

Nuclear Contamination Avoidance

Preface v

Introduction vi

Chapter 1. Vulnerability Analysis 1-0

- The IPB Process 1-0
- Nuclear Threat Status (STANAG 2984) 1-2
- Nuclear Vulnerability Analysis 1-4
 - Casualty and Damage Assessment 1-5
 - Safety Distance Assessment 1-5
 - Nuclear Radiation Safety 1-7
 - Primary Targets 1-7
 - Targeting Terms and Criteria 1-7
- Analysis of Friendly Unit Vulnerability 1-8
 - Vulnerability Analysis 1-8
 - Visual Technique 1-8
- Vulnerability Reduction 1-9
- Active Measures 1-9
- Passive Measures 1-9
 - Plan Ahead 1-9
 - Avoid Detection 1-9
 - Provide Warning 1-10
 - Maintain Discipline 1-10
 - Seek Protection 1-10
 - Disperse 1-10
 - Remain Mobile 1-10
 - Cover Supplies and Equipment 1-10

Limit Exposure 1-10

Prevent Spread of Contamination 1-11

Chapter 2. NBC Warning and Reporting System 2-0

- Standard NBC Reports 2-0
 - NBC 1 Report 2-1
 - NBC 2 Report 2-2
 - NBC 3 Report 2-3
 - NBC 4 Report 2-3
 - NBC 5 Report 2-3
- Managing the NBC Warning and Reporting System 2-4
 - Collecting Nuclear Information 2-4
 - Monitoring, Survey, and Reconnaissance Data 2-4
 - Evaluating Nuclear Information 2-4
 - Unit Procedures 2-4
 - NBCC Procedures 2-5
 - Transmitting Nuclear Information 2-5
 - Unit Level 2-5
 - Battalion Level 2-6
 - Brigade or Task Force Level 2-6
 - NBCC Level 2-6
 - Designated Observer System 2-6
 - Designated Ground-Based Observers 2-6
 - Designated Aerial Observers 2-7

DISTRIBUTION RESTRICTION: Distribution is authorized to US government agencies only to protect technical or operational information, as well as unclassified, controlled, nuclear information (UCN) material from automatic dissemination under the International Exchange Program or by other means. This determination was made 29 November 1991. Other requests for this document will be referred to Commandant, US Army Chemical School, ATTN: ATZN-CM-FNB, Fort McClellan, AL 36205-5020.

DESTRUCTION NOTICE: Destroy by any method that will prevent disclosure of contents or reconstruction of the document.

U.S. MARINE CORPS PCN: 139 001194 00

- Nondesigned Observers 2-7
- Friendly Nuclear Attack Warnings 2-7
 - Responsibility 2-7
- STRIKWARN Messages 2-7
- Automated Nuclear, Biological, and Chemical Information System (ANBACIS) 2-10

Chapter 3. Introduction to Nuclear Operations 3-0

- Nuclear Weapons Effects 3-0
- Initial Radiation Effects 3-1
- Residual Radiation Effects 3-1
 - Unused Fissionable Material 3-1
 - Fission Products 3-1
 - Neutron-Induced Activity 3-2
- Effects of Fallout on Ships at Sea 3-2
- Nuclear Clouds 3-2
 - Detecting the Attack 3-2
 - Angular Cloud Width 3-4
 - Stabilized Cloud-Bottom or Cloud-Top Angle 3-4
 - Cloud-Top or Cloud-Bottom Height 3-5
 - Observer Position 3-5
 - Location of Ground Zero/Azimuth to the Attack 3-5
 - Unit Level Procedures 3-5
- Location of Ground Zero 3-5
- Yield Estimation 3-6
 - On Shore 3-6
 - Onboard Ships 3-7
- Significance of Fallout Ashore versus at Sea 3-7
- Flash-to-Bang Time 3-7
- Type of Burst and Time of Attack 3-9
- Recording and Reporting
 - Nuclear Burst Data 3-9
- Evaluating Data 3-9
- NBCC Procedures 3-9
 - Date and Time of Attack 3-9
 - Ground Zero Location 3-10
 - Yield Estimation 3-11
 - Nuclear Burst Angular Cloud Width 3-11
 - Stabilized Cloud-Top or Cloud-Bottom Height 3-11
 - Stabilized Cloud-Top or Cloud-Bottom Angle 3-12
- Yield Estimation From Radar Data 3-12
- Illumination Time 3-12
- Resolved Yield 3-12

- NBC 2 Nuclear Report 3-13
 - Strike Serial Number 3-15
 - Simplified Fallout Prediction 3-15
 - Wind Data 3-15
- Effective Downwind Message 3-16
 - Preparation of a Message 3-16
 - Special Cases (Wind Data) 3-18
- Naval Effective Downwind Message 3-19
 - Preparation of a Message (Constant Pressure Data) 3-19
- M5A2 Fallout Predictor 3-21
 - Procedures for Using Simplified Method 3-21
 - Constructing a Simplified Predictor 3-23
- Simplified Fallout Prediction (Normal Case) 3-24
- Simplified Fallout Prediction (Expanded Case) 3-24
- Simplified Fallout Prediction (Circular Case) 3-24
- Ship's Fallout Template 3-24
 - Safety Distance 3-27
 - Fallout Plotting from NAV EDM and Observations 3-27
 - Fallout Plotting from NAV EDM and NAV NBC 2 Nuclear Report 3-29

Chapter 4. Detailed Fallout Prediction—NBC 3 Report 4-0

- Overview 4-0
 - Significance of Predicted Fallout Zones 4-0
 - Inside the Predicted Area 4-0
 - Outside the Predicted Area 4-1
 - Reliability 4-1
 - Arrival of Fallout 4-1
- NBCC Procedures 4-3
- Unit Procedures 4-11
- Fallout Plotting From
 - NAV NBC 3 Nuclear Report 4-13
 - Actual Fallout Direction 4-14

Chapter 5. Monitoring, Survey, and Reconnaissance 5-1

- Planning, Conducting, Recording, and Reporting 5-1
- Monitoring 5-1
 - Direct Monitoring 5-2
 - Indirect Monitoring 5-2
 - Recording and Reporting Monitoring Data 5-4

Surveys	5-8	Dose-Rate Calculations	7-2
Control of Surveys	5-9	Total Dose Calculations for NIGA	7-3
Survey Planning at the NBC Center	5-9	Crossing an Induced-Radiation Area	7-4
Personnel and Equipment		Transmission Factors	
Requirements	5-12	for Neutron-Induced Areas	7-6
Coordination	5-12	Determination of Decay Rate	
Survey Team Briefing	5-13	for Induced Radiation	7-6
Aerial Survey	5-13	Determination of Dose Rate	
Determination of Overall Correction		for an Arbitrary Time	7-7
Factors	5-15	Determination of Dose Accumulated	
Airborne Radioactivity	5-17	in an NIGA Area	7-8
Contour Line Plotting	5-17	Determination of Time of Exit	
Aerial Survey Team Actions	5-20	from an NIGA Area Given	
Recording and Reporting	5-25	a Maximum Dosage	7-7
Ground Survey	5-26	Chapter 8. Civilian Radiation Hazards	8-0
Reconnaissance	5-27	Appendix A. Operational Exposure	
Contamination Marking	5-28	Guidance	A-0
Vehicle Correlation Factor	5-30	Categories of Exposure	A-0
Unit Procedures	5-30	Risk Criteria	A-2
Ground Radiological Recon	5-30	Negligible Risk	A-2
Aerial Recon	5-33	Moderate Risk	A-2
NBCC Actions	5-34	Emergency Risk	A-2
Chapter 6. Nuclear Defense	6-1	Radiation Exposure Records	A-2
Optimum Time of Exit for Fallout Areas	6-1	Processing Data	A-3
Special Considerations	6-1	Individual Dosimetry	A-7
Sample Problem	6-3	Appendix B. Shielding	B-0
Transmission Factors	6-3	Principles	B-0
Calculation of H-Hour	6-4	Materials	B-0
Use of ABC-M1 Radiac Calculator	6-4	Effectiveness	B-0
Rainout and Washout	6-6	Transmission Factors	B-3
Tactical Implications	6-7	Determination of Transmission Factors	B-3
Period of Validity and Decay Rate	6-8	Sample Problems	B-3
Determination of Decay Rate	6-9	Exercise Problems	B-3
Normalizing Readings to H + 1	6-9	Appendix C. Nuclear Burst Effects	
Normalizing Factor	6-14	on Electronics	C-1
Total Dose Procedures	6-14	Types of EMP	C-1
Multiple Burst Procedures	6-18	Surface-Burst EMP	C-1
Dose Rate Calculation Methods	6-18	High-Altitude EMP	C-2
Dose Rate Calculations		The HEMP Threat	C-2
for Overlapping Fallout	6-21	Tactical Equipment	C-3
Crossing a Fallout Area	6-23	Personnel	C-4
Application of Avoidance Principles	6-31	Collectors and Antennas	C-4
ANBACIS System	6-31	Basic Planning	C-4
Chapter 7. Neutron-Induced Radiation		Mitigation Techniques	C-6
Areas	7-0	Administrative and Training Situations	C-6
Plotting NIGA Areas	7-1	Rules of Thumb	C-6
Decay of Induced Radiation	7-1	Training with Back-Up Systems	C-7

Preattack and During-Attack Operations C-7
Collectors and Antennas C-7
Cables and Grounds C-9
Command, Control, Communications
and Intelligence C-9
Shelters and Shielding c-10
Power Sources C-11
Postattack REcovery and
Continued Operations C-12

Appendix D. Wind Vector Plotting D-1

Upper-Air Wind Data D-1
Procedures D-2
Field Artillery Wind Data—
Manual Method D-2
Field Artillery Wind Data—
Plotting Scale Method D-5
Ballistic MET Message D-7
Computer MET Message D-9
Octant Codes and Locations D-9
Air Weather Service Wind Data—
Plotting Scale Method D-9
Air Weather Service Constant Pressure Data—
Plotting Scale Method D-11
Other Wind Data—Manual Method D-11

Appendix E. Nomograms and Tables E-1

Appendix F. Additional Calculations F-0

Determining Decay Rate F-0
Pocket Calculator Method F-0
Graphical Method F-0
Determining Dose Rates F-1
Normalizing Factors F-3
Mathematical Method F-3
Graphical Method F-3
Multiple Burst Procedures F-3
Calculating Fallout of One Burst F-3
Calculator Method F-3
Graphical Method F-5

Calculating Overlapping Fallout F-6

**Appendix G. Nuclear Operations
Checklists G-1**

Prepare for Operations
in an NBC Environment G-1
Prepare for a Nuclear Attack G-1
Respond to a Nuclear Attack G-2
Conduct Post Attack Operations G-3
Respond to a Nuclear Fallout Prediction G-3
Operate in a Nuclear-Contaminated Area G-3
Cross a Nuclear-Contaminated Area G-4
Conduct or Supervise
a Radiological Survey G-5
Conduct or Supervise Decontamination G-5
Evacuate Radiologically Contaminated
Casualties G-6
Respond to a STRIKWARN Message G-7
Respond to an Unexpected
Contaminated Area G-7
Respond to a Civilian Nuclear Accident
or Incident G-8

References References-1

Glossary Glossary-1

Index Index-1

Reproducible Forms

DA Form 1971-R, Radiological Data Sheet—
Monitoring or Point Technique
DA Form 1971-1-R, Radiological Data Sheet—
Route or Course Leg Technique
DA Form 1971-3-R, Effective Downwind
Message Worksheet
DA Form 1971-4-R, Fallout Prediction
Worksheet—Surface Burst
DA Form 1971-5-R Fallout Prediction
Worksheet—ADM Subsurface Burst