S. Army Office of the Surgeon General (OTSG) asked the Institute for Defense Analyses (IDA) to review radiation medical countermeasures (task CA-6-3079), such as radioprotectant drugs and radiation injury treatments, and their potential to mitigate the effects of a radiation or nuclear incident on the health and survival of those exposed to ionizing radiation (IR). Although no radioprotectants or radiation injury treatments are currently approved by the U.S. Food and Drug Administration (FDA) for the treatment of acute radiation syndrome (ARS), this paper describes the treatment of ARS with supportive care and filgrastim and includes an illustrative example of how these treatments could affect the number of casualties from a nuclear event. In addition to describing some example potential therapies that are still being tested for safety and efficacy, this paper outlines strategies beyond the traditional research and development (R&amp;D) pharmaceutical model that the Department of Defense could implement for acquiring future treatments for ARS. If pursued, these alternate R&amp;D paradigms could provide significant cost and time savings to the DOD as well as reduce the risk associated with pursuing the approval of a radiation therapy or radioprotectant.</p>	<p>P-5160 Sixt, Katherine M., Smith, Forrest R., Kim, Deborah, Curling, Carl A. Unclassified 106 p.</p>	<p>9/1/2014</p>
<b>Acute Radiation Syndrome (ARS) and Medical Radiation Countermeasures in a Nuclear Environment</b>	<p>Nuclear weapons and improvised nuclear devices are the radiation attacks most likely to cause widespread casualties from prompt radiation exposure. Ionizing radiation greater than 1 Gray (Gy) causes acute radiation syndrome (ARS). ARS is separated into the hematopoietic syndrome (beginning at 1 Gy) and the gastrointestinal syndrome (beginning at 5 Gy). There are currently no Food and Drug Administration (FDA)-approved therapies for the treatment of ARS, although supportive care can be used to treat the symptoms arising from ARS. Several countermeasures are in experimental research for ARS. In this work, IDA models the use of one therapy, filgrastim, in addition to supportive care in a nuclear weapons scenario, and from the models we estimate how many people would be saved if they could receive the therapies. In a 1 kiloton (kT) ground burst, 15% of radiation fatalities could be avoided by supportive care alone, and 24% by the addition of filgrastim to the supportive care regimen. In a 10 kT</p>	<p>NSD-5165 Sixt, Katherine M., Curling, Carl A., Smith, Forrest R. Unclassified 42 p.</p>	<p>3/3/2014</p>

Title	Abstract	IDA Publication Information	Report Date
<b>Casualty Estimation for Nuclear and Radiological Weapons</b>	<p>detonation, 13% and 30% of radiation fatalities are avoided. However, filgrastim and supportive care would not be effective in treating radiation fatalities in a 50 kT event, since fatalities are due to thermal burn in addition to the radiation fatalities.</p> <p>This analysis describes the application of the NATO chemical, biological, radiological, and nuclear (CBRN) casualty estimation methodology to nuclear and radiological weapon threats. In the planning process, casualty estimates may influence the course of action selected, the flow of personnel into the theater, or the amount and timing of the medical assets moved into the theater. For illustrative purposes, the situation is that a commander has asked his staff to plan an operation by a light infantry battalion task force. An alternative scenario is a public event used to estimate the impact of the radiological or nuclear events on civilian populations. The basic nuclear challenge is a 10 kiloton ground burst, with an alternative of a 10 KT low air burst. The radiological challenge is an attack with 1.11x10<sup>5</sup> terabecquerels (TBq) of the radioisotope Cesium-137 (137Cs). Alternative casualty estimates include 90Sr; 241Am, 238Pu; and fallout. The casualty estimates varied from none to 100% of the population considered. When casualties were present, the numbers of casualties were such that they pose a considerable if not catastrophic medical management problem. Further courses of action (such as countermeasure missions, unit dispersal and nuclear protective posture) should be considered to further mitigate nuclear or radiological weapons on the battlefield.</p>	<p>P-5220 Curling, Carl A. Unclassified 106 p.</p>	6/1/2016
<b>Analysis of NATO Doctrine for Biosurveillance</b>	<p>The United States is in the process of developing an "all-of-Nation" approach to a biosurveillance enterprise that will allow the U.S. to quickly detect an incident of national significance that affects human, animal, or plant health. While no formal all-of-government biosurveillance implementation doctrine exists, the Department of Defense (DOD) will and already does contribute to this enterprise with existing capabilities that are distributed across the DOD. The Institute for Defense Analyses was asked to report on the feasibility of the application of NATO doctrine to the development and implementation of biosurveillance concepts and doctrine.</p>	<p>D-5224 Curling, Carl A., Finnin, Michael S. Unclassified 40 p.</p>	10/1/2015

Title	Abstract	IDA Publication Information	Report Date
<b>The Application of Contagious Disease Epidemiological Models to Known Population Structure and Movement</b>	<p>An initial search revealed that neither NATO nor DOD had formal doctrine on biosurveillance. Therefore, NATO biosurveillance doctrine could not contribute to a developing DOD biosurveillance doctrine. The existing capabilities that exist both in NATO and DOD could certainly form a starting point for a biosurveillance doctrine in DOD. They each have qualities that resonate with the U.S. Strategy for biosurveillance, which takes an approach of collecting, integrating, analyzing, and communicating all-hazards and disease activity to allow better decision making.</p> <p>As part of its efforts to update the NATO CBRN standard casualty estimation methodology, IDA wanted to better understand (1) whether casualty estimates would change if their calculation considered movement and structure, and (2) if estimates changed, whether the change was significant enough to warrant a change to the methodology. To answer this question, IDA adapted a contagious disease model to account for structure and movement and developed an analytic representation of a military population using troop location data from Afghanistan. Using these tools, IDA compared casualty estimates that considered structure and movement with those that did not, using three measures: total number of expected casualties; overall duration of the modeled outbreak, and time to reach an overall casualty rate of 20%.</p> <p>The results showed a significantly different casualty estimate when considering structure and movement. However, the added benefits of a more situationally representative casualty estimate come at a cost of increased analytic and computational complexity. On balance, the IDA team believes that the purpose of an updated version of the casualty estimation methodology—support for medical planning—would be adequately served by the relatively conservative estimates generated without structure and movement, especially for small numbers of initial infections.</p>	<p>D-5225</p> <p>Burr, Julia K., Cubeta, Robert L., LaViolet, Lucas L., Curling, Carl A.</p> <p>Unclassified</p> <p>54 p.</p>	3/1/2016
<b>2014 Review on the Extension of the AMedP-8(C) Methodology to</b>	<p>This is the sixth in a series of annual reviews on the extension of the casualty estimation methodology originally described in <i>Allied Medical Publication 8 (C): NATO Planning Guide for the Estimation of CBRN</i></p>	<p>D-5226</p> <p>LaViolet, Lucas L., Danilack, Aaron D.</p>	8/1/2015

Title	Abstract	IDA Publication Information	Report Date
<b>New Agents, Materials, and Conditions</b>	<p><i>Casualties</i> (AMedP-8(C)) and most recently published as <i>AMedP-7.5 Study Draft 2</i> (SD2). The objective of this document, the 2014 review, is to identify additional improvements to the AMedP-7.5 SD2 casualty estimation methodology through a comparison of its casualty estimates for four agents (anthrax, botulinum toxin, sarin (GB), and distilled mustard (HD)) to the casualty estimates of Hazard Prediction and Assessment Capability (HPAC), a modeling and simulation tool developed by the Defense Threat Reduction Agency whose capabilities also include casualty estimation. By comparing every step of the two methodologies, the IDA team observed that the threshold dose-response model used in the AMedP-7.5 SD2 chemical agent methodology overestimates (or underestimates) chemical casualties in a way that is highly dependent on the scenario analyzed. In order to avoid this unpredictable variation from the probit model estimate and to more consistently and accurately predict the number of casualties from chemical agents, the IDA team recommends changing the threshold model in the AMedP-7.5 SD2 chemical agent methodology to a probit model.</p>	<p>Unclassified 70 p.</p>	
<b>NATO Allied Medical Publication 7.5 Study Draft 3 (AMedP-7.5 SD.3), "NATO Planning Guide for the Estimation of CBRN Casualties"</b>	<p>This document is the third in a series of developmental draft documents leading to AMedP-7.5(A), the next iteration of the NATO CBRN casualty estimation methodology. This document presents the methodology as comprising five components—user input, estimation of the CBRN challenge, estimation of human response, casualty estimation, and reporting. This document fully describes the required inputs, the method of calculating the CBRN challenge, and the estimation and reporting of human response casualties, including a dedicated section for each agent/effect describing how to estimate human response and casualties from the specific agent/effect. The methodology includes 12 chemical agents, 17 biological agents, nuclear effects, radiological dispersal device isotopes, and radiological fallout. To increase user- friendliness, each dedicated section contains a flowchart for that agent/effect instructing the user on which equations and lookup tables should be used, and the sequence in which they should be used; Appendix A contains illustrative examples for each of the major types of agent or effect. Although this is a Study Draft, it</p>	<p>NSP-5308 Curling, Carl A., Oxford, Sean M. Unclassified 338 p.</p>	12/1/2015

Title	Abstract	IDA Publication Information	Report Date
<b>AMedP-7.6, Commander's Guide on Medical Support to Chemical, Biological, Radiological, and Nuclear (CBRN) Defensive Operations, Edition A, Study Draft 2</b>	<p>is envisioned as the final product, other than any changes required as part of the NATO review process.</p> <p>Allied Medical Publication 7.6 (AMedP-7.6) is a NATO Standardization Agreement intended to inform commanders and provide guidance to Allied Medical Advisors, Medical Directors, and medical staff at the CJFC level on the development and execution of CBRN medical courses of action. It explicitly considers the interactions of medical staff elements with operational staff, particularly CBRN defense staff, the role of medical support in CBRN defensive courses of action, and the interface with host nations, international and nongovernmental organizations, and member nations. AMedP-7.6 focuses on those operational level aspects of medical support that are unique to CBRN incidents or would differ from conventional medical support when conducted in a CBRN environment. Study Draft 2 is a complete draft of this document and is expected to require little revision prior to publication as a Final Draft in the NATO standardization process.</p>	<p>NSP-5363</p> <p>Burr, Julia K., LaViolet, Lucas L., Schultz, Douglas P., Curling, Carl A.</p> <p>Unclassified</p> <p>102 p.</p>	6/1/2016
<b>Review of Dangerous Radioisotopes: What is Available in Practice, What Should We be Concerned About?</b>	<p>This presentation is prepared for the 2015 meeting of the Radiation Injury Treatment Network (RITN) and is intended to provide a context to the type and scale of radiological weapons that would result in casualties.</p>	<p>NSD-5549</p> <p>Curling, Carl A., Lodge, Alex</p> <p>Unclassified</p> <p>29 p.</p>	6/1/2015
<b>Analysis of Policy and Doctrine Supporting the Management of Operational Exposures to Ionizing Radiation</b>	<p>This document includes a review of policy at the Department of Defense, Chairman of the Joint Chiefs of Staff, and Service levels as well as doctrine at the Joint Staff and Service levels. Policy supporting the management of operational exposures to ionizing radiation is somewhat fragmented, with the exception of the U.S. Air Force, which combines all policy related to ionizing radiation, regardless of location, into a single policy document. Doctrine for managing operational exposures to ionizing radiation is well established in Joint Publication 3-11. Doctrine for the management of radiation and nuclear casualties is contained in <i>Army Techniques Publication (ATP) 4-02.83 (Multiservice Tactics, Techniques, and Procedures for Treatment of Nuclear and Radiological Casualties)</i>;</p>	<p>D-8020</p> <p>Bohannon, Mark E., Curling, Carl A.</p> <p>Unclassified</p> <p>32 p.</p>	6/1/2016

Title	Abstract	IDA Publication Information	Report Date
<b>2015 Review on the Extension of the AMedP-8(C) Methodology to New Agents, Materials, and Conditions</b>	<p>however, the academic nature of this document limits its applicability to the management of the individual patient.</p> <p>This review investigated policy and doctrine on the management of orphaned CBRN sources. The concept of an orphaned material is best described in radioactive sources, where orphaned sources are described as materials not under regulatory control. In reviewing policy across the DOD and Joint Service doctrine, there is generally very good policy and doctrine for the management of found chemical warfare material, incomplete policy and doctrine for abandoned radioactive materials, and limited policy and doctrine for biological materials. CBRN materials discovered in conjunction with a military operation would likely be managed under Weapons of Mass Destruction (WMD) Elimination doctrine; radioactive sources that are not abandoned industrial sources are not well addressed.</p>	<p>D-8047 Curling, Carl A., Bohannon, Mark E. Unclassified 32 p.</p>	6/1/2016
<b>Review of Radioisotopes as Radiological Weapons</b>	<p>A simple methodology for evaluating the credibility of radiological material as a threat was developed. This methodology compares the largest quantity of radioactive material typically found in a single instrument or device that is available in commercial practice ("P") with the quantity of radioactive material necessary for it to pose a sufficient threat to be of concern ("C"). If the ratio of "P" to "C" is high (0.1 or greater), it is more credible that the radioactive material could be used in a radiological weapon. The P/C ratio is constructed so that the higher the P/C ratio the more credible it is that a suitable source can be found to pose the threat of concern. The conclusion is that radiological weapons should be considered as credible threats to U.S. military operations. Evaluating a number of different RDD scenarios, <sup>60</sup>Co, <sup>75</sup>Se, <sup>90</sup>Sr, <sup>137</sup>Cs, <sup>170</sup>Tm, <sup>192</sup>Ir, <sup>238</sup>Pu, <sup>239</sup>Pu/Be, <sup>241</sup>Am, <sup>241</sup>Am/Be, <sup>244</sup>Cm, and <sup>252</sup>Cf were evaluated as credible candidates to be used in some form, often several forms, of radiological weapon threat. Radioactive material is available credible capability to pose a threat as a radiological weapon.</p>	<p>D-8048 Curling, Carl A., Lodge, Alex Unclassified 90 p.</p>	6/1/2016

Title	Abstract	IDA Publication Information	Report Date
<b>Consideration of Neutron Radiation Following a Nuclear Detonation</b>	This document discusses consideration of neutron radiation following a nuclear detonation, to include an enhanced nuclear weapon. The three major impacts of a nuclear detonation are blast, thermal, and radiation. With higher yield weapons and increased height of burst, blast and thermal effects predominate. However, with lower yields, ground bursts, and enhanced nuclear weapons, prompt radiation is the predominant effect, and neutron radiation can account for as much as 75% of the total radiation. Studies suggest the possibility of a different clinical presentation for acute radiation syndrome resulting from a neutron heavy exposure, which may complicate diagnosis and treatment.	NSD-8086 Bohannon, Mark E., Curling, Carl A. Unclassified 30 p.	6/1/2016
<b>Review of CBRN Medical and Operational Terminologies in NATO CBRN Publications</b>	The U.S. Army Office of The Surgeon General (OTSG) asked IDA to review and compare the terminology used in the NATO publications related to medical CBRN defense and operational CBRN defense for consistency. The use of the correct terminologies in NATO CBRN defense publications is deemed highly important because of the need to have clear and unambiguous communication among the NATO members and partner nations. The IDA team identified and reviewed twelve NATO CBRN publications and collected the terminologies within the publications to develop two different lexicons, one for terms and definitions and a second one for abbreviations. The use of certain terms and abbreviations were also analyzed and summarized along with recommendations when the terminologies do not align.	P-8088 Kelley, Audrey C., Bishop, Kristen A. Unclassified 174 p.	8/1/2016
<b>Technical Reference Manual to Allied Medical Publication 7.5 (AMedP-7.5) NATO Planning Guide for the Estimation of CBRN Casualties</b>	This Technical Reference Manual (TRM) serves as a supplement to AMedP-7.5, documenting the analyses, rationale, and underlying data utilized in the development of the methodology. This document provides information beyond the scope of AMedP-7.5 that will allow for transparency and verification of the methodology.	P-8122 Oxford Sean M., LaViolet, Lucas A., Bishop, Kristen A., Burr, Julia K., Curling, Carl A., Danakian, Lusine, Disraelly, Deena S., Haugh, Brian A., Hebner, Margaret C.,	10/1/2016



Title	Abstract	IDA Publication Information	Report Date
<b>NATO Allied Medical Publication 7.5 Final Draft (AMedP-7.5 FD), NATO Planning Guide for the Estimation of CBRN Casualties</b>	This document, the archive copy of what was posted to the NATO forums, is the final draft in a series of developmental draft documents leading to AMedP-7.5(A), the next iteration of the NATO CBRN casualty estimation methodology. This document presents the methodology as comprising four components—user input, estimation of the CBRN challenge, estimation of human response, and casualty estimation and reporting. This document fully describes the required inputs, the method of calculating the CBRN challenge, and the estimation and reporting of human response and casualties, including a dedicated section for each agent/effect describing how to estimate human response and casualties from that specific agent/effect. To increase user-friendliness, each dedicated section contains a flowchart for that agent/effect instructing the user on which equations and lookup tables should be used, and the sequence in which they should be used.	Kelley, Audrey C., Kneece, Royce R., Lee, Preston J., Patterson, Christina M., Rosenfield, Daniel K., Sitarz, Hans C., Sneddon, Robert S., Walsh, Terri J., Wheeler, Mike O., Zirkle, Robert A.  Unclassified 12:00 AM  NSP-8181  Oxford, Sean M., Unclassified 348 p.	1/12/2016
<b>NATO Allied Medical Publication 7.6 Final Draft (AMedP-7.6 FD),</b>	Allied Medical Publication 7.6 (AMedP-7.6) is a NATO Standardization Agreement intended to inform commanders and provide guidance to Allied Medical Advisors, Medical Directors, and medical staff at the CJFC level on	NSP-8254  Burr, Julia K. Unclassified	10/14/2016

Title	Abstract	IDA Publication Information	Report Date
<b>Commander's Guide on Medical Support to Chemical, Biological, Radiological, and Nuclear (CBRN) Defensive Operations, Edition A, Final Draft</b>	the development and execution of CBRN medical courses of action. It explicitly considers the interactions of medical staff elements with operational staff, particularly CBRN defense staff, the role of medical support in CBRN defense courses of action, and the interface with host nations, international and nongovernmental organizations, and member nations. AMedP-7.6 focuses on those operational level aspects of medical support that are unique to CBRN incidents or would differ from conventional medical support when conducted in a CBRN environment. This Final Draft is not expected to require revision prior to publication in the NATO standardization process.	348 p.	
<b>Review of Human Factors and Medicine Panel Reports</b>	The U.S. Army Office of The Surgeon General (OTSG) asked the Institute for Defense Analyses (IDA) to review and summarize the technical reports and papers published by the Human Factors and Medicine (HFM) Panels that are related to medical CBRN to learn about the topics that have been and are currently being reviewed by the HFM Panels. The purpose of the summary report is to provide the sponsor an insight into the work performed and currently ongoing by different HFM Panels that is related to medical CBRN and which may be useful to the NATO CBRN Working Group. The IDA team identified, reviewed, and summarized 23 CBRN-related HFM Panel reports and concluded that most of the reports described early-stage research that might not be very impactful on NATO CBRN doctrines. The IDA team also identified the research that should be monitored by the CBRN community that might be significant in the near future.	D-8371 Kelley, Audrey C., Bishop, Kristen A., Curling, Carl A. TBD (Currently in DRAFT FINAL status) 323 p.	2/1/2017
<b>Differentiating between Naturally Occurring and Intentionally Caused Outbreaks of Disease in Deployed U.S. Forces</b>	Differentiating between naturally occurring and intentionally caused outbreaks of disease is difficult and requires specialist knowledge not usually available to deployed U.S. forces. This paper identifies ten factors one should consider when attempting to discern whether an outbreak was intentionally caused. The key question is: for the various observations one can make about an ongoing outbreak, is there something unusual or peculiar about this outbreak as compared to historical natural outbreaks?	D-8372 Oxford, Sean M., LaViolet, Lucas L., Cubeta, Robert L. TBD (Currently in DRAFT FINAL status)	3/1/2017

Title	Abstract	IDA Publication Information	Report Date
<b>Lessons Learned from NATO Exercise Clean Care 2016</b>	<p>This paper provides decision support via both high-level general guidance and thinking through the issues, and more disease-specific information about what is normal in a naturally occurring outbreak.</p> <p>This publication also documents the proof of concept for a quantitative model that predicts the number of initial infections in an outbreak of contagious disease; a high number of initial infections likely indicates an intentional outbreak. The model uses a traditional Susceptible, Exposed and infected, Infectious, and Removed (SEIR) model to generate simulated outbreaks that are used to train a machine learning algorithm (K nearest neighbors, KNN). We tested the KNN algorithm's ability to predict accurately against additional SEIR-simulated outbreaks. Accuracy depends on the allowable error in the prediction and the number of days of case history that is available.</p> <p>IDA supported the NATO Clean Care 2016 training exercise, held in September 2016 at the Tisa Training Area, Czech Republic. This support included the development and execution of a table-top exercise within the NATO Biological Medical Panel, designed to generate a health risk assessment and health brief for the Clean Care training audience, and injects for the exercise itself. IDA personnel also served as the lessons learned lead for the exercise, organizing the collection, recording, assessment, and submission of exercise observations, following the NATO-prescribed format and process. This paper documents the content and outputs of the table-top exercise, the Clean Care 2016 observations, and Clean Care exercise evaluation forms provided by the training audience. It also includes a top-level assessment of the observations, based on NATO-defined metadata fields, and proposals for pooling observations and generating lessons identified, in accordance with NATO processes.</p>	<p>107 p.</p> <p>D-8373 Burr, Julia K., LaViolet, Lucas A. TBD (Currently in DRAFT FINAL status) 1,000,000 p.</p>	3/1/2017
<b>Parameters for Estimation of Casualties</b>	<p>This document describes the continued extension of the CBRN casualty estimation methodology to include 1st and 3rd degree flash burns. Flash burns result from the initial thermal pulse from the nuclear weapon</p>	<p>P-8374 Curling, Carl A., Todd, Samantha</p>	3/1/2017

Title	Abstract	IDA Publication Information	Report Date
<b>from First and Third Degree Flash Burns</b>	<p>detonation. The thermal pulse from a detonation lasts from a fraction of a second to several seconds in duration (increasing with yield), and is assumed to result in exposure to the exposed skin on the body (typically not more than 50% of the body surface area). This analysis identified the threshold fluence values (<math>Q_t</math>) for 1st and 3rd degree burns to bare skin and various uniform types.</p> <p>The 1st degree burn insult range is 1–&lt;10 percent of the total body surface area (%BSA) because a 1st degree flash burn greater than 10 % BSA will also include at least a 1 %BSA 2nd degree burn,. For 1st degree burns in the insult range of 1–&lt;10 %BSA, the injury severity was found to be relatively minor, fitting within the definition of “Severity Level 1 (Mild),” and lasting for no more than a week without treatment. There was no change in the characterization of burn injury severity over time when considering both 2nd and 3rd degree burns. 1st degree burns are routinely treated with “over the counter” medications to ease the pain and moisturize the skin, and the casualty returns to duty immediately following treatment, on Day 2. For 3rd degree burns, patients with greater than a 5 %BSA 3rd degree burn, or a 20 %BSA 2nd degree burn, becoming CONV (by evacuation to a burn center) at 48 hours. There are no changes to the DOW or RTD estimates, whether for burn injuries or any other CBRN injury or insult.</p>	<p>TBD (Currently in DRAFT FINAL status) 43 p.</p>	
<b>2016 Review on the Extension of the AMedP-8(C) Methodology to New Agents, Materials, and Conditions</b>	<p>This review provides the OTSG Medical CBRN Defense Staff Officer a summary of the products delivered under Task Order CA-6-3079. This allows OTSG to perform a retrospective review of this task order, and permits this information to be incorporated into future plans for studies and analyses sponsored by OTSG. This is a review of eight years of studies and analyses performed in support of the OTSG Medical CBRN Defense Staff Officer and the Medical Branch of the Joint Requirements Office for CBRN Defense (JRO-CBRND) / J8. Products were reviewed as reported in 93 monthly reports. Accounting for some redundancy in reporting, 64 formal and 108 informal products were identified. These deliverables included the development and promulgation of new or updated NATO doctrine on CBRN casualty estimation and operational guidance for medical CBRN defense.</p>	<p>D-8375 Curling, Carl A. TBD (Currently in DRAFT FINAL status) 200 p.</p>	<p>3/1/2017</p>

Title	Abstract	IDA Publication Information	Report Date
	<p>Fourteen chemical agents and twelve biological agents were added to the CBRN casualty estimation methodology. Table top exercises were developed, executed, and analyzed to evaluate concepts of the CBRN casualty estimation methodology, medical CBRN operations, and the impact of the international health regulations. Existing and proposed doctrine under development by other agencies was reviewed, and comments provided to OTSG to be considered with respect to those comments provided by the Services, Joint Staff, and DOD agencies.</p>		

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## Appendix B. Informal Products

**Table B-1. Informal Products for Task Order CA-6-3079**

Title	Delivery Date
Proposed Responses to Critical Comments with U.S. Comment Review Matrix (CRM)	July 15, 2009
Revisions made to AMedP-8(C) Study Draft 3 (SD.3) that appear in Study Draft 4 (SD.4)	July 15, 2009
Draft Executive Summary of AMedP-8(C) Study Draft 4	July 16, 2009
Preliminary Responses to CHPPM's CRM on AMedP-8(C) SD.4	September 23, 2009
Briefing for U.S. Position Meeting for the 24 <sup>th</sup> BioMedAC, "New Agents Work Plan v2.pptx"	September 29, 2009
Overarching article on Human Response Injury Profiles (HRIP), "A New Methodology for CBRN Casualty Estimation Over Time"	October 19, 2009
Internal IDA AMedP-8 Database Tool	November 1, 2009
Final Proposal for Responses to SD4 Comments	November 6, 2009
Preliminary Response to French Comments on SD.4	November 12, 2009
NATO Feb 09 TTX Script Final	January 25, 2010
NATO Feb 09 TTX worksheets Final	January 25, 2010
Proposed Response to French Comments on SD.4	January 29, 2010
Proposed Response to Hungarian Comments on SD.5	January 29, 2010
SD.5 Errata	January 29, 2010
NATO Feb 09 TTX	February 3, 2010
AMedP-8(C) RD.1, with revisions to Annex B, Para B104 "Radiological Effects Examples — Radiological Dispersal Device (RDD)"	February 5, 2010
<u>SharePoint site, <a href="https://collab.ida.org/CBHumanResponseModeling">https://collab.ida.org/CBHumanResponseModeling</a></u>	March 31, 2010
Draft Spreadsheet "Chemical Agent Human Response Modeling Parameters.xls"	March 31, 2010
AMedP-8(C) and MEG Comparison	May 28, 2010
PowerPoint Presentation on "Allied Medical Publication 8 Planning Guide for CBRN Casualty Estimation (AMedP-8(C))"	July 23, 2010
Draft briefing "AMedP8 Overview Long.ppt"	January 13, 2011
Draft errata sheet for AMedP-8(C) RD.1 included in email, Subject: "Errata for AMedP-8(C)," for eventual editorial correction.	January 20, 2011
Draft response to comments on AMedP-8(C) (Dr. Lam and others) included in email, Subject: "RE: AMEDP- (UNCLASSIFIED)."	January 21, 2011

Title	Delivery Date
Terminology tracking forms for new terms within AMedP-8(C). (Eight documents, including "Glossary Terms to be Added to NATO Lexicons," "Defeat Dose Addition TTF_2009," "Radiological Casualty Addition TTF_2009," "Very Severe (Severity Level 4) Addition TTF_2009," "Severe (Severity Level 3) Addition TTF_2009," "Moderate (Severity Level 2) Addition TTF_2009," "Mild (Severity Level 1) Addition TTF_2009," and "No Observable Effect (Severity Level 0) Addition TTF_2009.")	February 10, 2011
Med Mgmt of Nuclear Casualties Study Plan v2.docx	March 1, 2011
Assess the Preparedness for the Med Mgmt of Nuc Casualties v7.pptx	March 3, 2011
Medical Management of Nuclear Casualties Study Plan DRAFT v6b.docx	April 12, 2011
Proposed Study Plan on the Med Mgmt of Nuc Casualties v3.pptx	April 25, 2011
PowerPoint presentation Nuc Study Preliminary Briefing v4.pptx as an informal product in support of IDA D-4319	September 14, 2011
Poster presentation on the impact of medical countermeasures and treatment on the CBRN casualty estimate, Bundeswehr Medical Biological Defense conference	October 26, 2011
PowerPoint presentation Human Response Modeling Parameters for Five Additional Non-Contagious Biological Agents: Brucellosis, Glanders, Q Fever, SEB, and Tularemia, Bundeswehr Medical Biological Defense conference	October 26, 2011
Presented poster presentation on the impact of medical countermeasures and treatment on the CBRN casualty estimate, DTRA CBD S&T conference	November 14, 2011
Poster presentation on "Human Response Modeling Parameters for Five Additional Non-Contagious Biological Agents: Brucellosis, Glanders, Q Fever, SEB, and Tularemia," DTRA CBD S&T conference	November 14, 2011
PowerPoint presentation at the 33rd CBRNMedWG meeting entitled "Five More Bio Agent Parameters 33rd CBRNMedWG Brussels Feb 2012 DRAFT"	February 8, 2012
Study Draft 1 of Chapter 8 "Medical CBRN" of Allied Joint Publication 4.10 "Allied Joint Medical Support Doctrine" (AJMedP-7)	May 10, 2012
PowerPoint presentation "Allied Joint Medical Doctrine for Support to CBRN Defensive Operations" during the AJMedP-7 custodial meeting in Warsaw, POLAND	May 24, 2012
CBRN Casualty Estimation Work Effort of the Medical CBRN Defense Planning and Resource Project, Task CA-6-3079a3 Midterm Review (Task Order CA-6-3079a3 Mid-Term Review.pptx)	August 28, 2012
Presentation on "The Impact of Medical Care on CBRN Casualty Estimation" Impact of Medical Care 30th BioMedAC Brussels Nov 2012 v3.pptx	September 28, 2012
Study Draft 2 of Allied Joint Medical Publication 7, "Allied Joint Medical Doctrine for Support to CBRN Defensive Operations (AJMedP-7 SD.2)"	October 18, 2012



<b>Title</b>	<b>Delivery Date</b>
Presentation on "Allied Joint Medical Doctrine for Support to CBRN Defensive Operations" to NOMC, Ieper, BELGIUM (AJMedP7 NOMC Brf DRAFT v3a jkb.pptx)	October 25, 2012
Presentation on "The Impact of Medical Care on CBRN Casualty Estimation" to BioMedAC, Brussels, BELGIUM (Impact of Medical Care 30th BioMedAC Brussels Nov 2012 v6.pptx)	November 6, 2012
Notes on Development of AMedP-7(E) short.docx	January 16, 2013
Notes on Development of AMedP-8(D) short.docx	January 16, 2013
AJMedP-7 Status 17 Jan 13.docx	January 16, 2013
Presentation on AMedP-7(E) short.docx	January 16, 2013
Presentation on AJMedP-7 Status 17 Jan 13.docx	January 16, 2013
IHR TTX Read Ahead.docx	January 18, 2013
Presentation on IHR TTX Read Ahead.docx	January 18, 2013
AMedP-6 Overview Comments.docx	April 26, 2013
AMedP-6 SD.3 CRM from IDA.xlsx	April 26, 2013
DOD Response Planning Brf to AFRRRI Conference 28 Aug 2013.pptx	August 21, 2013
RIID Inventory of Safes v5.xlsx	September 6, 2013
"Seven Bio Agent Parameters_BioMedAC 2013.pptx" Presentation for 32 <sup>nd</sup> BioMedAC on modeling of new agents for AMedP-8	October 4, 2013
AMedP-7 SD1 Comment and Response Matrices.xls	January 24, 2014
AJMedP-7 Combined Comment Matrix.docx	February 4, 2014
AJMedP-7 SD4 Revision Summary Memo.docx	February 4, 2014
AMedP-7.6(A) SD.1 (.docx and .pdf), (subsequently withdrawn for revision per reviewer recommendation)	February 5, 2014
AMedP-7.6 Way Ahead 14Mar14.docx	March 14, 2014
IDA Task 3079 Initial OTSG Review.pptx	April 3, 2014
Anthrax Infectivity SMO 2014.pptx, April	April 3, 2014
Bioforensics and the BioMedAC.pptx	April 15, 2014
AMedP-8(C) Annotated Outline.pdf	April 29, 2014
Adjudicated Consolidated Comment Matrix for AJMedP-7 SD.4	June 18, 2014
IDA_memo_FHP_conf_2014.pdf, SUBJECT: Summary from IDA attendance at Force Health Protection NATO Conference (23-26 JUNE 2014, Budapest, HUNGARY)	July 8, 2014
Enhancements to AMedP-8(C) Contagious Disease Modeling Biomed_31Oct14.pptx	October 31, 2014
IDA Task 3079 Status Review 14 Jan 2015 final.pptx	January 14, 2015
IDA Task 3079 Study Plan 12 Feb 2015 final.pptx	February 11, 2015
AMedP-7.6 Custodial Meeting Mar 2015.pptx	March 12, 2015
AMedP-7.5 Custodial Brussels Mar 2015-FINAL.pptx	March 13, 2015
Review of AMedP-7 5 Biological Agents for BioMedEP Norway May 2015 final.ppt	May 21, 2015

<b>Title</b>	<b>Delivery Date</b>
Summary of AMedP-7.5 Bio Agent Models for BioMedEP 2015-06-04.docx	June 4, 2015
Parameters for Estimation of Casualties from 10 Additional Chemical and Biological Agents Status Summary.docx and -.ppt	June 30, 2015
Parameters for Estimation of Casualties from 5 Chemical Agents Status Summary.docx and -.ppt	June 30, 2015
Casualty Estimation for Nuclear and Radiological Weapons Status Summary.docx and -.ppt	June 30, 2015
Analysis of NATO Doctrine for Biosurveillance Status Summary.docx and -.ppt	June 30, 2015
Contagious Disease Modeling Structure and Movement Status Summary.docx and -.ppt	June 30, 2015
Operational Planning Guidance for CBRN Psychological Casualties Status Summary.docx and -.ppt	June 30, 2015
NATO CBRN TEP MLT Minutes June 2015.docx (submitted to COL Paul Argo, U.S. Army Medical Department Center and School, copied to OTSG)	July 14, 2015
TEP Meeting June 2015 MFR jkb.docx (submitted to COL Paul Argo, U.S. Army Medical Department Center and School, copied to OTSG)	July 14, 2015
MFR "NATO CBRN Lessons Learned Workshop MFR with Notes"	October 1, 2015
MFR "Analysis of CBRN Psychological Casualties"	October 27, 2015
STANAG 2553 "NATO Planning Guide for the Estimation of CBRN Casualties"	November 18, 2015
Consolidated IDA comments NATO Allied Medical Publication 7.1, <i>Medical Management of CBRN Casualties</i> , Study Draft 4 (AMedP-7.1 SD.4)	December 2, 2015
Abstract on the topic of "Comparison of AMedP-7.5 Biological Casualty Estimates" for consideration of the Biodefense Conference 2016, 26 - 29 April 2016 in Munich, GERMANY	January 4, 2016
Afghan Troop Movement Data Feb 2016.xlsx	February 26, 2016
Memo on the Use of Afghan Troop Movement Data FOUO.docx	February 26, 2016
Summary of Allied Medical Publications for Elyssium II Final 20 July 2016.pptx	July 18, 2016
AMedP-7(dot)5 Final Draft 2016-07-21.docx	July 21, 2016
CRM - STANAG 2553, AMedP-7.5 SD3 (Final Draft).docx	July 21, 2016
Analytic concepts SD 1-45.pptx	August 1, 2016
Cross Reference Name with Index on MRV Record 2 September 2016.xlsx	September 2, 2016
Scanned and redacted MRV files posted on a shared FTP site 6 September 16	September 6, 2016
Index of MRV Records 9 September 2016.xlsx	September 12, 2016
Index of Single Individuals in Multiple MRV Protocols 9 September 2016.xlsx	September 12, 2016
Study Summary List 30 September 2016.xlsx	September 30, 2016

Title	Delivery Date
MRV Study Abstracts 30 September 2016.docx	September 30, 2016
IDA Casualty & Decon Estimates for CCCD Course Support.pptx	October 4, 2016
AMedP-7.5 Prague Oct 2016	October 5, 2016
AMedP-7 6 SD2 Consolidated CRM NATO.docx	October 5, 2016
AMedP-7 6 SD2 Consolidated CRM U.S..docx	October 5, 2016
AMedP-7 6 Update to CBRN Med WG Oct 2016 jkb.pptx	October 5, 2016
Capability Codes of Interest to CBRNMedWG v1.docx	October 21, 2016
AMedP-7 5 Final Draft + editorial (20161027).docx (and *.pdf)	October 27, 2016
SD 1.45 Analysis.pptx	November 15, 2016
Index of MRV Records 30 November 2016.xlsx	November 30, 2016

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## **Appendix C. Illustrations**

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### **Table**

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## Appendix D. References

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- Institute for Defense Analyses Task Order CA-6-3079, “CBRN Casualty Estimation and Support to the Medical CBRN Defense Planning & Response Project,” Amendment 1, Signed 29 January 2010.
- Institute for Defense Analyses Task Order CA-6-3079, “CBRN Casualty Estimation and Support to the Medical CBRN Defense Planning & Response Project,” Amendment 2, Signed 16 December 2010.
- Institute for Defense Analyses Task Order CA-6-3079, “CBRN Casualty Estimation and Support to the Medical CBRN Defense Planning & Response Project,” Amendment 3, Signed 16 December 2011.
- Institute for Defense Analyses Task Order CA-6-3079, “CBRN Casualty Estimation and Support to the Medical CBRN Defense Planning & Response Project,” Amendment 4, Signed 19 November 2012.
- Institute for Defense Analyses Task Order CA-6-3079, “CBRN Casualty Estimation and Support to the Medical CBRN Defense Planning & Response Project,” Amendment 5, Signed 14 November 2013.
- Institute for Defense Analyses Task Order CA-6-3079, “CBRN Casualty Estimation and Support to the Medical CBRN Defense Planning & Response Project,” Amendment 6, Signed 20 October 2014.
- Institute for Defense Analyses Task Order CA-6-3079, “CBRN Casualty Estimation and Support to the Medical CBRN Defense Planning & Response Project,” Amendment 7, Signed 18 February 2015.
- Institute for Defense Analyses Task Order CA-6-3079, “CBRN Casualty Estimation and Support to the Medical CBRN Defense Planning & Response Project,” Amendment 8, Signed 8 December 2015.
- Institute for Defense Analyses Task Order CA-6-3079, “CBRN Casualty Estimation and Support to the Medical CBRN Defense Planning & Response Project,” Amendment 9, Signed 1 February 2016.
- Institute for Defense Analyses Task Order CA-6-3079, “CBRN Casualty Estimation Update of the Medical CBRN Defense Planning & Response Project,” Amendment 0, 22 May 2009.
- North Atlantic Treaty Organization (NATO), *AMedP-8(C): NATO Planning Guide for the Estimation of CBRN Casualties*, STANAG 2553 (Brussels: NATO, March 2011).

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## **Appendix E. Abbreviations**

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ACT	NATO Allied Command Transformation
AJMedP	Allied Joint Medical Publication
AJP	Allied Joint Publication
AMedP	Allied Medical Publication
ARS	Acute Radiation Syndrome
BioMedAC	NATO Biological Medical Advisory Committee
BMEG	Biological Military Exposure Guidelines
BSA	Body Surface Area
CAA	Center for Army Analysis
CB	Chemical and Biological
CBRN	Chemical, biological, radiological, and nuclear
CBRNMedWG	NATO CBRN Medical Working Group
CET	Casualty Estimation Tool
CJFC	Combined Joint Force Component
CONV	Convalescent
CRM	Comment Review Matrix
CRN	Chemical, Radiological, and Nuclear
CUD	Common User Database
DHHS	Department of Health and Human Services
DHS	Department of Homeland Security
DMSB	Defense Medical Standardization Board
DOD	Department of Defense
DOE	Department of Energy
DOW	Died of Wounds
DTRA	Defense Threat Reduction Agency
FD	Final Draft
FDA	Food and Drug Administration
FTP	File Transfer Protocol
FY	Fiscal Year
GA	Tabun

GD	Soman
GF	Cyclosarin
Gy	Gray
HD	Mustard
HFM	Human Factors and Medicine
HPAC	Hazard Prediction and Assessment Capability
HRIP	Human Response Injury Profile
IDA	Institute for Defense Analyses
IR	Ionizing Radiation
JMPT	Joint Medical Planning Tool
JRO-CBRND	Joint Requirements Office for CBRN Defense
KNN	K Nearest Neighbors
kT	Kiloton
L	Lewisite
MEG	Military Exposure Guideline
MRV	Military Research Volunteer
NATO	North Atlantic Treaty Organization
NBC CREST	Nuclear Biological and Chemical Casualty Resource and Estimation Support Tool
NH3	Ammonia
NOMC	NATO Operational Medical Conference
OTSG	Office of The Surgeon General
P8CEM	P8 Casualty Estimation Methodology
P8PEM	P8 Patient Estimation Methodology
PHC	U.S. Army Public Health Command
R&D	Research and Development
RD	Ratification Draft
RITN	Radiation Injury Treatment Network
RTD	Return to Duty
SD	Study Draft
SEB	Staphylococcal Enterotoxin B
SEIRP	Susceptible, Exposed and Infected, Infectious, Removed, and Prophylaxis
STANAG	Standardization Agreement
TBq	Terabecquerel
TG	Technical Guide

TML+	Tactical Medical Logistics Planning Tool
TRM	Technical Reference Manual
TTTF	CBRN Task-Time-Treater Files
USACHPPM	U.S. Army Center for Health promotion and Preventive Medicine
USAMRID	U.S. Army Medical Research Institute of Infectious Diseases
VEE	Venezuelan Equine Encephalomyelitis
WHO	World Health Organization
WIA	Wounded in Action
WMD	Weapons of Mass Destruction

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1. REPORT DATE (DD-MM-YY) XX-03-2017		2. REPORT TYPE Final		3. DATES COVERED (From – To)	
4. TITLE AND SUBTITLE  2016 Review on the Extension of the AMedP-8(C) Methodology to New Agents, Materials, and Conditions: 2009–2016 IDA Project Summary			5a. CONTRACT NO. HQ0034-14-D-0001		
			5b. GRANT NO.		
			5c. PROGRAM ELEMENT NO(S).		
6. AUTHOR(S)  Carl A. Curling			5d. PROJECT NO.		
			5e. TASK NO. CA-6-3079		
			5f. WORK UNIT NO.		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Institute for Defense Analyses 4850 Mark Center Drive Alexandria, VA 22311-1882			8. PERFORMING ORGANIZATION REPORT NO. IDA Document D-8375 IDA Log H 17-000155		
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) Army Office of The Surgeon General/MEDCOM G-37 Force Management DHHQ 7700 Arlington Blvd. Falls Church, VA 22042-5143			10. SPONSOR'S / MONITOR'S ACRONYM(S) OTSG		
			11. SPONSOR'S / MONITOR'S REPORT NO(S).		
12. DISTRIBUTION / AVAILABILITY STATEMENT  Approved for public release; distribution is unlimited.					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT  This review provides the Office of The Surgeon General (OTSG) Medical Chemical, Biological, Radiological, and Nuclear (CBRN) Defense Staff Officer a summary of the products delivered under Task Order CA-6-3079. This allows OTSG to perform a retrospective review of this task order, and permits this information to be incorporated into future plans for studies and analyses sponsored by OTSG. This is a review of eight years of studies and analyses performed in support of the OTSG Medical CBRN Defense Staff Officer and the Medical Branch of the Joint Requirements Office for CBRN Defense (JRO-CBRND)/J8. Products were reviewed as reported in 93 monthly reports. Accounting for some redundancy in reporting, 64 formal and 108 informal products were identified. These deliverables included the development and promulgation of new or updated North Atlantic Treaty Organization (NATO) doctrine on CBRN casualty estimation and operational guidance for medical CBRN defense. Fourteen chemical agents and twelve biological agents were added to the CBRN casualty estimation methodology. Table top exercises were developed, executed, and analyzed to evaluate concepts of the CBRN casualty estimation methodology, medical CBRN operations, and the impact of the international health regulations. Existing and proposed doctrine under development by other agencies was reviewed, and comments provided to OTSG to be considered with respect to those comments provided by the Services, Joint Staff, and Department of Defense agencies.					
15. SUBJECT TERMS CBRN, NATO, Casualty Estimation, Medical Planning					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NO. OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			MAJ Thomas Rezentes
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