ATP 3-11.37
MCWP 3-37.4
NTTP 3-11.29
AFTTP 3-2.44

MULTI-SERVICE TACTICS, TECHNIQUES, AND PROCEDURES FOR CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE AND SURVEILLANCE

March 2013

DISTRIBUTION RESTRICTION: Approved for public release; distribution is unlimited.

FOREWORD

This publication has been prepared under our direction for use by our respective commands and other commands as appropriate.

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1. This change adds pages to Appendix J for prescription of forms.

2. A bar (|) marks new or changed material.

3. ATP 3-11.37, 25 March 2013, is changed as follows:

Remove Old Pages	Insert New Pages
Pages iv, vi, vii, and ix	pages iv, vi, vii, and ix
Pages J-1 through J-6	pages J-1 through J-9
Pages References-2	References-2
Pages Index-1	Index-1

4. File this transmittal sheet in front of the publication for reference purposes.

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25 March 2013

Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Reconnaissance and Surveillance

Contents

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***This publication supersedes FM 3-11.19/MCWP 3-37.4/NTTP 3-11.29/AFTTP (I) 3.2.44, 30 July 2004 and rescinds FM 3-11.86/MCWP 3.37/NTTP 3-11.31/AFTTP (1) 3-2.52, 4 October 2004.**

Figures

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Preface

SCOPE

This publication will provide Service commanders and their staffs at the tactical level with multi-Service tactics, techniques, and procedures (MTTP) for chemical, biological, radiological, and nuclear (CBRN) reconnaissance and surveillance (R&S). At a minimum, this manual will—

- Provide the doctrinal tools to plan, prepare, and execute CBRN R&S operations to identify and report CBRN hazards and related precursors that U.S. forces or its allies may encounter.
- Incorporate current doctrine contained in *Multiservice Tactics, Techniques, and Procedures for Nuclear, Biological, and Chemical Reconnaissance*.
- Incorporate current doctrine contained in *Multiservice Tactics, Techniques, and Procedures for Biological Surveillance,* which is rescinded upon publication of this MTTP.
- Incorporate and implement the following North Atlantic Treaty Organization (NATO) Standardization Agreements (STANAGs) (unclassified) and other international CBRN published guidance (treaties, agreements, conventions):
  - STANAG 2002 (Edition 10).
  - STANAG 2103/NATO ATP-45(D).
  - STANAG 2150 (Edition 7).
  - STANAG 2451 (Edition 3).
  - STANAG 2522 (Edition 1).

Note. This manual addresses tactics, techniques, and procedures associated with site assessment. For information on site exploitation, see *Multi-Service Tactics, Techniques, and Procedures for Weapons of Mass Destruction Elimination Operations.*

PURPOSE

The purpose of this publication is to provide a standardized reference for use by all Services while conducting CBRN R&S. It serves as a basis for developing Service-specific manuals and tactical-level standing operating procedures (SOPs), refining existing Service training products (U.S. Army training support packages, combined arms training strategies, U.S. Marine Corps Training and Readiness Manuals), informing training center and unit exercises, guiding Service school curricula, and driving the examination of organizations and materiel developments applicable to military support of CBRN R&S.

Note. CBRN hazards include those created from the accidental or intentional releases of toxic industrial materials (TIMs), biological pathogens, and radioactive matter.

APPLICATION

This publication is designed for use at the tactical level, but has implications at operational and strategic levels. This manual is applicable to conventional force commanders and staffs at all echelons. It applies to the active and reserve components and military forces of allied countries while serving under U.S. control. The manual supports command staffs, CBRN staff officers, CBRN enlisted personnel, and non-CBRN personnel performing or assigned R&S missions or tasks**.** This publication is not directive in authority, and no part of this document should be construed as limiting commanders' freedom of action or committing commanders to a fixed or particular course of action (COA). Nor should it be construed to imply that specific tactics, techniques, and procedures (TTP) are to be used in all situations. Commanders may apply the doctrine and information presented in this manual in any manner appropriate to their particular situation and mission and may compel compliance through separate orders, regulations, or directives. Properly trained and equipped personnel conduct CBRN R&S.

IMPLEMENTATION PLAN

Participating Service command offices of primary responsibility will review this publication, validate the information, and reference and incorporate it into Service and command manuals, regulations, and curricula as follows:

- **U.S. Army.** The U.S. Army will incorporate the procedures in this publication in U.S. Army training and doctrine publications as directed by the commander, U.S. Army Training and Doctrine Command. Distribution is according to the Department of the Army (DA) Form 12-99 *(Initial Distribution Requirements for Publications).*
- **U.S. Marine Corps (USMC).** The USMC will incorporate the procedures in this publication in training and doctrine publications as directed by the Deputy Commandant for Combat Development and Integration. Distribution is according to the USMC publications distribution system.
- **U.S. Navy (USN)**. The USN will incorporate these procedures in USN training and doctrine publications as applicable. Distribution is according to Military Standard Requisition and Issue Procedure/Military Standard Transaction Reporting and Accounting Procedures Desk Guide, Navy Supplement (NAVSUP) Publication-409.
- **U.S. Air Force.** The U.S. Air Force will incorporate the procedures in this publication in U.S. Air Force training and doctrine publications as directed by the Air Staff. Distribution is according to the U.S. Air Force publications distribution system.

PROGRAM PARTICIPANTS

The following commands and agencies participated in the development of this publication:

- **Joint.** Joint Requirements Office-Chemical, Biological, Radiological, and Nuclear Defense, 401 MANSCEN Loop, Suite 1309, Fort Leonard Wood, Missouri 65473.
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- **USMC.** Marine Corps Combat Development Command, 3300 Russell Road, Suite 204, Quantico, Virginia 22134-5021 and USMC CBRN Defense School, 1273 Iowa Ave, Fort Leonard Wood, Missouri 65473.
- **USN.** Navy Warfare Development Command, Norfolk, Virginia 23511.
- **U.S. Air Force.** Headquarters Air Force Civil Engineer Support Agency, Tyndall Air Force Base, Florida 32403-5319.

USER INFORMATION

CBRN defense specialists from the four Services collectively developed this publication under the leadership of the U.S. Army CBRN School.

The USA proponent for this publication is the U.S. Army Chemical, Biological, Radiological and Nuclear School. Send comments and recommendations on a Department of the Army (DA) Form 2028 (Recommended Changes to Publications and Blank Forms) to the Commandant, U.S. Army Chemical, Biological, Radiological and Nuclear School, ATTN: ATSN-Z, 14000 MSCOE Loop, Suite 2617, Fort Leonard Wood, MO 65473.

We encourage recommended changes for improving this publication. Please reference changes by specific page and paragraph and provide a rationale for each recommendation. Send comments and recommendations directly to—

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In Army doctrine, information collection replaces the term *intelligence, surveillance, and reconnaissance (ISR).* Information collection now includes four primary tasks (instead of the traditional three): reconnaissance, surveillance, security operations, and intelligence operations.

ATP 3-11.37 uses joint terms where applicable. Terms for which ATP 3-11.37 is the proponent publication (the authority) are marked with an asterisk (*) in the glossary. Definitions for which ATP 3-11.37 is the proponent publication are boldfaced in the text. These terms and their definitions will be in the next revision of FM 1-02 and Joint Publication (JP) 1-02.

Appendix A contains a metric conversion chart for this manual. A complete listing of preferred metric units for general use is contained in Federal Standard 376B http://www.usaid.gov/policy/ads/300/fstd376b.pdf.

Unless this publication states otherwise, masculine nouns and pronouns do not refer exclusively to men.

Introduction

This manual revises and combines *Multiservice Tactics, Techniques, and Procedures for Nuclear, Biological, and Chemical Reconnaissance* and the now rescinded MTTP for Biological Surveillance manuals by incorporating shifting and emerging guidance, lessons learned, concepts and technologies to address doctrinal gaps identified in the CBRN Passive Defense Capabilities Based Assessment and from Service feedback. Accordingly, this publication is renamed: *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Reconnaissance and Surveillance.* Its primary purpose is to provide a standardized reference for use by all Services while conducting CBRN R&S operations. This publication contains several key modifications that were required to update and coalesce existing R&S doctrine. It is ultimately designed to provide commanders with detailed, timely, and accurate CBRN intelligence to gain situational understanding of CBRN threats and hazards.

Using a “plan, prepare, and execute” construct, this publication seeks to organize those activities necessary to ensure effective resource management and synchronize the efforts of staffs and leaders. In particular, execution activities are organized into a structural hierarchy that seeks to illustrate the elements of CBRN R&S. These elements are forms, modes, methods, tasks, and techniques. CBRN reconnaissance operations are partitioned into three possible forms (route, zone, and area), as are CBRN surveillance operations (area, point, and medical). There are three modes common to CBRN reconnaissance and surveillance (mounted, dismounted, and aerial), while there are four methods (standoff, remote, direct, and indirect). There are five common CBRN R&S tasks (detect, identify, quantify, collect samples, and report). CBRN reconnaissance-unique tasks (locate, survey, and mark) are supported by thirteen specific techniques, and CBRN surveillance-unique tasks (observe and monitor) have four embedded techniques. This structure is intended to provide a systematic means of promoting the production of usable information that supports the commander’s critical information requirements (CCIR) relative to CBRN threats and hazards. The selection of the appropriate CBRN R&S element to satisfy information requirements is accomplished after methodically allowing for the mission, enemy, terrain and weather, troops and support available, time available, and civil considerations (METT-TC).

Another significant change in this manual is the migration to the new Department of Defense (DOD) four-tier system for determining the identity of CBRN hazards. The identification levels are: presumptive, field confirmatory, theater validation, and definitive. This publication becomes the proponent for doctrinal definitions of these four identification levels. It must be noted that forward-deployed U.S. Navy medical assets possess the ability to conduct field confirmatory and theater validation level analyses and, as such, have opted to continue to operate in the legacy three-tiered system. These identification levels support applied military decisionmaking at the tactical, operational, and strategic levels.

Finally, this publication introduces the sample management process and notes the vital role played by precise sample collection techniques in eventually providing commanders with the analyzed data necessary to make informed CBRN protection, prophylaxis, and medical treatment decisions. While environmental samples and clinical specimens are included in the sample management process, clinical specimens are only collected by specially trained personnel. Clinical specimens will not be discussed in this manual, and the reader should refer to *Multiservice Tactics, Techniques, and Procedures for Health Service Support* in a CBRN environment for more information on clinical specimen collection.

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Chapter 1

Fundamentals

This chapter introduces the ISR process and associated CBRN aspects. It provides the fundamentals for how CBRN R&S is integrated into joint and Service warfighting functions, CBRN passive defense operational elements, and CBRN passive defense principles. It also provides CBRN R&S principles.

INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE

1-1. CBRN R&S are part of a commander's overall ISR operations. CBRN R&S provide CBRN data and information to intelligence. *Intelligence* is the product resulting from the collection, processing, integration, evaluation, analysis, and interpretation of available information concerning foreign nations, hostile or potentially hostile forces or elements, or areas of actual or potential operations (JP 1-02) The end state of R&S operations is intelligence that supports a commander's decisionmaking at all levels.

1-2. Developing situational understanding of the operational environment is critical to achieve success in military operations. Knowledge about the operational environment requires proactive and continuous R&S to acquire information. Information that is collected from multiple sources and analyzed becomes intelligence that provides answers to CCIRs concerning the adversary, climate, weather, terrain, and population. Developing this is the function of ISR.

1-3. ISR is an activity that synchronizes, integrates, and processes information from sensors and assets for exploitation and information dissemination in direct support of current and future operations. This is an integrated intelligence and operations function. For military forces, this activity is a joint operation that focuses on priority intelligence requirements (PIRs) while answering the CCIRs. Through ISR, commanders and staffs continuously plan, task, and employ collection assets and forces. These assets collect, process, and disseminate timely and accurate combat information and intelligence to satisfy the CCIRs and other intelligence requirements. ISR supports military operations through—

- Synchronization.
- Integration.

1-4. This publication focuses on CBRN R&S. The terms *reconnaissance* and *surveillance* are, in many cases, used synonymously, yet they are in fact two separate and distinct tasks of ISR operations:

- *Reconnaissance* a mission undertaken to obtain, by visual observation or other detection methods, information about the activities and resources of an adversary, or to secure data concerning the meteorological, hydrographic, or geographic characteristics of a particular area. (JP-1-02)
- *Surveillance* is the systematic observation of aerospace, surface, or subsurface areas, places, persons, or things, by visual, aural, electronic, photographic, or other means. (JP-1-02)

1-5. The purpose of CBRN R&S is to provide commanders with detailed, timely, and accurate CBRN intelligence, by visual observation or CBRN detection methods, and to gain situational understanding of CBRN threats and hazards. Information that is collected from multiple sources and analyzed becomes intelligence that provides answers to the CCIR/PIR concerning an adversary use of CBRN weapons or regarding impacts of an accidental release of CBRN material.

1-6. Understanding the difference between R&S allows the CBRN staff planner to better advise the commander regarding the employment of CBRN R&S assets. As described above, their purposes differ through separate means by which the information/intelligence required is observed and collected. Simply put, CBRN reconnaissance can be considered an active means of observation and collection while CBRN surveillance is a passive means.

1-7. Surveillance is passive and may be continuous; reconnaissance missions have finite objectives and use active means (such as movement). Commanders complement surveillance with frequent reconnaissance. Surveillance, in turn, increases the efficiency of reconnaissance by focusing on those identified missions to reduce the risk to personnel. R&S can be independent or complimentary of one another. When used together, they can create a synergy of greater value than when used separately.

RELEVANCE TO JOINT AND SERVICE WARFIGHTING FUNCTIONS

1-8. While this manual focuses on CBRN R&S, the CBRN staff planner must understand how CBRN R&S is relevant to the joint and Service warfighting functions. The joint and Service warfighting functions are—

- Command and control (C2).
- Intelligence.
- Fires.
- Movement and maneuver.
- Protection.
- Sustainment.

Note. The U.S. Army uses the term *mission command* instead of C2.

1-9. CBRN R&S directly supports the joint and Service warfighting function of intelligence. Intelligence provides commanders with an understanding of the operational environment. The intelligence function includes planning and direction, to include managing counterintelligence activities, collection, processing, and exploitation, analysis, production, dissemination, integration, evaluation, and feedback. It also supports military decisionmaking associated with the commander's decisions for operations, medical decisions, and forensics-based attribution. (For more information on the joint and Service warfighting functions, see JP 3-0.)

RELEVANCE TO CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR PASSIVE DEFENSE OPERATIONAL ELEMENTS

1-10. CBRN R&S is principally focused on informing the military mission area (MMA) of CBRN passive defense. However, CBRN R&S provides critical input to MMAs; weapons of mass destruction (WMD) security cooperation and partner activities; threat reduction cooperation; WMD interdiction, WMD offensive operations, WMD elimination, WMD active defense, CBRN passive defense, and WMD consequence management. For more information on the eight MMAs, see JP 3-40 and *Multi-Service Doctrine for Chemical, Biological, Radiological and Nuclear Operations*.

1-11. CBRN passive defense encompasses passive measures taken to minimize or negate the vulnerability to, and effects of, CBRN incidents causing a high order of destruction or mass casualties. CBRN R&S provides critical input to CBRN passive defense and its operational elements. The CBRN passive defense operational elements are—

- CBRN shape.
- CBRN sense.
- CBRN shield.
- CBRN sustain.

1-12. CBRN R&S directly supports the CBRN passive defense operational element of CBRN sense. CBRN sense entails activities that provide continuous CBRN threat and hazard (potential or actual) information and intelligence to support the COP through CBRN R&S early detection, identification, and determination of the scope of hazards. CBRN sense provides the capability to continually provide the information about the CBRN situation at a time and place by detecting, identifying, and quantifying CBRN hazards in the air and water and on land, personnel, equipment, and facilities. This capability includes detecting, identifying, and quantifying CBRN hazards in all physical states (solid, liquid, gas). CBRN sense is also key to CBRN contamination avoidance.

1-13. Success for CBRN defense operations begins with synchronizing the joint and Service warfighting functions that are common to joint operations at all levels of war with the operational elements of CBRN passive defense (CBRN shape, CBRN sense, CBRN shield, and CBRN sustain).

RELEVANCE TO THE PRINCIPLES OF CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR DEFENSE

1-14. CBRN R&S directly supports the principles of CBRN defense, which are—

- Avoidance of CBRN hazards.
- Protection of individuals, units, and equipment from unavoidable CBRN hazards.
- Decontamination to restore operational capability.

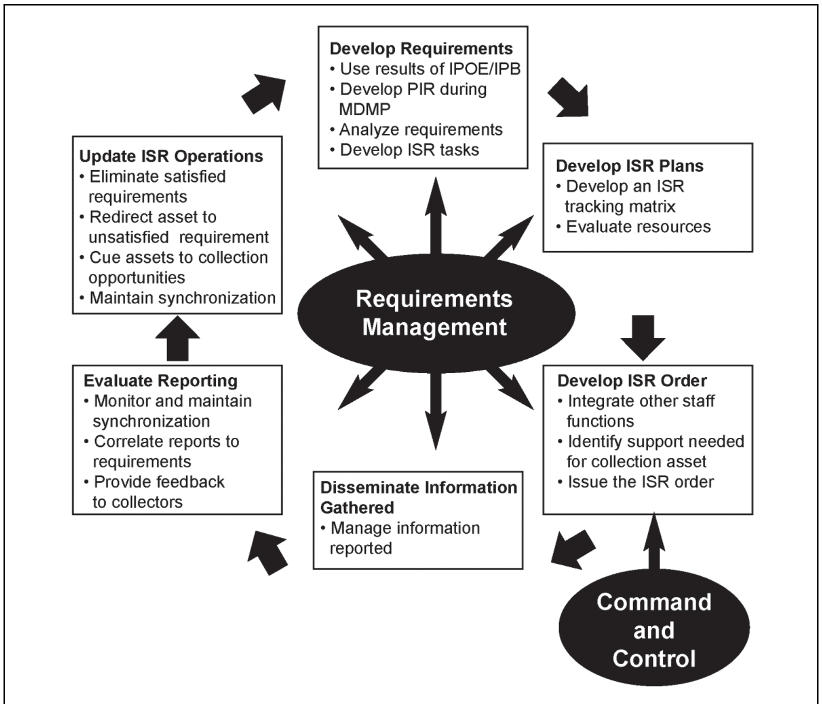
1-15. CBRN R&S implements CBRN contamination avoidance through detection, identification, and quantification of CBRN hazards. The implications of detection may include—

- Predicting.
- Warning and reporting.
- Marking.
- Relocating and rerouting.
- Treatment.
- Verification.
- Changes in individual protective equipment (IPE) and personal protective equipment (PPE) levels.

1-16. For more information regarding CBRN contamination avoidance, see *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Avoidance.*

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR ASPECTS OF INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE SYNCHRONIZATION AND INTEGRATION

1-17. CBRN R&S is part of the cyclical ISR process. During the phases of the ISR process, the CBRN staff integrates CBRN R&S whenever there is a CBRN threat or hazard. The CBRN staff provides input to the overall ISR process, seeks to define what information is required, determines the best method to collect the information, allocates assets to collect the information, disseminates intelligence derived from the information, and assesses the value of the intelligence. Figure 1-1, page 1-4, depicts the ISR synchronization and integration process.



Legend:

IPB	intelligence preparation of the battlespace
IPOE	intelligence preparation of the operational environment
ISR	intelligence, surveillance, and reconnaissance
MDMP	military decisionmaking process
PIR	priority intelligence requirements

Figure 1-1. The ISR synchronization and integration process

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE OPERATIONS

1-18. CBRN reconnaissance operations are those operations undertaken to obtain, by visual observation or other detection methods, information on the potential or actual CBRN hazards and threats in an area of operations. CBRN reconnaissance primarily relies on technology rather than human observation. CBRN reconnaissance is a focused collection effort. It is performed in support of operations to provide information used in the intelligence preparation of the operational environment (POE)/intelligence preparation of the battlespace (IPB) process, and in support of the commander's ability to formulate, confirm, or modify the COA.

1-19. The principles of CBRN reconnaissance include—

- **Ensure continuous CBRN reconnaissance.** CBRN reconnaissance is conducted before, during, and after operations. Before an operation, CBRN reconnaissance focuses on filling gaps in information about an adversary's CBRN capabilities, specific hazard considerations, and the terrain. During an operation, CBRN reconnaissance focuses on providing the commander with updated CBRN information that verifies CBRN hazards. This information may include location, type, intensity, persistence, size, and any other characteristics that may support the commander's decisionmaking. This allows commanders to verify which COA is actually being adopted by the adversary and to determine if the plan is still valid based on actual events in the operational area. After an operation, CBRN reconnaissance focuses on providing situational awareness as to the area, extent, and duration of the CBRN threats and hazards in the operational area and on collecting the information necessary for planning subsequent CBRN operations. In stability or civil support operations, CBRN reconnaissance focuses on specific civilian hazard considerations.

- **Do not keep CBRN reconnaissance assets in reserve.** CBRN reconnaissance assets, like artillery assets, are never kept in reserve. When committed, CBRN reconnaissance assets use their resources to accomplish the mission. (This does not mean that all assets are committed all the time.) Commanders use CBRN reconnaissance assets based on their capabilities and METT-TC to achieve the maximum coverage needed to answer the CBRN CCIRs.

  At times, this requires commanders to withhold or position CBRN reconnaissance assets so that they are available at critical times and places. The rest required by CBRN reconnaissance assets to sustain the CBRN reconnaissance effort is not to be obtained by placing them in reserve. However, CBRN reconnaissance assets should be treated as committed assets with specific missions assigned. This fundamental does not apply to R&S elements with multiple roles that can conduct CBRN reconnaissance, security, and other combat missions in an economy-of-force role.

> ***Note.*** The U.S. Marine Corps uses the acronym METT-T (mission, enemy, terrain and weather, troops and support available—time available). Civilian considerations are inherently measured within the context of the acronym.

- **Orient on the CBRN reconnaissance objective.** The commander uses the CBRN reconnaissance objective to focus the CBRN reconnaissance efforts of the R&S element. Commanders of subordinate CBRN R&S elements remain focused on achieving this objective, regardless of what their forces encounter during the mission.
- **Report information rapidly and accurately.** CBRN reconnaissance assets must acquire and report accurate and timely information on the CBRN threats and hazards and other relevant information observed while performing their principle task of CBRN reconnaissance. Information may quickly lose its value. CBRN R&S elements report exactly what they see and, if appropriate, what they do not see. Seemingly unimportant information may be extremely important when combined with other information. Negative reports should be forwarded to higher headquarters for review or collaboration, as they may fill in gaps of the overall ISR picture. The unit information management plan ensures that CBRN R&S element assets have the proper communication equipment to support the integrated ISR.
- **Retain freedom of action.** CBRN reconnaissance assets must retain battlespace mobility to successfully complete their missions. If these assets are decisively engaged, CBRN reconnaissance stops and a battle for survival begins. CBRN reconnaissance assets must have clear engagement criteria that support the commander's intent. They must employ proper movement and CBRN reconnaissance techniques, and use overwatching fires and SOPs. Initiative and knowledge of the terrain and the adversary reduce the likelihood of decisive engagement and help maintain freedom of movement. When conducting CBRN reconnaissance, the CBRN R&S element adopts a combat formation designed to limit exposure to CBRN hazards. This provides the R&S element with the maximum opportunity to move across terrain without the entire R&S element becoming contaminated. The IPOE/IPB process can identify anticipated CBRN hazard areas/locations.
- **Gain and maintain CBRN hazard understanding.** When an R&S element conducting CBRN reconnaissance detects or locates a CBRN hazard, it works to gather and maintain information about the hazard for reporting to its higher headquarters.
- **Develop the situation rapidly.** When a CBRN reconnaissance asset encounters a CBRN hazard, it must quickly determine the threat it faces. For a new CBRN hazard, it must determine the type of hazard, CCIR, and PIR relevance and assess the implications of the hazard information.

1-20. The forms of CBRN reconnaissance are—

- **Route reconnaissance.** The purpose of route reconnaissance is to provide detailed information on trafficability, adversary activity, CBRN contamination, and the adjacent terrain from the viewpoint of adversary and friendly forces. Route reconnaissance focuses on obtaining information about a specified route and terrain from which a CBRN hazard could influence movement along that route. Route reconnaissance can orient on a road, railway, waterway, or general direction of attack to provide new or updated information on route contamination conditions or activities along the route.

- **Area reconnaissance.** The purpose of area reconnaissance is to confirm or deny the presence of potential or suspected CBRN threats/hazards or contamination within a given area. Before moving forces into or near a specified area, the commander may call on his CBRN R&S element to conduct an area reconnaissance. The area could be a town, ridgeline, woods, or another feature that friendly forces intend to occupy, pass through, or avoid. The commander frequently employs area reconnaissance to gain information on objective areas, to confirm the IPOE/IPB templates, and to provide detailed information regarding CBRN threats and hazards. Within an operational area, area reconnaissance can focus the reconnaissance on the specific locale that is critical to the commander. This form of focusing the reconnaissance also permits the mission to be accomplished more quickly.
- **Zone reconnaissance.** The purpose of a zone reconnaissance is to obtain information on CBRN threats and hazards affecting terrain and routes within a specified zone. The zone reconnaissance form includes the use of moving elements, stationary teams, or multiple area reconnaissance actions. Commanders normally assign a CBRN zone reconnaissance mission to the CBRN R&S element when they need detailed information before moving their forces into or through the zone. The reconnaissance provides the commander with a detailed picture of the CBRN threat or hazard, enabling him to choose the appropriate COA. The CBRN R&S element conducts terrain-oriented CBRN zone reconnaissance to gain detailed information about routes, terrain, and resources within the assigned zone. This is the most thorough and complete reconnaissance mission; and therefore, it is very time-intensive.

Note. Route, area, and zone reconnaissance may include finding a bypass (clear) route that allows forces to avoid contamination.

1-21. CBRN reconnaissance provides commanders with information on CBRN hazards in an operational area. The key tasks for CBRN reconnaissance are identified below (further task details can be found in chapter 4):

- Detect CBRN hazards.
- Locate CBRN hazards.
- Identify CBRN hazards.
- Quantify CBRN hazards.
- Collect environmental CBRN samples.
- Conduct CBRN surveys.
- Mark CBRN hazards.
- Report CBRN hazards.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR SURVEILLANCE OPERATIONS

1-22. *CBRN surveillance* is the systematic observation of aerospace, surface, or subsurface locations, places, persons, or things, by visual, aural, electronic, photographic, or other means to confirm or deny the presence of CBRN hazards. CBRN surveillance facilitates situational understanding and maintenance of an accurate, high fidelity, real-time picture of the operational environment as changes occur.

1-23. The commander will use available assets (intelligence, medical, and CBRN surveillance) to detect CBRN hazards. Resulting detection information will aid in decisionmaking to reduce the effects of CBRN hazards and feed directly into the U.S. force warning and reporting network when appropriate. In conjunction with intelligence, medical and CBRN surveillance are used to assess the potential use of CBRN weapons by the adversary (for example, signals intelligence may intercept threat employment orders for a CBRN attack). Human intelligence (HUMINT) may also provide information on future threat intentions and CBRN weapon manufacturing capabilities and locations. Medical surveillance assesses the incidence of illness to determine whether a CBRN incident may have occurred. CBRN surveillance serves as another critical component of awareness.

1-24. The principles of CBRN surveillance include—

- **Maintain continuous CBRN surveillance on CBRN named areas of interest (NAIs).** Once the CBRN surveillance of a NAI commences, CBRN surveillance must be maintained until the mission is completed or terminated by the higher commander. Commanders designate to whom the CBRN information will be reported and the means of communication. Continuous CBRN surveillance on NAIs requires multiple collection assets, a purpose (PIRs), and a location (NAI or target area of interest [TAI]) for each CBRN asset. During CBRN ISR synchronization, CBRN collection assets are selected that can best answer the CBRN-specific information requirements (SIRs) generated from the CCIR. During CBRN ISR integration, specific assets are tasked to perform these missions, using the tools developed during ISR synchronization to ensure continuous coverage.
- **Avoid designating too many CBRN NAIs.** Continuous CBRN surveillance suffers as a result of excessive NAIs. Coordinators for surveillance assets should be present at ISR rehearsals to determine appropriate tasking and ability to cover particular NAIs.
- **Provide continuous observation before, during, and after operations.** Within present capabilities, commanders strive to maximize CBRN assets, including processing and analysis, to provide persistent observation before, during, and after operations. Before initial entry into a theater of operations, national assets are the major sources of CBRN information. Once in the operational area, CBRN surveillance is deployed as early as possible to help focus CBRN reconnaissance efforts and provide early warning. During operations, CBRN surveillance supports target acquisition, discovers information that cues CBRN reconnaissance, answers the CBRN CCIR, and assists the commander and staff in assessing operations. CBRN surveillance helps look for remnants of adversary CBRN capabilities or activity and provides information to begin subsequent CBRN planning.
- **Orient CBRN surveillance to provide early and accurate warning.** One of the main purposes of CBRN surveillance is to provide early warning of imminent CBRN hazards. Together with IPOE/IPB, commanders use CBRN surveillance to assess the most dangerous and most probable threats/hazards and ascertain the most likely location or direction in which these will come. They then orient CBRN surveillance assets to observe these locations for indicators of threat to friendly forces. Reports of threat must be early and accurate, with timely processing and dissemination.
- **Track and assess key CBRN threats and hazards.** CBRN surveillance support for targeting includes tracking and assessing. Once a CBRN threat or hazard is detected, planning cells must also consider the need to maintain visibility on the hazard.
- **Provide continuous, redundant, and overlapping coverage on critical locations.** Commanders integrate the capabilities of limited CBRN surveillance assets to provide continuous coverage of critical locations identified during planning. Commanders and staff continuously assess CBRN surveillance results to determine changes in critical locations requiring this level of coverage. The intelligence and operations staff work together to achieve balance in the use of CBRN assets with cueing, mixing, and redundancy in an attempt to use limited assets most effectively and collect the most critical information with the fewest assets as quickly as possible.
    - Cueing is the integration of one or more types of CBRN R&S systems to provide information that directs follow-on collection of more detailed information by another system. Cueing helps to focus limited reconnaissance assets, especially limited ground CBRN R&S assets, which can rarely examine every part of a large area/location closely. Electronic, thermal, visual, audio, and other technical assets with wide-area surveillance capabilities, often working from aerial platforms, can quickly determine areas of adversary concentration or areas where there is no adversary presence. These assets may cue ground and air reconnaissance assets to investigate specific locations to confirm and amplify information developed by technical assets (for example, aerial capabilities can cover large areas and cue CBRN ground reconnaissance or an unmanned aircraft system [UAS] once a

CBRN hazard is identified). The commander may dispatch CBRN ground reconnaissance to verify the information and mark the area. Or he may dispatch a UAS to verify the information for operational purposes. Similarly, a CBRN ground reconnaissance capability could cue CBRN surveillance capabilities. The key point is to use CBRN reconnaissance assets based on their capabilities and use the complementary capabilities of other assets to verify and expand available information.

- Mixing is using two or more different CBRN assets to collect against the same intelligence requirement while providing an increased probability of detection and confidence. Employing a mix of systems not only increases the probability of detection, but also tends to provide more complete information (for example, a standoff capability may detect and locate a CBRN hazard, while the intelligence analysis and control element uses organic and supporting assets to determine its identity and threat to military forces and future plans). Employing a mix of systems is always desirable if the situation and available resources permit. Mixing systems can also help uncover deception attempts by revealing discrepancies in information reported by different CBRN teams.
- Redundancy is using two or more like-CBRN assets to collect against the same intelligence requirement while providing an increased probability of detection and confidence. Based on the PIR, the commander must decide which NAI justifies having more than one asset covering it. When more than one asset covers the same NAI, a backup is available. In the event that one asset cannot reach the NAI in time, the first asset suffers mechanical failure or the adversary detects and engages the first asset. Redundancy also improves the probability of detecting and collecting the required information.

- **Report information rapidly and accurately.** Commanders may base their planning and tactical decisions on information obtained through CBRN surveillance efforts. Intelligence loses its relevance as it ages. Commanders establish the latest time information is of value (LTIOV) to guide timely reporting. The R&S element or other asset must accurately report what it observes and report it in a timely manner. Digitization speeds the process and assists in accuracy. Speed is critical when conducting early warning and reporting of a CBRN incident.

1-25. The forms of CBRN surveillance are—

- **CBRN point surveillance.** The purpose of CBRN point surveillance is to provide intermittent or continuous observation of a specific CBRN-related place (such as a structure), person, or object. This can be associated with, but is not limited to, a TAI or a NAI. CBRN point surveillance ensures that time-sensitive critical operations can be conducted without unwarned encounters with CBRN hazards/plumes. It is important to note that detection of a hazard may occur before or after exposure to personnel. Point surveillance is the most limited in geographic scope of all forms of surveillance.
- **CBRN area** s**urveillance.** The purpose of CBRN area surveillance is to provide greater detection capability in large areas. CBRN area surveillance is the temporary or continuous observation of a specific prescribed geographic area. It can be associated with, but is not limited to, a CBRN TAI or a CBRN NAI. This area may include a town, neighborhood, cluster or group of buildings, or other man-made or geographic feature. Unlike area reconnaissance, it does not include individual structures, such as a bridge or single building. The uses of detectors (deployed in arrays) and standoff detectors are key to the coverage of larger areas.
- **Medical** s**urveillance.** The CBRN surveillance process can include health surveillance. Health surveillance is the regular or ongoing systematic collection, analysis, and interpretation of health-related data essential to the evaluation, planning, and implementation of public health practice. The systematic collection of health care information is essential to the surveillance process. Health surveillance includes medical, occupational, and environmental surveillance. This information is used to monitor the health of a population and to identify potential risks to health, disease, and injury—thereby enabling timely interventions to prevent, treat, or control exposure. The foundation of a health surveillance program is the determination of unit-specific illness and injury rates of public health significance (see *Multiservice Tactics, Techniques, and Procedures for Health Service Support in a Chemical, Biological, Radiological, and Nuclear Environment*). Health surveillance may provide the first indicator that a CBRN incident has

occurred. If an incident is not detected directly, the first indication may be an increase of illness among the affected population. Some hazards induce symptoms after an incubation period (biological) or prolonged exposure (radiation and chemical). An influx of patients reporting similar symptoms may indicate that an incident has occurred.

1-26. The following are key tasks for CBRN surveillance (chapter 4 provides further details for each CBRN surveillance task):

- Monitor CBRN hazards.
- Observe CBRN hazards.
- Detect CBRN hazards.
- Identify CBRN hazards.
- Quantify CBRN hazards.
- Collect environmental CBRN samples.
- Report CBRN hazards.

SUMMARY

1-27. Commanders and their staffs evaluate CBRN R&S information to assess its impact on operations and help mitigate the impact of assessed CBRN hazard. This chapter focuses on the fundamentals of CBRN R&S in support of combat operations and as a focused application of special/unique capabilities supporting reconnaissance operations. The remaining chapters and appendixes discuss CBRN R&S from the following perspectives:

- The military operation supported unit/higher headquarters staff.
- The assets of the supporting units that are CBRN R&S capabilities.

1-28. The military force has the ability to analyze the CBRN aspects of ISR products that meet the technical CBRN hazard detection requirements of users. This capability provides relevant CBRN environment information for integration into operational activities. The end results are products that describe the CBRN hazard environment for operational planning, preparation, execution, and continuous assessment.

1-29. The CBRN staff translates ISR products and all source information into an understanding of the CBRN threat and the operational environment for CBRN defense actions. This process requires—

- Timely conduct to assess vulnerability.
- Specific COAs to reduce vulnerability and counterspecific threats/hazards.
- CBRN warning and reporting on potential and actual CBRN incidents to facilitate risk assessments and actions to minimize the short- and long-term health effects of toxic exposures.

1-30. R&S data is processed into information and then analyzed to become intelligence. Judgment/understanding/experience is then applied to the CBRN ISR products to satisfy CCIRs. The commander uses the answered CCIRs to make informed decisions. CBRN R&S information management is conducted through—

- Obtaining the relevant data relative to potential or actual CBRN threats/hazards.
- Processing data into relevant information.
- Analyzing acquired information and determining the impact of the information on operations.
- Applying judgment to develop understanding, know what has occurred, determine its impact on operations, and determine what should be done about it.
- Supporting CBRN defense execution through orders and risk management.
- Maintaining situational awareness (SA) with man-in-the-loop assessment.

1-31. The CBRN staff focuses on knowing what data is relevant, determining what can be collected before events, and developing a data collection plan to obtain other data. The CBRN staff processes data into operationally significant information and develops a collection plan to obtain additional data if information is incomplete. The CBRN staff uses the military decisionmaking process (MDMP) to translate information into intelligence. It estimates and assesses hazards to develop possible COAs.

Note. The Marine Corps uses the Marine Corps planning process (MCPP). For a comparison of the MDMP and MCPP, see *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Aspects of Command and Control*.

1-32. Understanding requires SA. The commander uses this awareness to communicate intent and issue orders that mitigate risk through application of various CBRN defense measures.

Chapter 2

Planning Activities

Chapter 1 introduced the ISR process and the associated CBRN aspects. This chapter will focus on the planning activities associated with the integration of CBRN into the overall development of the ISR plan. The ISR process is used by the CBRN officer in conjunction with the intelligence officer and staff to develop the CBRN ISR plan. This plan is in itself part of the overall ISR plan. The intelligence officer and CBRN officer are responsible for the development of the CBRN ISR plan. The purpose of integrating CBRN R&S into the ISR process is to incorporate all CBRN R&S assets and resources into a single plan. This will capitalize on each capability and succeed in synchronizing and coordinating CBRN R&S missions within the overall scheme of maneuver. A good CBRN ISR plan (see example in appendix B) fits into and supports the overall operations plan or order. It positions and tasks CBRN R&S assets so they can collect the right information, sustain or reconstitute for branches or sequels (follow-on or emerging efforts), or shift priorities as the situation develops. CBRN ISR synchronization and integration together result in an effort focused on answering the commander's CBRN information requirements (IRs) through CBRN ISR tasks translated into orders. The CBRN ISR process is a continuous effort that refines, synchronizes, and integrates CBRN IRs into the CBRN ISR plan. Changes to the CBRN ISR plan can be based on, or influenced by (but are not limited to), the following:

- A CBRN CCIR is satisfied or is no longer relevant and frees a CBRN ISR asset for other operations. An example of this would be if a CBRN reconnaissance asset were tasked to find a bypass around a contaminated area and that bypass were no longer needed.
- The unit receives information that requires confirmation. This leads to a new tasking or retasking of a CBRN ISR asset.
- The timing of the operation has become desynchronized, requiring a modification of the LTIOV or changes to priorities.
- The commander generates new CBRN CCIR as the COA evolves and the threat situation develops.
- A change to the adversary situation (the adversary follows an unexpected COA).
- Higher headquarters directs the unit to begin an unplanned operation.

When CBRN ISR collection requirements are matched to actual CBRN R&S assets, the result is the CBRN ISR plan. The CBRN ISR synchronization matrix (see appendix B) is also developed and used to further define the use of CBRN ISR assets against CBRN IRs by describing the time and space for which the CBRN R&S effort will occur.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE PLANNING FUNDAMENTALS

2-1. CBRN ISR planning begins with the development of CBRN IRs and intelligence gaps. These CBRN requirements eventually become CBRN ISR tasks for collection. CBRN ISR planning fundamentals include—

- Identifying CBRN IRs and intelligence gaps.
- Developing CBRN indicators and SIRs.
- Identifying CBRN R&S tasks.

2-2. CBRN requirements are broken down into the following types:

- **CBRN PIR.** CBRN PIR is a CBRN intelligence requirement, stated as a priority for intelligence support that the commander and staff need to understand the adversary or the CBRN operational environment. CBRN PIRs are associated with a decision based on an adversary action or inaction or the operational area that will affect the overall success of the mission. The staff selects these during mission analysis as part of the process for identifying the CBRN CCIR.
- **CBRN intelligence requirements.** CBRN intelligence requirements are essential elements of intelligence that will fill a gap in the commander's knowledge or understanding of the CBRN operational environment or threat forces.
- **CBRN IRs**. CBRN IRs are items of CBRN information regarding the adversary and other relevant aspects of the CBRN operational environment that need to be collected and processed to meet the CBRN IRs of a commander.
- **CBRN indicators and SIRs**. Each CBRN IR is broken down into CBRN indicators and CBRN SIRs that are used to develop the ISR plan and answer CBRN IRs. They—
  - Fill a gap in knowledge and understanding of the operational area or the threat.
  - Support the development of situational understanding and answer gaps in the COP.
  - Provide additional details required for analysis.

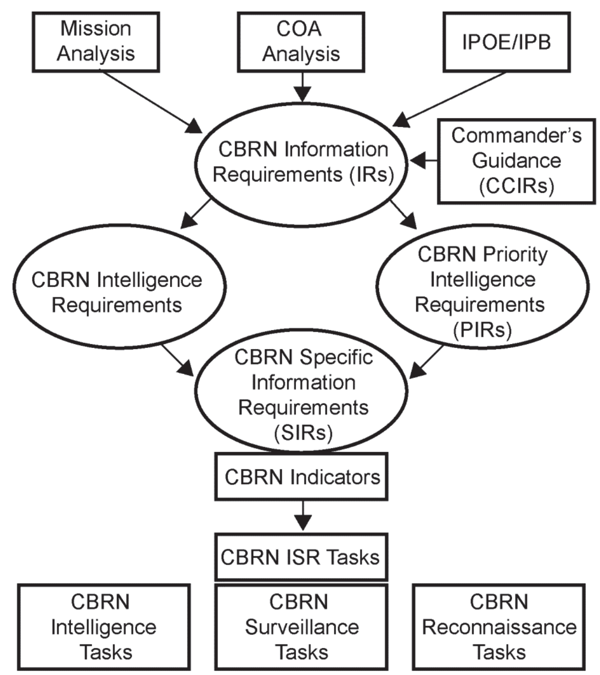
2-3. During the initial receipt of a mission, the commander will provide guidance to the staff, which will include CBRN information that he considers critical. This guidance will be refined during the planning process into the CBRN CCIR. CBRN CCIR is CBRN IRs identified by the commander as being critical to facilitating timely decisionmaking. The key elements are CBRN friendly force information requirements (FFIRs) and CBRN PIR. CBRN FFIR is CBRN-related information that the commander and staff need to understand the status of friendly forces and supporting CBRN capabilities.

2-4. During planning, the entire staff analyzes the CBRN CCIR and any requests for information (RFIs) and orders to identify gaps in information.

2-5. CBRN ISR tasks are developed by the CBRN officer, intelligence officer, and staff for inclusion into the CBRN ISR plan. Figure 2-1 shows the CBRN ISR task development process. Accurate CBRN indicators are necessary to write effective CBRN ISR tasks. To do this, CBRN SIRs are developed using CBRN indicators. CBRN indicators are defined as information, which reflects the intention or capability of an adversary to adopt or reject a COA. Positive or negative evidence of threat CBRN activity or any characteristic of the operational area, which points toward the adoption, or rejection of a particular threat COA may influence the commander's selection of friendly COA. Indicators turn CBRN SIRs into effective CBRN ISR tasks by using directive statements with definable metrics. Examples of CBRN SIRs and ISR tasks are—

- **SIR:** Determine if the adversary use persistent chemical agents along east west routes Omega and Delta between 180500ZJUL2009 and 170500ZJUL2009.
- **ISR:** Report chemical agent attacks along routes Omega and Delta between 170500 and 180500ZJUL2009 (LTIOV–181200ZJUL2009).
- **SIR:** Determine if the adversary release biological agents along the forward edge of the battle area during the initial phase of its attack.

- **ISR:** Report any positive biological attack detections or indicators along phase line Bravo between 140500Z and 160900ZJUL2009 LTIOV 161200ZJUL2009).
- **SIR:** Determine if the adversary contaminated main supply routes (MSRs) Gold and Black.
- **ISR task:** Conduct a route reconnaissance along routes Gold and Black to confirm or deny the presence of CBRN contamination (LTIOV–190500ZJUL2009).



Legend:

CBRN	chemical, biological, radiological, and nuclear
CCIR	commander's critical intelligence requirement
COA	course of action
IPB	intelligence preparation of the battlespace
IPOE	intelligence preparation of the operational environment
IR	information requirements
ISR	intelligence, surveillance, and reconnaissance
PIR	priority intelligence requirements
SIR	specific information requirements

Figure 2-1. CBRN ISR task development process

2-6. CBRN R&S elements that have the capability to execute identified CBRN ISR tasks are identified. The following are some discriminators used to better identify a CBRN asset to perform a specific CBRN ISR task:

- Is the CBRN R&S element equipped to execute the task?
- Is the CBRN R&S element trained to execute the task?
- Can the CBRN R&S element execute the CBRN ISR task within the time identified for the information to be of value?
- Does the CBRN ISR task require a specialized or generic CBRN R&S element? For example, if a CBRN ISR task requires biological surveillance, then a general-purpose force CBRN R&S element may not be enough.

2-7. Once CBRN ISR tasks have been identified and the commander has approved the R&S assets to perform those tasks, then the CBRN ISR plan and CBRN ISR synchronization matrix can be created. This includes the development of the CBRN ISR and overlay and CBRN ISR collection matrix as well.

Appendix B provides examples of these CBRN ISR products (the CBRN ISR plan, overlay, and the CBRN ISR synchronization and collection matrixes).

2-8. The CBRN synchronization matrix is integral to the overall ISR plan. It allows the CBRN officer and staff to synchronize CBRN R&S assets to CBRN ISR tasks at the proper point in the overall scheme of maneuver. It is typically done in a spreadsheet format. Between the CBRN plan and the CBRN synchronization matrix, the following information is generally included:

- CBRN PIRs and IRs.
- CBRN indicators.
- Times and dates of the collection mission or RFIs.
- LTIOVs.
- NAIs.
- Available assigned, attached, supporting, and higher echelon units and organizations which possess CBRN collection assets to be tasked or requested for CBRN ISR tasks.
- CBRN ISR tasks and RFIs.
- CBRN SIRs to facilitate CBRN ISR integration.
- Other information deemed necessary to support the management of the collection effort.

2-9. CBRN missions can be task-organized in various ways dependent on the operational environment. If a subordinate unit has a CBRN R&S element embedded in its organization, the higher headquarters can task the unit to execute the CBRN R&S mission using its CBRN R&S element. If a unit that occupies the area where the CBRN R&S task must be accomplished does not have a CBRN R&S element, then the higher headquarters can attach an R&S element to it. Various mission command/C2 relationships that can occur are further discussed in *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Aspects of Command and Control*.

2-10. CBRN ISR overlays are created to graphically depict what is in the CBRN ISR synchronization matrix. Examples of an ISR overlay can be found in appendix B. The CBRN ISR overlay augments the CBRN ISR plan in graphic form. Typical items depicted on the CBRN ISR overlay are—

- Friendly boundaries and phase lines.
- CBRN reconnaissance handover lines.
- CBRN NAIs and TAIs.
- Limits of advance (LOA) and limits of reconnaissance (LOR). LOR are constraints derived from higher headquarters orders, which may designate LOA that impacts reconnaissance units.
- Counterreconnaissance areas.
- Fire support control measures.
- Graphics depicting the form of CBRN reconnaissance (zone, area, route).
- Routes, start points, release points, infiltration lanes, and checkpoints.
- Observation post locations (primary and alternate).
- Sample transfer points, decontamination sites, ambulance exchange points, and logistic release points.
- Planned or existing obstacles.
- Threat information (known hazard areas, danger areas).
- Coverage areas for sensors.
- UAS flight paths.
- Retransmission locations.
- Theater laboratory support locations.

2-11. The CBRN ISR collection matrix is a CBRN ISR synchronization tool that links CBRN PIR to the commander's lines of operation and/or decision points, links CBRN collection requirements to CBRN NAI and CBRN TAI, provides the task/purpose for the CBRN collection task, and provides detailed CBRN collection and reporting requirements. It is constructed in spreadsheet format and is comprised of individual worksheets, as required. Like the CBRN ISR synchronization matrix, the CBRN ISR collection matrix is not a tasking document and is not published as part of the base order. It is, however, a key tool that the CBRN officer, intelligence officer, and operations officer use in executing the CBRN ISR plan.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE AND SURVEILLANCE PLANNING CONSIDERATIONS

2-12. Guidance for the development of the CBRN ISR plan are as follows:

- Identify areas of interest for CBRN ISR.
- Identify and coordinate with organic, subordinate, and supporting CBRN R&S assets.
- Pre-position CBRN R&S assets to support requirements.
- Assess the time and distance factors associated with movement formations and R&S techniques.
- Orient the mission execution to provide timely notification of critical information to support tactical decisions.
- Orient the CBRN R&S on the presence or absence of CBRN contamination in areas of interest.
- Plan the resupply (logistic) activities to sustain CBRN R&S operations.
- Plan security to protect CBRN R&S assets.
- Determine the rules of engagement (ROE) so that there is an understanding of the circumstances and limitations under which U.S. forces will initiate and/or continue combat engagement with other forces that are encountered.
- Plan to deploy and integrate automatic detection, identification, and warning systems with individual detection and identification equipment. Ensure maximum coverage of critical areas with automatic systems. Rely on manual systems to expand or back up the coverage.
- Use operational exposure guides (OEGs) to support radiological search and survey guidance.
- Use military exposure guidelines to support chemical search and survey guidance.
- Plan to use the data provided by the fielded detectors and the primary or additional CBRN staff to determine the unit status. The actual presence or absence of contamination should be confirmed by multiple detection systems. The following indicators could be included in unit SOPs to determine the presence or absence of contamination:
  - Agent symptoms in personnel and wildlife. (Some chemical agents manifest themselves minutes to several hours after an attack; some biological agents manifest themselves several days or weeks after an attack.)
  - Tactics and weapon systems used in the attack.
  - Suspicious clouds, vapors, powders, or liquids.
  - Intelligence data supporting the likely or actual use of chemical-biological agents in the joint operations area.
- Reports from personnel, teams, and automatic systems.
- Plan to request specialized assets (CBRN R&S teams, damage assessment and response teams, contamination control teams) to verify initial positive indications, identify agents, and survey unmonitored areas.
- Determine the possible locations for after-mission decontamination.
- Use the radiological OEGs and radiation exposure status to determine protective posture/risk mitigation steps for radiological threats/hazards and chemical military exposure guidelines and Technical Guide (TG)-230 to assess risk from chemical threats/hazards.
- Plan to establish command or support relationships to ensure responsiveness and flexibility when using a supporting CBRN R&S element.
- Plan for logistics, medical support, and installation protection with individual and collective protection.
- Engage public health/preventive-medicine assets early and continuously during the planning process.

2-13. For additional related information on general CBRN staff planning, see *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Aspects of Command and Control*.

2-14. The tactical planning for CBRN R&S focuses on ensuring that CBRN ISR tasks are met. The specific planning factors that are considered include ensuring that—

- CBRN detection requirements are resourced (for example, operators are trained and tasked to operate CBRN detection systems).
- Sample collection techniques and procedures are rehearsed and understood.
- A chemical, biological, radiological, and nuclear warning and reporting system (CBRNWRS) is established and provides the required reports to higher, subordinate, and adjacent commands.
- The sample evacuation process is rehearsed and understood.
- CBRN detection resources are integrated into protection plans.
- Analytical laboratory support is designated and the location is determined.
- Available assets within the operational area, according to capability to complete ISR tasks, are determined.
- Mission command/C2 of units and reporting procedures are established.
- Orders are prepared.

2-15. CBRN tactical R&S planning concentrates on—

- Military operations.
- Assets of the supporting units that are CBRN R&S capable.

2-16. Each Service uses whatever method is normally used to plan its missions, determine acceptable risk, and make risk decisions. Risk management is an integral part of CBRN tactical R&S planning and is an integral part of the MDMP and troop leading procedures (TLP). The five steps of risk management fit into and support TLP and MDMP.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE PLAN IMPLEMENTATION

2-17. CBRN ISR tasks are used to produce mission statements for identified CBRN R&S assets. These mission statements are used as a basis for orders (operation orders [OPORDs], fragmentary orders [FRAGORDs], warning orders [WARNORDs], mission taskings]) given to R&S assets to plan, prepare, and execute.

2-18. Planning is critical for units that are CBRN R&S-capable, and there is seldom enough time to plan for every possible situation. There are, however, essential elements (the commander's intent, a complete mission statement) that must be included in CBRN R&S orders. The CBRN R&S assets will use TLP to plan their R&S missions, identify required actions to be performed at the objective, and then plan backward to the departure from friendly lines and forward to the reentry of friendly lines. The CBRN R&S asset leader will receive the orders from the supported unit. It is critical that the CBRN R&S asset leader fully understand the mission and situation. If the CBRN R&S asset leader has questions or concerns, he should get answers and conduct coordination while at the supported unit tactical operations center (TOC), where communications are good and key personnel are available.

2-19. The CBRN R&S asset leader will coordinate directly and continuously with the supported unit staff throughout the planning and preparation phases. Mission coordination must be thorough and detailed since the CBRN R&S asset could be operating semi-independently, forward of friendly units, and beyond direct fires. Additionally, the CBRN R&S asset leader must coordinate with those units in whose area the CBRN R&S asset will move and operate. Items to coordinate with the supported unit include—

- Changes and updates in the adversary and friendly situations.
- The best use of terrain for routes, rally points, and forward reconnaissance bases.
- Light and weather data.

- Decontamination sites and linkup.
- Sample transfer points and field/theater laboratory locations/support.
- The availability of an element to provide local/overwatch security.
- Mission-oriented protective posture (MOPP) level for supporting elements.
- The use and location of landing zones (LZs).
- The departure and reentry of friendly lines.
- Fires on the objective and along the planned routes, including alternate routes.
- Rehearsal areas and times.
- Special equipment requirements.
- Health service support (HSS), including medical evacuation.
- Logistic support (packaging, transportation, disposal of sample collection and decontamination waste).
- Signal plan call signs, frequencies, code words, pyrotechnics, challenges, and passwords.
- Identification procedures to reduce the incidence of friendly fire.

2-20. The CBRN R&S asset leader should consider the following:

- **Essential and supporting tasks.** Ensure that the essential tasks are assigned on the objective, at danger areas, at security or surveillance locations, along routes, and during the passage of lines.
- **Key travel and execution times.** Estimate the time requirements for moving to the objective, reconnoitering the objective, establishing security and surveillance, completing assigned tasks while on the objective, moving to and through friendly lines, and conducting operational debriefings.
- **Primary and alternate routes**. Select primary and alternate routes to and from the objective.
- **Signals.** Consider using special signals (hand-and-arm signals, flares, voice, whistles, radios, infrared equipment). Communication is key to successful R&S operations.

2-21. The threat environment must be considered when planning a CBRN R&S mission. In uncertain and permissive environments, the CBRN R&S asset must consider hazards (mines, improvised explosive devices [IEDs]) when executing R&S missions. The possible types of CBRN hazards that may be encountered must be known. However, the CBRN R&S asset must be prepared for the unexpected. This allows the CBRN R&S asset to determine what IPE; PPE; and detection, monitoring, and identification devices are needed to operate safely while conducting the mission.

2-22. CBRN R&S asset leaders use TLP to integrate activities during planning and, when required, during preparation and execution. The TLP are a sequence of actions that help CBRN R&S asset leaders to effectively and efficiently use available time to issue orders and execute tactical operations. It begins with the alert of a new mission; and for the CBRN R&S asset leader, time will dictate the amount of detail put into each step. TLP are not a hard and fast set of rules. They are a guide that must be applied consistent with the situation and the experience of the CBRN R&S asset leader and his subordinate leaders. The tasks involved in some steps (initiate movement, issue the WARNORD, conduct reconnaissance) may recur several times during the process. The last step, those activities associated with supervising and refining the plan, occur throughout troop leading. For more information on TLP, see *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Aspects of Command and Control*.

SUMMARY

2-23. This chapter outlines planning considerations for CBRN R&S operations. The tactical commander and the CBRN staff plan for CBRN R&S with personnel and equipment capable of performing the necessary tasks. Chapter 3 discusses the preparation activities required to conduct CBRN R&S activities at the tactical level. Although TLP were briefly discussed in this chapter, TLP continue while preparing for CBRN R&S operations and will be further discussed in chapter 3.

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Chapter 3

Preparation Activities

This chapter provides CBRN R&S preparation activities at the staff and R&S asset levels. CBRN R&S preparation includes those activities undertaken by the R&S element before mission execution to improve their ability to conduct the operation. CBRN R&S preparation may include CBRN ISR plan refinement, rehearsals, reconnaissance, coordination, inspections, and movement.

PREPARATION

3-1. Planning and preparation overlap to ensure effective time management and synchronized efforts. As leaders plan missions, R&S elements and personnel prepare.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE AND SURVEILLANCE MISSION PREPARATION

3-2. The nature of CBRN R&S operations differs tremendously from situation to situation. It requires various staff, unit, and personnel actions for each unique mission. CBRN R&S preparation begins when the WARNORD is delivered by the staff and received by the R&S asset. Preparation for CBRN R&S missions includes the following:

- **Command and staff.** Command and staff perform the following tasks:
  - Update and refine products developed during planning.
  - Update the CBRN COP (including the visualization of the operational environment and the CBRN threats and hazards based on new information gathered through collection and friendly reporting).
  - Issue orders to officially task the CBRN R&S element.
  - Issue FRAGORDs to adjust the plan as necessary.
  - Receive backbriefs.
  - Approve CBRN R&S element plans.
- **R&S assets.** R&S assets perform the following tasks:
  - Conduct TLP to include mission and task analysis.
  - Task organize.
  - Conduct coordination and liaison with supported and supporting units (for example, decontamination units, sample transfers, and convoy commanders).
  - Conduct precombat checks.
  - Select appropriate IPE/PPE.
  - Maintain and inspect equipment.
  - Distribute supplies.
  - Feed military personnel.
  - Rest.
  - Coordinate premission health screening.
  - Use camouflage.
  - Distribute individual medical countermeasures as necessary.
  - Conduct rehearsals and drills.

- Conduct backbriefs.
- Conduct training.
- Conduct movement and linkup as required.
- Conduct reconnaissance and terrain analysis relative to the mission.
- Conduct security force coordination.

PREPARATION CONSIDERATIONS

3-3. The early movement of military units, personnel, and equipment to support mission requirements will occur during the preparation phase. Staffs continually update and validate their commander's intent as they receive intelligence based on the results of ISR operations and friendly information from reports. Significant new information requires commanders to make one of the following assessments:

- The new information validates the plan with no further changes.
- The new information requires adjusting the plan.
- The new information invalidates the plan.

3-4. Movement control includes planning, routing, scheduling, and controlling personnel and materiel movements into, within, and out of an operational area. Maintaining movement control, keeping lines of communication open, managing reception and transshipment points, and obtaining host nation (HN) support are critical to CBRN tactical R&S operations. Prior to any mission, the unit designated as a CBRN R&S capability must receive a detailed IPOE/IPB of the operational area from supported headquarters. This information is part of the mission analysis during TLP (discussed in chapter 2). The section/team leader must determine the probability of contact and where that contact will most likely occur. To do this, they use information from the intelligence staff, sensor reports, and information collected by tactical patrols. The section/team leader is then able to plan for contact and determine how to employ TTP (proper movement techniques to reduce the occurrence of chance contact, sample collection techniques for suspect CBRN contamination).

3-5. Each staff section and element conducts activities to maximize the operational effectiveness of the force. Coordination between echelons (and the preparation that precedes execution) are just as important, if not more important, than plan development. Staff preparation includes assembling and continuously updating estimates.

3-6. Unit CBRN R&S capabilities must prepare to begin operations immediately after an attack, or they may delay operations to avoid or reduce exposure to potential CBRN hazard. Specialized CBRN R&S teams may be directed to start operations immediately after an incident or upon locating a suspected hazardous area/location to provide commanders with a quick assessment of the status and the overall situation. Unit CBRN R&S teams and individuals generally do not begin operations until directed by their higher headquarters. They must be prepared for short-notice mission assignments in a high CBRN threat environment.

3-7. CBRN R&S assets prepare for CBRN R&S operations as a foundation for the conduct of other military operations. A CBRN R&S element must readily adapt to multiple transitions between offense, defense, stability, or civil support operations.

3-8. CBRN R&S asset preparation is a continuous process. Even in the absence of a given mission, the CBRN element focuses on maintaining continued readiness and preparation by conducting—

- Equipment maintenance.
- Personnel/team training.
- Area studies.

3-9. The CBRN R&S asset conducts precombat checks/precombat inspections (PCCs/PCIs) and readies equipment and personnel for the upcoming mission. Orders must thoroughly cover the aspects of the operations (including possible adversary COAs to reduce reaction time). The CBRN R&S assets must know friendly information (location of friendly obstacles, location of designated passage points and lanes, recognition signals, location of the counterreconnaissance screen).

3-10. The need for close coordination with the supported unit is critical in the preparation phase. CBRN R&S assets operating forward of the supported unit's defensive positions must understand the scheme for screening force to reduce the possibility of friendly fire. The CBRN R&S capability must coordinate movements in the main defensive area to prevent losses to friendly minefields, obstacles, and screening force efforts. The leader of the CBRN R&S asset should obtain a copy of the fire support overlay before departure or coordinate with the fire support officer to use the existing target information reference system to adjust fire.

3-11. CBRN R&S assets must implement effective quality management practices so that their systems, processes, and analytical tests are functioning properly. The omission of any aspect of the quality management program decreases the overall quality of the analytical result. A quality management program can include ensuring that—

- Proper operator training and certification are performed to maintain knowledgeable, skilled operators and technicians to perform the analysis. Documentation of initial and continuing training for all operators of the system or process must be maintained.
- Proficiency of each operator is maintained through the periodic analysis of unknown samples (such as proficiency tests). The results must be verified and documented by a supervisor or designated observer who attests to the accuracy of the analysis and adherence to the proper analytical process.
- Preventive maintenance checks and services (PMCS)/planned maintenance system (PMS–Navy) on equipment and instruments are conducted on a routine basis as recommended by the equipment operating manual. The documentation of PMCS performance and the problems corrected must be maintained.
- Critical reagents and controls are transported and stored in the proper environment as directed by the manufacturer.
- Positive and negative controls are performed and the results are obtained and documented.
- Management and supervisory personnel maintain awareness of potential errors and problems with the system or process, evaluate personnel and processes, document errors or problems, and take corrective action to eliminate or minimize errors or problems.

ASSESSMENT

3-12. Assessment continues during the preparation phase of a mission. It includes assessing the progress of preparation and the evaluation of the readiness and ability of the element to conduct its given missions against the criteria of success. CBRN R&S asset leaders assess their unit's progress by comparing it with the commander's intent and adjusting their actions to achieve the envisioned end state, particularly in the absence of orders. Assessment activities also include assessing the readiness of subordinate unit CBRN R&S capabilities.

3-13. When preparing for CBRN R&S missions, it is important to ensure that CBRN R&S elements assess their communications capabilities so that they can communicate with each other and, more importantly, report the results of their R&S activities to their supported unit. CBRN information is critical to the commander's decisionmaking in a CBRN operational environment. A CBRN R&S element must be prepared to communicate at all times.

Note. For Service-specific CBRN R&S capabilities, see *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Aspects of Command and Control*.

SUMMARY

3-14. The key focus of this chapter is to address CBRN R&S tasks and considerations while preparing for a CBRN R&S mission. For detailed information on the remaining preparation activities, see appendix C and *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Aspects of Command and Control.* The information outlined in this chapter assists commanders, staffs, and R&S leaders in preparing for CBRN R&S operations. Chapter 4 discusses the execution activities required to conduct CBRN tactical R&S activities.

Chapter 4

Execution Activities

Chapter 4 provides an overview of CBRN ISR forms, modes, methods, tasks, and techniques used to conduct CBRN R&S operations. When conducting CBRN R&S missions, multiple variations of these elements (forms, modes, methods, and CBRN ISR tasks and techniques) can be used. CBRN R&S leaders plan their missions around these elements. There is no standard set or combination that must be used. CBRN R&S leaders incorporate METT-TC/METT-T during the planning and execution of their assigned CBRN R&S missions to determine their best COA at any given time. Specific guidance and acceptable risk are also factors that affect CBRN R&S mission execution. The commander considers the factors of METT-TC/METT-T to determine whether to conduct mounted, dismounted, or aerial CBRN R&S. Conditions that may result in a decision to conduct certain forms of CBRN R&S include time, level of detail required, available assets, IPOE/IPB, terrain, environmental conditions, size of the area/location, and whether the area/location or route is secure and/or clear.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE AND SURVEILLANCE FORMS

4-1. Figure 4-1, page 4-2, shows the forms of CBRN reconnaissance (route, zone, and area) and three forms of CBRN surveillance (area, point, and medical). Descriptions of these forms can be found in chapter 1.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE AND SURVEILLANCE MODES

4-2. There are three modes associated with CBRN R&S. They are discussed in the following paragraphs.

MOUNTED

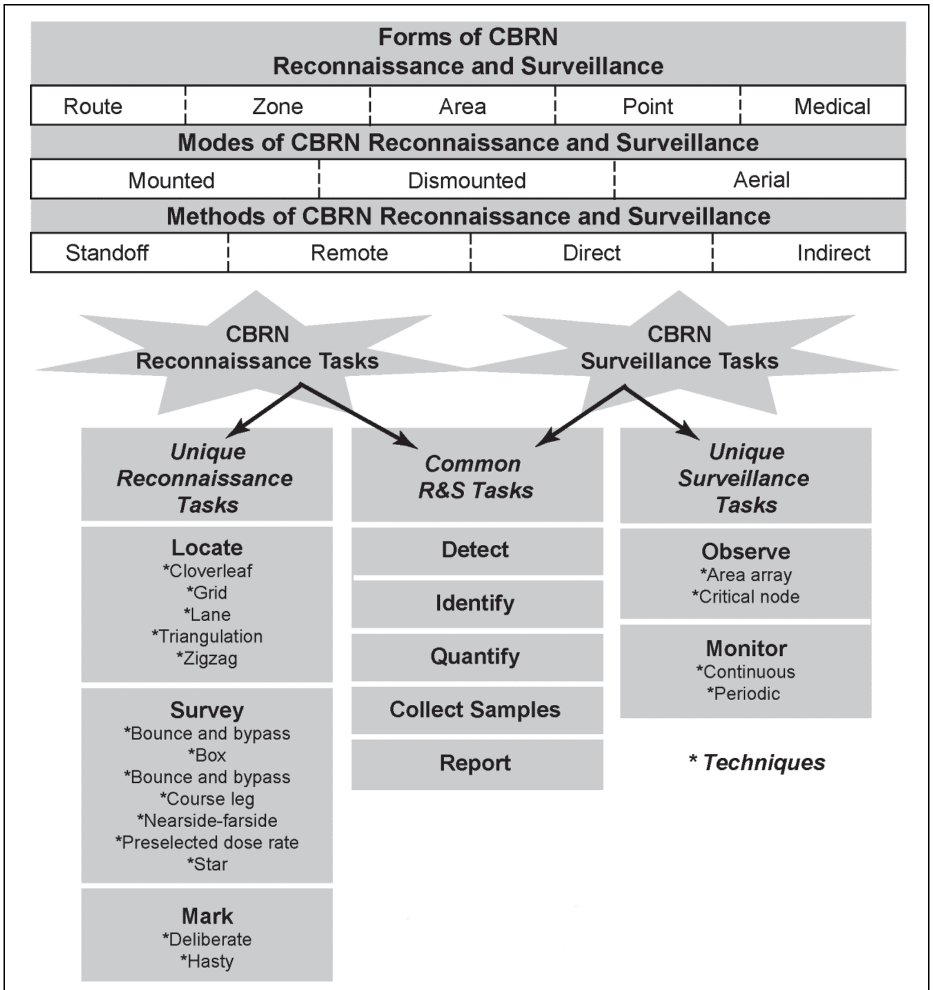
4-3. Mounted CBRN R&S operations are usually performed to minimize the exposure of personnel to CBRN threats/hazards. Many of these vehicles provide additional protection from CBRN hazards using shielding and onboard air filtration systems. See *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Aspects of Command and Control* for further descriptions of these assets and unit designations. The conduct of mounted CBRN R&S tasks also allows for larger areas/locations to be covered over a shorter period of time than dismounted forms of CBRN R&S. See appendix D for further information on mounted CBRN R&S.

DISMOUNTED

4-4. Dismounted CBRN R&S operations are conducted mainly by foot, with limited vehicle support. They normally require more time than mounted R&S operations. The following conditions may result in the commander directing a dismounted CBRN R&S mission:

- Time is available.
- Detailed CBRN R&S is required.
- Stealth is required.

- The IPOE/IPB process indicates close proximity to adversary positions.
- The CBRN R&S element encounters danger areas.
- Urban environments and restrictive terrain limits the effectiveness of mounted reconnaissance.
- Confined spaces and/or areas/locations.



Legend:

CBRN	chemical, biological, radiological, and nuclear
R&S	reconnaissance and surveillance

Figure 4-1. CBRN ISR task elements

4-5. See appendix E for further information on dismounted CBRN R&S.

AERIAL

4-6. Typically, aerial CBRN R&S operations are conducted during radiological surveys. Aerial R&S operations can cover a much larger area in a shorter period than ground mounted and dismounted operations. It provides added CBRN protection to military personnel by using distance to take readings that can be converted to actual ground readings using an air-ground correlation factor. (See appendix F for more information on aerial CBRN R&S.)

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE AND SURVEILLANCE METHODS

4-7. The following are the methods used when conducting CBRN R&S—

- **Standoff.** During surveillance operations the standoff method is conducted to provide early warning, tracking and in some cases, identification of a CBRN hazard. During reconnaissance operations, the standoff method is conducted to assist in locating and confirming the presence of a CBRN hazard. Stationary standoff detection can be performed for chemical, biological, and radiological (CBR) threats/hazards. Standoff is used to detect CBRN threats/hazards by observing a CBRN NAI from a safe distance. The observer is not on the target, but at a distance away from the target allowed by his detection method. Also, certain CBRN standoff detectors can be operated on the move. The difference between standoff and remote is the location of the detector relative to the receiver (which can be a person or technology). (See appendix G for more information on standoff R&S.)
- **Remote.** Remote CBRN R&S operations are usually performed from a distant location through a communication link to a CBRN detector or monitor. These devices are normally designed to be recoverable. Current remote operations use detectors and monitors at stationary locations. Emerging technologies allow remote CBRN detectors and monitors to be remotely operated on mobile platforms such as UASs, unmanned ground vehicles (UGVs), and robots. (See appendix G for more information on remote CBRN R&S.)
- **Direct.** Direct monitoring is the simplest, most precise monitoring technique. The CBRN monitor is used to get an unshielded (outside) reading of the suspected hazard. Direct readings are used when conditions and risk are acceptable. Direct monitoring is used—
  - While monitoring for the initial detection or arrival of fallout.
  - When in low dose rate areas/locations.
  - When determining unshielded (outside) ground dose rates for transmission or correlation factors.
  - When verifying the contamination status of a new position.
  - While moving through a contaminated area on foot.
- **Indirect.** Indirect CBRN monitoring, detection, identification, and sample collection occur when the CBRN device is not used at the source of the CBRN hazards. Indirect monitoring can be used by an R&S element to measure radiation levels when dose rates are high enough to be read inside a shielded location. It lowers the risk of exposure to personnel. An example of an indirect reading is when a radiological dose rate reading is taken while inside a bunker. This reading is converted using the correlation factor of the bunker to determine the outside intensity of the radiation. Another example is when a device is used that can look into a container and identify the agent inside without having to open the container. Such devices use various methods, such as X-ray spectroscopy and Raman spectroscopy, to do this.

4-8. Indirect radiological dose rate readings are taken at known distances from a radiological source. The actual radiation intensity at the source is calculated using the inverse square law that applies to radiation. For further details see the *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Avoidance*.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE AND SURVEILLANCE TASKS

4-9. CBRN R&S tasks were briefly introduced in chapter 1. Below are the tasks and their descriptions. CBRN R&S tasks make up the core of CBRN R&S missions. CBRN R&S missions can be broken down into a set of these tasks. Not all missions will include these tasks. Examples would be a CBRN reconnaissance operation that does not include the "collect environmental samples" task or a CBRN surveillance mission that does not require the CBRN hazard to be quantified.

Chemical, Biological, Radiological, and Nuclear Reconnaissance Tasks

4-10. The CBRN reconnaissance tasks are—

- **Detect chemical, biological, radiological, and nuclear hazards.** Detecting CBRN hazards is described as determining the presence of a CBRN hazard in the environment.
- **Locate chemical, biological, radiological, and nuclear hazards.** Locating CBRN hazards is described as finding the place where the CBRN hazard exists. To locate CBRN hazards, the zigzag, lane, cloverleaf, or grid techniques can be used. Further details on these techniques are provided later in this chapter.
- **Identify chemical, biological, radiological, and nuclear hazards.** Identifying CBRN hazards is described as determining the specific CBRN hazard present in the environment. The identification levels are presumptive, field confirmatory, theater validation, and definitive. Further details on CBRN identification levels can be found in chapter 5.
- **Quantify chemical, biological, radiological, and nuclear hazards.** Quantifying CBRN hazards is described as determining the amount of the specific CBRN hazard present in the environment.
- **Collect chemical, biological, radiological, and nuclear samples.** Collecting environmental CBRN samples is described as obtaining a representative amount of the CBRN hazard for subsequent analysis later. Environmental samples include air, water, soil, and vegetation. They can include liquids, solids, or vapors. They do not include clinical/medical specimens. Further details on sample collection can be found in chapter 6 and appendix H.
- **Survey chemical, biological, radiological, and nuclear hazards.** Surveying CBRN hazards is described as the active effort to determine the extent of contamination of CBRN hazards. When conducting a CBRN survey the nearside-farside, box, star, bounce and bypass, course leg, or preselected dose rate techniques can be used. Further details on these techniques are provided later in this chapter.
- **Mark chemical, biological, radiological, and nuclear hazards.** Marking CBRN hazards is described as the use of visual or other indicators to warn others of the presence of a CBRN agent in a particular area/location. When marking a CBRN hazard, hasty or deliberate techniques are used. Further details on these techniques are provided later in this chapter.
- **Report chemical, biological, radiological, and nuclear hazards.** Reporting is described as providing relevant information about the CBRN hazard and other related data. The commander's IRs drive CBRN R&S. Reporting information derived from CBRN R&S provides answers to the commander's IRs. Reporting must be timely, accurate, and as complete as possible to ensure effective and informed operational decisionmaking and to support medical assessment and surveillance determinations.

Chemical, Biological, Radiological, and Nuclear Surveillance Tasks

4-11. The CBRN surveillance tasks are—

- **Monitor chemical, biological, radiological, and nuclear hazards.** Monitoring CBRN hazards is described as checking the environment using passive measures for the presence of CBRN hazards. When monitoring for CBRN hazards, periodic or continuous techniques are used. Further details on these techniques are provided later in this chapter.
- **Observe chemical, biological, radiological, and nuclear hazards.** Observing CBRN hazards is described as watching a specific location to determine the potential for the presence of a CBRN hazard using visual means.
- **Detect chemical, biological, radiological, and nuclear hazards.** Detecting CBRN hazards is described as determining the presence of a CBRN hazard in the environment. The critical node and area array techniques are used when conducting CBRN surveillance. Further details on these techniques are provided later in this chapter.
- **Identify chemical, biological, radiological, and nuclear hazards.** Identifying CBRN hazards is described as determining the specific CBRN hazard present in the environment. There are four identification levels—presumptive, field confirmatory, theater validation, and definitive. Further details on CBRN identification levels can be found in chapter 5.

- **Quantify chemical, biological, radiological, and nuclear hazards.** Quantifying CBRN hazards is described as determining the amount of the specific CBRN hazard present in the environment.
- **Collect chemical, biological, radiological, and nuclear samples.** Collecting CBRN samples is described as obtaining a representative amount of the CBRN hazard for subsequent analysis later. Environmental samples include air, water, soil, and vegetation. They can include liquids, solids, or vapors. They do not include clinical/medical specimens. Further details on sample collection can be found in chapter 6 and appendix H.
- **Report chemical, biological, radiological, and nuclear hazards.** Reporting CBRN hazards is described as providing relevant information about the CBRN hazard and other related data. The commander's IRs drive CBRN R&S. Reporting information derived from CBRN R&S provides answers to the commander's IRs. Reporting must be timely and accurate to ensure effective and informed decisionmaking.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE AND SURVEILLANCE TECHNIQUES

4-12. CBRN R&S techniques are briefly introduced in this chapter. Further discussions of CBRN techniques are discussed in appendixes D, E, F, and G.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE TECHNIQUES

4-13. The CBRN reconnaissance techniques are—

- **Zigzag.** The zigzag CBRN reconnaissance technique is used to locate contamination areas during route, zone, and area reconnaissance missions. The zigzag technique involves many turns, and a high level of maneuverability is required when conducting this technique. (See appendixes D and E for further details.)
- **Lane.** The lane CBRN reconnaissance technique is used to locate contamination areas during route, zone, and area reconnaissance missions. The lane technique traverses an area, periodically probing for contamination. It delivers a very detailed coverage of an area in a short period. (See appendixes D and E for further details.)
- **Cloverleaf.** The cloverleaf CBRN reconnaissance technique is used during mounted and dismounted operations. The R&S element moves in a cloverleaf pattern, with each leaf extending 50 to 200 meters from the starting point. This technique is not used in radiological contaminated areas due to the lack of shielding. (See appendixes D and E for further details.)
- **Grid.** The grid CBRN reconnaissance technique is employed by R&S elements where speed and accuracy are important. It is employed by superimposing a grid over the R&S element maps, which enables them to rapidly communicate locations of contaminants, location of samples were collected, locations of casualties, and other pertinent information. (See appendixes D and E.)
- **Triangulation.** The triangulation CBRN reconnaissance technique is employed by R&S elements to locate radiological contamination sources while dismounted. (See appendix E.)
- **Nearside-farside.** The nearside-farside survey technique is normally used by an R&S element to determine the beginning and end of contamination along a route. (See appendixes D and E.)
- **Box.** The box survey technique is used to determine the general dimensions (length and width) of a contaminated area. It is best employed by three teams, and the process starts once a team enters the contaminated area. (See appendixes D and E.)
- **Star.** The star survey technique is a very quick way to determine the rough limits of a contaminated area. (See appendixes D and E.)
- **Bounce and bypass.** The bounce and bypass technique is used to locate the general boundaries of a contaminated area. (See appendixes D and E.)
- **Course leg.** The course leg technique is used to conduct an aerial reconnaissance survey mission to define the extent of a radiological hazard. The pilot flies a straight line between two checkpoints (for example, from Point A [top of a hill] to Point B [top of another hill]). The aircraft only lands to obtain the air-ground correlation factor data.

- **Preselected dose rate.** The preselected dose rate technique is used to determine the boundaries of radiological contamination while limiting and controlling exposure to R&S elements. Useful in surveying the presence of residual radiological contamination and neutron-induced radiation, this technique also permits the R&S element to avoid excessive radioactive hazard levels by assigning specific dose rates to be surveyed from outside the hazard toward the center of the attack/incident area or location.
- **Hasty marking.** The hasty marking technique is used when initial marking must be rapid, providing only the bare minimum signature needed to safely pass small units through or around CBRN hazards. (See appendix I.)
- **Deliberate marking.** The deliberate marking technique is used for larger units (battalion and above) that may require improved lanes to accommodate two-way traffic. (See appendix I.)

Chemical, Biological, Radiological, and Nuclear Surveillance Techniques

4-14. The CBRN surveillance techniques are—

- **Periodic.** The periodic CBRN monitoring technique during CBRN surveillance missions consists of frequent checks of the environment for the arrival or presence of CBRN hazards.
- **Continuous.** The continuous monitoring technique during CBRN surveillance missions involves uninterrupted checking for CBRN hazards at a given location over a specified period of time.
- **Critical node.** The critical-node technique uses a set of detectors and/or monitors positioned around and throughout a specific high-value target to provide for the detection and early warning of a CBRN attack. Examples of such are aerial port of debarkation, seaport of debarkation (SPOD), and mission command/C2 locations.
- **Area array.** The area array technique uses a set of CBRN detectors and/or monitors positioned within a given geographic space to provide for detection and early warning of a CBRN incident. They are positioned to complement and overlap each other in such a way as to increase the probability of detection of a CBRN hazard.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE AND SURVEILLANCE CONSIDERATIONS

4-15. A key factor in CBRN R&S execution is the time available to conduct the mission. The commander must recognize increased risk to the CBRN R&S element and the main body when he accelerates the pace of CBRN R&S. This risk can be somewhat offset by employing aerial reconnaissance and technical means to cover open terrain or areas of lower threat.

4-16. The following weather, terrain, and light conditions impact the effectiveness of CBRN R&S capabilities and drive employment considerations:

- Battlespace obscuration, fog, rain, and snow result in reduced visibility. Generally, CBRN R&S during limited-visibility conditions takes more time. However, these conditions provide for better stealth and enhance the survivability of CBRN R&S assets. A commander frequently employs dismounted CBRN R&S patrols at night. These patrols use light amplification and thermal observation devices, electronic surveillance devices, and surveillance radars to compensate for reduced visibility conditions.
- High winds, extreme temperatures, and loose topsoil or sand may adversely affect aerial CBRN R&S. Aerial reconnaissance assets plan their missions in much the same way as ground units. They use the same type of operational graphics and consider the same critical tasks. The air reconnaissance commander organizes the assets to accomplish the mission by considering the same IPOE/IPB aspects as those associated with ground forces. He focuses on air hazards to navigation and anticipated adversary air defense capabilities.
- In limited visibility, mounted CBRN R&S tends to focus on road networks. The adversary can detect engine and track movement noises of friendly mounted CBRN R&S elements at considerable distances at night, which makes them susceptible to ambush. Strict noise and light discipline, along with masking sounds such as artillery fires, help keep a mounted reconnaissance force from being compromised or ambushed.

4-17. No single CBRN R&S capability can answer every intelligence requirement, and there are rarely enough CBRN R&S assets to cover every mission requirement.

4-18. Units and systems performing CBRN R&S are vulnerable to detection, engagement, and destruction by the adversary. When this occurs and the CBRN R&S capability can no longer perform its primary mission, the commander must determine whether to reconstitute by regenerating or reorganizing the unit.

SUMMARY

4-19. This chapter provides an overview of CBRN R&S, forms, modes, methods, tasks, and techniques used throughout CBRN R&S operations. Detailed descriptions can be found in the appendixes. The end state of CBRN R&S is the production of usable information that supports the commander's IRs. As part of the commander's IRs, samples may be obtained during CBRN R&S that will further provide information once analyzed and identified. Chapter 5 addresses the identification levels.

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Chapter 5
Identification Levels

The purpose of CBRN R&S operations is to provide decisionmakers with critical information concerning the area/location and identity of suspected CBRN hazards to allow them to establish and update CBRN protection requirements. This chapter provides details on the new DOD four-tier system for determining the identity of CBRN hazards. The new four identification levels are—presumptive, field confirmatory, theater validation, and definitive. This publication is the proponent for doctrinal definitions of these four identification levels. Forward-deployed Navy medical assets (including the forward deployable preventive-medicine units [FDPMUs]) and those aboard aircraft carriers (nuclear) amphibious assault ships (general purpose), and amphibious assault ships (multipurpose), will continue to operate within a three-tiered system and conduct field confirmatory and theater validation level analyses on suspected biological warfare materials within the same laboratories. The FDPMUs are likewise equipped to conduct field confirmatory and theater validation level analyses on 7 chemical warfare (CW) agents and over 130 toxic industrial chemicals (TICs) that pose environmental health threats. These facilities participate in monthly or bimonthly quality assurance (QA) and proficiency testing and have 24-7 subject matter expert (SME) reachback support. When suspicious incidents occur that may involve the use of CBRN agents against U.S., allied, or coalition forces, verification through CBRN R&S operations—combined with samples from the field, their history, and the results from the analytical laboratories—may provide irrefutable evidence to senior leaders that an attack has occurred. Evidence must be scientifically valid, and any samples must have a documented chain of custody from the point of collection to presentation. General military application/decision scenarios that require some form of CBRN identification are also described within this chapter. These scenarios establish the framework upon which identification levels are derived. This manual focuses on decisions at two levels—tactical and operational. However, to be fully inclusive, there is also a brief discussion on strategic, CBRN-related decisions.

TACTICAL DECISIONS

5-1. At the tactical level, decisions include, but are not limited to—

- Detect to warn. Used when detecting for chemical aerosols or radiological fallout. The decision to warn is based on the assumption that there is a threat of an upwind aerosol or fallout cloud moving toward the warned forces. It also can be a notification that exposure may have already occurred. A warning should be accompanied by treatment and/or protection guidance to ensure a consistent, effective response when possible. This type of warning is normally sent via a CBRN1 report.
- Contamination avoidance.
- Appropriate personal protection level. Ensure that forces are in the appropriate level of personal protection (for example, MOPP4).
- Additional information. Obtain additional information to support the concept of operations and scheme of maneuver.

OPERATIONAL DECISIONS

5-2. At the operational level, CBRN-related decisions are primarily a follow-up to tactical decisions and/or are used to determine/verify hazard mitigation during ongoing deployment operations. At this level, impacted decisions include, but are not limited to—

- Verification of hazard reduction so that troops can reduce or eliminate MOPP level.
- Detect to treat. The decision to administer postexposure medical countermeasures or treatment is made after there is evidence of likely detection of, or exposure to, a CBRN agent. The commander makes the decision to treat and warn with advice from the command surgeon and supporting input from the CBRN officer and intelligence staff. The command surgeon will recommend the appropriate medical countermeasures or treatment regimen. The message to begin treatment is sent using very specific information as to what medical countermeasures to use, how much to administer treatment, and who should receive this treatment. The message is normally sent via medical channels, but CBRN staff should also be kept informed at all levels.
- Positive identification.
- Forensics (for evidence and attribution).

STRATEGIC DECISIONS

5-3. At the strategic level, CBRN analytical results have an impact on decisions related to national strategic direction and integration. At this level, applications and decisions include, but are not limited to—

- Intelligence collection.
- Forensics (for evidence and attribution).
- Continuous monitoring/surveillance of deployed bases for emerging or routine environmental hazards (for example, certain TICs from local industrial emissions) so that deployment health exposures are documented.
- Meeting decontamination verification/clearance requirements.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR IDENTIFICATION IMPLICATIONS

5-4. As introduced previously, the specific decision required is the primary factor determining the level of CBRN identification required on a sample. Additional factors also potentially influencing the command staff as they determine the types and numbers of samples required and the level of CBRN analysis needed on each sample include—

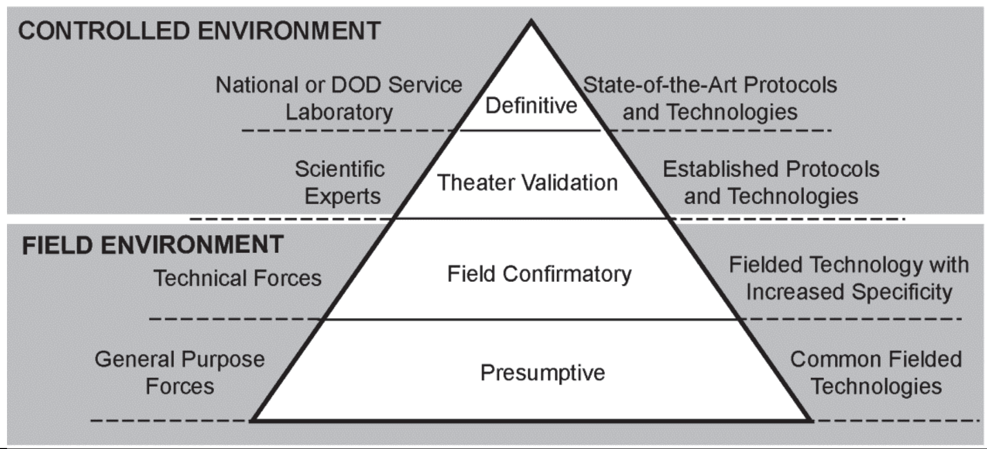
- Higher identification levels that require support from low-density, highly trained, specialized units.
- Higher identification levels that require more time to complete.
- The command/support relationship with supported and supporting units.
- CBRNWRS protocols.
- The type of CBRN reconnaissance and/or surveillance mission that will be performed to equip the R&S element with the right detection and identification devices.
- Logistics support, sample transfer, and escort requirements.
- Follow-on CBRN R&S missions.
- Collection management plan maintenance.

5-5. When there is a need to identify possible treaty violations, the collection of evidence and the analysis of samples may require protocols that can withstand international scrutiny—procedures that establish a "forensic trail." Although such evidence is required quickly, the proof of use of these agents must be so that it cannot be refuted.

IDENTIFICATION LEVELS

5-6. Through METT-TC/METT-T and the CCIR, staff personnel plan for the capabilities needed to achieve the appropriate level of identification. This information is fed back into the collection management plan to prepare for and execute sample collection operations (see chapter 6) of the CBRN hazard detected and identified by the CBRN R&S capability.

5-7. The higher the level of identification completed on a CBRN hazard—the higher the confidence the commander has that a CBRN attack or incident has occurred. Samples may not require analysis at all four identification levels. An example of this is a presumptively identified biological sample sent directly to a theater validation laboratory. An overview of the identification levels is provided in figure 5-1.



Legend:
DOD Department of Defense

Figure 5-1. Overview of CBRN identification levels

Notes.

1. Samples may not require analysis at all identification levels, depending on the agent and the decisions and actions taken after identification.

2. In figure 5-1, *technical forces* are specially trained and equipped forces that possess a higher degree of CBRN detection and sampling capability compared to general-purpose forces.

PRESUMPTIVE IDENTIFICATION

5-8. ***Presumptive identification* is the employment of technologies with limited specificity and sensitivity by general-purpose forces in a field environment to determine the presence of a chemical, biological, radiological, and/or nuclear hazard with a low level of confidence and the degree of certainty necessary to support immediate tactical decisions.**

5-9. Presumptive identification is obtained using commonly fielded devices/materials/technologies available to general-purpose forces to indicate/warn of the possible presence of a CBRN/target substance. It provides important information to support warning decisions and actions, such as taking avoidance, protection, and decontamination measures. Table 5-1, page 5-4, provides further presumptive identification descriptors.

Table 5-1. Presumptive identification descriptors

Presumptive		
Who	Chemical Biological Radiological	• General purpose forces
Where	Chemical Biological Radiological	• Field environment
Capabilities	Chemical	• Detector paper using chemical sensitive dyes • Photo-ionization detection • Ion mobility spectroscopy • Electrochemical sensors • Flame spectrophotometry • Surface acoustic wave • Reagents
	Biological	• Antigen antibody immunoassays
	Radiological	• Handheld RADIAC survey equipment for the detection of beta- and gamma-ionizing radiation • Gamma and neutron dose detection and gamma dose rate detection
Why	Chemical	• Determine presence/absence of chemical hazards including CW agents and TICs to support immediate tactical decision such as avoidance, protection, or decontamination
	Biological	• Determine presence/absence of biological hazards including BW agents and TIBs to support immediate tactical decision such as, avoidance, protection, or decontamination
	Radiological	• Determine presence/absence of radioactive hazards including TIRs to support immediate tactical decision such as, avoidance, protection, or decontamination
Sample actions	Chemical	• Assuming higher protective posture • Warning • Reporting • Sampling • Further assessments/exploitation
	Biological	• Sampling • Triggering other sensors • Reporting • Further assessments/exploitation
	Radiological	• Assuming higher protection (shielding/distance) • Warning • Reporting • Further assessments/exploitation
Legend: BW CW RADIAC TIB TIC TIR	 biological warfare chemical warfare radiation detection, indication, and computation toxic industrial biological toxic industrial chemical toxic industrial radiological	

FIELD CONFIRMATORY IDENTIFICATION

5-10. ***Field confirmatory identification*** **is the employment of technologies with increased specificity and sensitivity by technical forces in a field environment to identify chemical, biological, radiological, and/or nuclear hazards with a moderate level of confidence and the degree of certainty necessary to support follow-on tactical decisions.**

5-11. Field confirmatory identification is obtained using fielded devices/materials/technologies that are available to specially trained personnel and units in a field environment that includes collection and analyses of samples to substantiate the presence and type of a CBRN/target substance at a given area/location. Field confirmatory identification can be used to prove (or disprove) previous presumptive results. It results in higher confidence levels to support tactical decisions regarding avoidance, protection, and decontamination measures and immediate treatment. Table 5-2 provides further field confirmatory identification descriptors.

Table 5-2. Field confirmatory identification descriptors

Field Confirmatory		
Who	Chemical Biological Radiological	• Technical forces
Where	Chemical Biological Radiological	• Field environment
Additional capabilities not available at lower identification levels	Chemical	• Fourier transform infrared spectroscopy • Gas chromatography/mass spectroscopy
	Biological	• Employment of two methods: ▪ Antigen antibody immunoassays ▪ Polymerase chain reaction
	Radiological	• Handheld RADIAC survey equipment for the detection of alpha-ionizing radiation • Handheld RADIAC survey equipment with increased sensitivity for the detection of beta- and gamma-ionizing radiation • Handheld scintillation-based gamma spectrometry (low specificity and sensitivity) • Dose rate neutron- and gamma-detection devices • Handheld survey equipment for the detection of nonionizing radiation
Why	Chemical	• To substantiate the presence and type of chemical hazards at a given area/location to support follow-on tactical decisions (avoidance, protection, decontamination)
	Biological	• To substantiate the presence and type of biological hazards at a given area/location to support follow-on tactical decisions, such as treatment
	Radiological	• To substantiate the presence and type of radioactive hazards at a given area/location to support follow-on tactical decisions (avoidance, protection, decontamination)
Sample actions	Chemical	• Reporting • Sample evacuation to theater validation laboratories • Further assessments/exploitation • Determining appropriate treatment and prophylaxis

Table 5-2. Field confirmatory identification descriptors (continued)

<table>
<tr><th colspan="3">Field Confirmatory (continued)</th></tr>
<tr><td rowspan="2">Sample actions (continued)</td><td>Biological</td><td>• Reporting
• Beginning immediate medical treatment
• Sample evacuation to theater validation laboratories
• Further assessments/exploitation</td></tr>
<tr><td>Radiological</td><td>• Reporting
• Further assessments/exploitation</td></tr>
<tr><td colspan="3">Legend:
RADIAC radiation detection, indication, and computation</td></tr>
</table>

THEATER VALIDATION IDENTIFICATION

5-12. ***Theater validation identification* is the employment of multiple independent, established protocols and technologies by scientific experts in the controlled environment of a fixed or mobile/transportable laboratory to characterize a chemical, biological, radiological, and/or nuclear hazard with a high level of confidence and the degree of certainty necessary to support operational-level decisions.**

5-13. Using accepted QA measures, theater validation quantifies the CBRN sample. It provides additional critical information to support timely and effective decisions regarding avoidance, protection, and decontamination measures and medical prophylaxis and treatment for affected units and personnel. It can also support preliminary attribution to implicate or support trace analytics for the source of the identified CBRN material. Table 5-3 provides further theater validation identification descriptors.

Table 5-3. Theater validation identification descriptors

<table>
<tr><th colspan="3">Theater Validation</th></tr>
<tr><td rowspan="3">Who</td><td>Chemical</td><td rowspan="3">• Scientific experts applying multiple independent, established protocols and technologies</td></tr>
<tr><td>Biological</td></tr>
<tr><td>Radiological</td></tr>
<tr><td rowspan="3">Where</td><td>Chemical</td><td rowspan="2">• Fixed or mobile laboratory with constant temperature and humidity controls; stable power supply</td></tr>
<tr><td>Biological</td></tr>
<tr><td>Radiological</td><td>• Controlled environment; fixed or mobile laboratory with constant temperature and humidity controls; stable power supply</td></tr>
<tr><td rowspan="3">Additional capabilities not available at lower levels of identification</td><td>Chemical</td><td>• Gas chromatograph-flame ionization detector
• Gas chromatograph-electron capture detector
• Gas chromatograph-mass spectrometer-mass spectrometer</td></tr>
<tr><td>Biological</td><td>• Multiple analyses involving at least two complementary technologies:
▪ Enzyme-linked immunosorbent assay
▪ Polymerase chain reaction
▪ Electrochemical luminescence</td></tr>
<tr><td>Radiological</td><td>• Liquid scintillation counting equipment
• Semiconductor-based gamma spectrometry (high specificity and low sensitivity)
• Scintillation-based gamma spectrometry (high specificity and low sensitivity)</td></tr>
</table>

Table 5-3. Theater validation identification descriptors (continued)

Theater Validation (continued)		
Why	Chemical Biological	• To support timely and effective operational-level decisions, including medical prophylaxis and treatment for affected units and personnel and other avoidance, protection, and decontamination measures
	Radiological	• To support timely and effective operational-level decisions regarding avoidance, protection, and decontamination measures
Sample actions	Chemical	• Reporting • Sample evacuation to definitive laboratories • Further technical assessments/exploitation
	Biological	• Medical countermeasures/treatment • Reporting • Force health protection • Sample evacuation to definitive laboratories • Further technical assessments/exploitation
	Radiological	• Reporting • Further technical assessments/exploitation

DEFINITIVE IDENTIFICATION

5-14. ***Definitive identification*** **is the employment of multiple state-of-the-art, independent, established protocols and technologies by scientific experts in a nationally recognized laboratory to determine the unambiguous identity of a chemical, biological, radiological, and/or nuclear hazard with the highest level of confidence and degree of certainty necessary to support strategic-level decisions.**

5-15. Definitive identification supports attribution to implicate or point to the source of the identified material. It uses the highest level QA measures. Table 5-4 provides further definitive identification descriptors.

Table 5-4. Definitive identification descriptors

Definitive		
Who	Chemical Biological Radiological	• Scientific experts using multiple state-of-the-art independent, established protocols and technologies
Where	Chemical Biological Radiological	• National or DOD Service laboratories
Additional capabilities not available at lower levels of identification	Chemical	• Technologies are similar to theater validation level, but with higher controls at fixed accredited facilities
	Biological	• Multiple independent, state-of-the-art established protocols and technologies similar to theater validation but with higher controls at fixed accredited facilities ▪ Enzyme-linked immunosorbent assay ▪ Polymerase chain reaction ▪ Electrochemical luminescence ▪ Monoclonal antibodies

Table 5-4. Definitive identification descriptors (continued)

Definitive (continued)		
Additional capabilities not available at lower levels of identification (continued)	Radiological	• Gas proportional counting equipment • Low-background (shielded) high-purity germanium spectrometry (high specificity and high sensitivity) • Alpha spectrometry • Inductively coupled plasma mass spectrometry • Liquid scintillation counting equipment
Why	Chemical	• To support strategic-level decisions. To support attribution; to implicate or point to the source of the identified material
	Biological	• To support strategic-level decisions. To support attribution; to implicate or point to the source of the identified material
	Radiological	• To support strategic-level decisions. To support attribution; to implicate or point to the source of the identified material
Sample actions	Chemical	• Reporting • Further technical assessments/exploitation
	Biological	• Prophylaxis/treatment • Reporting • Further technical assessments/exploitation
	Radiological	• Reporting • Further technical assessments/exploitation
Legend: DOD Department of Defense		

SUMMARY

5-16. This chapter outlines the new DOD four-tier system for determining the identity of chemical, biological, radiological, and nuclear hazards. These tiered levels provide a consistent basis for applied military operational decisionmaking at the tactical, operational, and strategic levels. Chapter 6 discusses the sample management/sample collection actions required to conduct CBRN R&S activities at the tactical level.

Chapter 6
Sample Management

Quality sample collection is especially critical for analyzing and identifying CBRN threats/hazards. In-theater agent identification is generally conducted by the supporting environmental laboratories to support the commander's IR. This chapter provides information on CBRN R&S sample management operations at the tactical level. This chapter will cover sample management, the principles of sample collection, roles, responsibilities, and key tasks associated with sample collection. Further TTP can be found in appendixes H and J, which provides standard reporting requirements and guidance. Note that proper sample collection, the documentation of adequate associated information, and the use of appropriate reporting procedures are essential for operational decisionmaking and to address potential future medical exposure concerns. Commanders may receive the mission to collect CBRN environmental samples as evidence to support intelligence and operational requirements. CBRN sample management operations are particularly important if a potential adversary uses previously unknown agents or if an adversary allegedly uses a CBRN agent first. The collection of CBRN samples and background information must be as detailed and comprehensive as possible. The commander may order a sample collection for the support of intelligence and operational requirements (verification that an attack has occurred, identification of agents used, delivery systems and their nation of origin, and determination of the level of CBRN warfare technology involved).

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE AND SURVEILLANCE SAMPLE MANAGEMENT PRIORITIES

6-1. *Chemical, biological, radiological, and nuclear (CBRN) sample management* is the process whereby CBRN samples are collected, packaged, transported, stored, transferred, analyzed, tracked, and disposed. It begins with the decision to collect CBRN samples and continues to the reporting of information produced by the final analysis of that sample. This process includes safeguarding and prioritizing CBRN samples, tracking their movements and analytical status, and reporting the end result of sample analysis. The CBRN sample management process establishes procedures, guidelines, and constraints at staff and unit levels to protect and preserve the integrity of CBRN samples that may have tactical, operational, and/or strategic implications. (See figure 6-1, page 6-2.)

6-2. CBRN R&S sample management priorities may be established by the commander to coincide with PIR. Sample management feeds into ISR planning. At each level of command, sample management operations must be precisely defined within the area of responsibility (AOR). Sample transport across an AOR must be deliberately planned, controlled, tracked, and executed at all levels.

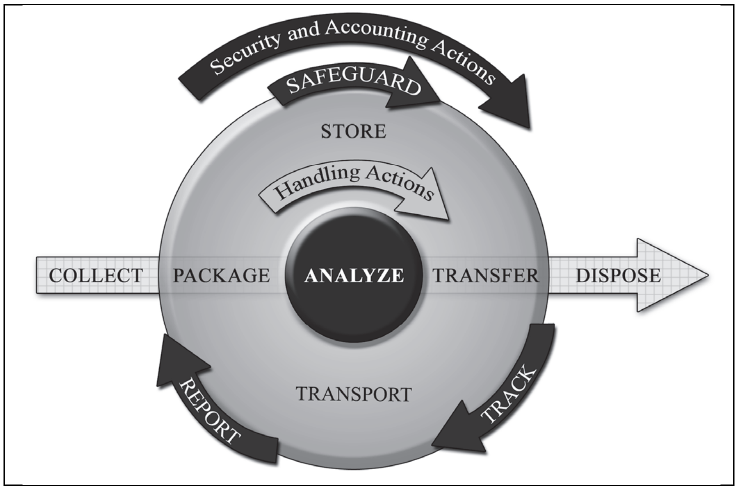


Figure 6-1. CBRN sample management process

SAMPLE MANAGEMENT ELEMENTS

6-3. Sample management includes the development of a sample management plan, selection of sample collection areas/locations, documentation of missions, and identification of key tasks associated with specific sample management operations. The following should be considered when conducting sample management:

- Not all of the samples taken in a joint operations area are meant to be evacuated to the continental United States (CONUS). Many factors will influence the requirement to take samples and determine what level of identification is needed. The commander's PIR will drive the prioritization of CBRN sample collection within the AOR.
- The requirement to transport CBRN samples to supporting laboratories while maintaining a chain of custody is of significant importance. Under normal circumstances, the CBRN R&S element is responsible for the evacuation of their samples to a designated sample transfer point. However, depending on the proximity of the supporting laboratory, the CBRN R&S asset may be required to evacuate the sample directly to the laboratory.
- The command must ensure that it has an executable plan to get the samples to the supporting laboratories. In some cases, dedicated assets are used to escort samples. The priority for dedicated assets will likely go to escorting samples from the theater back to the CONUS-based national laboratories for definitive analysis and identification.
- The combatant commander's sample management plan must include the escort of samples within the AOR. This may require using other available assets as sample couriers. At all times, the chain of custody must be maintained to ensure accurate reporting of the sample collection operation results. Safety and security for the courier and the sample package must be ensured. A set of basic tasks can be used to train in-theater couriers to transport CBRN samples. The basic tasks are—
  - Conduct coordination.
  - Conduct linkup.
  - Ensure package integrity.
  - Transfer the sample (chain of custody).
  - Safeguard, transport, and track the sample.

6-4. Further details about the above tasks can be found in appendix H.

SAMPLE MANAGEMENT PLAN

6-5. A sample management plan is essential to a successful CBRN R&S operation. The plan defines the strategies and methods to best fulfill the objectives of the commander. Each sample management mission is unique; therefore, it requires a plan that is individually tailored to mission requirements. In many cases, large amounts of collection material might not be available; therefore, it becomes imperative that a sample management plan establishes priorities of collection to ensure that the most important samples are taken first. The most important consideration is that the sample accurately reflects the scene and that it has not been contaminated by the collection or handling process. A sample management plan that will yield the most accurate results must be constructed for each CBRN R&S operation—with considerations given to the sample media, associated key tasks, and sample collection techniques required to support a successful operation.

6-6. The sample management plan is drafted and contains the minimum requirements to meet the commander's objectives. It includes the—

- Purpose and scope of the CBRN R&S operation, including the objectives, limitations, who should conduct the sample collection operation (CBRN personnel, preventive medicine [PVNTMED] personnel, tactical forces), and pertinent background information.
- Contaminants or type of contaminants expected to be encountered based on intelligence information.
- Number of "duplicates" required of each sample. In some cases, samples are sent to different laboratories for processing (theater laboratory, HN laboratory).
- Number of quality assurance/quality control and background samples to be taken.
- Time schedule (how long the sample collection mission will last).
- Documentation and disposition of samples.
- Supporting sample transfer point locations or locations to deliver the sample.
- Supporting assets (security, decontamination).
- Sample disposition procedures.

6-7. Sample courier duties will be AOR-dependent. Sample courier duties are as follows:

- Conduct coordination.
  - Obtain and carry detection and identification (ID) kits and equipment.
  - Obtain appropriate respiratory protection and gloves.
  - Ensure that immunizations are up to date.
  - Begin prophylaxis if required.
  - Obtain approved decontaminant solution.
  - Establish a linkup point with the CBRN sample element.
- Conduct linkup.
  - Don respiratory protection and gloves prior to the linkup.
  - Report the linkup to higher headquarters.
- Ensure package integrity.
  - Use detection and ID equipment to determine if the outside of the package is contaminated.
  - Ensure that the package is packed according to applicable guidance (for example, International Air Transport Association [IATA] or Code of Federal Regulations [CFR]), Air Force Manual 24-204 or Military Standard [MIL STD] 129P).
  - Place in an additional transport bag/container as appropriate.
  - Conduct a surface wipe-down of the package.
  - Conduct self-decontamination if required.

Note. Once the package integrity is verified, respiratory protection is no longer required.

- Transfer the sample (chain of custody).

  - Transfer the sample package using the appropriate chain-of-custody forms and procedures.
  - Report the transfer of custody to higher headquarters.
- Coordinate movement.
  - Report the departure and start of movement.
  - Coordinate with the applicable operations elements as required (for example, movement through unit sectors).
- Safeguard and transport the sample.
  - Be prepared to conduct immediate action in the event of a package breach.
  - Ensure that IPE is on hand during movement.
  - Maintain the sample at 1°C to 4°C.
  - Seal and repackage if required.
  - Conduct decontamination of the package if required.
  - Report a package breach if required.

Note. Sample collection and processing procedures can be found in appendix H.

SAMPLE LABELING AND CHAIN OF CUSTODY

6-8. Samples must be properly labeled and marked to meet standards and should be accompanied by a strict chain of custody maintained for every sample collected. The chain-of-custody document must accompany the sample during transport from the point of collection, to the receiving laboratory, to the final disposition of the sample. The chain of custody will—

- Provide answers about the sample: When was it collected? Who has maintained custody of it? What has been done with it at each change of custody? What happened to it while in custody?
- Show each time that the sample is transferred to another individual, element, unit, or agency. The receiving person must sign the document to show that he received the sample.

COMMON GUIDELINES

6-9. Collecting samples and subsequent identification can provide the commander with intelligence information that answers the PIR, senses the adversary's intentions or actions, knows why the information is relevant, knows what the impacts are; and knows what precautions are needed. While specific procedures vary, there are common guidelines that apply to any sample collection operation. Safety is the foremost concern during a sample management operation. The sample area/location may be inherently dangerous and contaminated. The following common guidelines should be considered when CBRN R&S elements collect samples:

- Identify threats/hazards that could impact the sample collection operation. Develop a plan for minimizing or avoiding the threat/hazard, to include environmental and other threats/hazards in the immediate area (heat, cold, slipping, noise, electrical shock, venomous snakes, bug bites, rodents).
- Ensure that personnel involved in the operation are dressed in the appropriate level of protection commensurate with the associated threats/hazards.
- Ensure that the sample collection area/location is clear of secondary devices or triggered mechanisms that could destroy the sample or cause harm to the CBRN R&S element before the operation. Remain vigilant for the possibility that these devices may be present. If any devices are found, immediately clear the area/location and inform the higher headquarters so that they can contact explosive ordnance disposal (EOD) assets to render the devices safe. Do not proceed with sample collection operations until notified that it is safe to do so.
- Ensure that backup personnel are be dressed in the appropriate IPE/PPE, have monitoring devices, and are prepared to enter the area/location as an emergency rescue team.

KEY TASKS ASSOCIATED WITH SAMPLE MANAGEMENT

6-10. The commander and staff must ensure that the CBRN R&S element is trained and equipped to perform the key tasks of conducting the sample management operation. In some circumstances, commanders may require technical-level expertise (CBRN specialists, PVNTMED personnel) over tactical forces that are CBRN-capable. CBRN R&S elements are generally tasked for collecting and initially packaging agent samples. PVNTMED and CBRN R&S elements are responsible for environmental sample collection, but PVNTMED are responsible for environment health sample collection and exposure surveillance. Specially trained personnel are responsible for collecting biomedical samples. The key tasks are collect, package, transport, store, transfer, analyze, track, report, safeguard, and dispose. The chain-of-custody process begins when the sample is collected. The chain of custody is critical because it provides an audit trail of when and where the sample was taken. The team assigns an identification number and affixes it to the sample or its container to aid in identification. (For detailed information on the chain of custody, see appendix H.)

COLLECT

6-11. The preparation of a sample collection order requires detailed coordination and careful execution. Unit missions, capabilities, and authorized equipment cause differences in how samples are collected and processed. The quality of any analytical evaluation is directly related to the quality of the sample or specimen and the degree of sample degradation that occurs before testing.

PACKAGE

6-12. Once the sample has been collected, proper packaging and decontamination of each layer of packaging is instrumental during the sample collection operation. Packaging procedures can be found in appendix H.

WARNING

For safety and to eliminate the chance of cross contamination, each layer of a sample container must be decontaminated during packaging.

TRANSPORT

6-13. There are specific requirements to effectively transport a sample to the appropriate agency or transfer point. Collected samples may be transported to a sample transfer point, which may also be the decontamination point. Samples are generally escorted during the entire evacuation process to ensure safety and maintain the chain of custody. Technical escort (TE) capability is preferred during the transport process, but may not always be practical due to the limited number of TE trained personnel. Once the sample has been collected, proper packaging is instrumental during the sample collection operation.

STORE

6-14. Those samples specifically designated for transport/delivery to theater or CONUS laboratories must be stored properly until it can get to the laboratory. In general, samples should be stored at 1°C to 4°C.

TRANSFER

6-18. When samples are transferred from one unit or agency to another, a custody transfer occurs. A custody transfer also occurs when supervision of the sample changes. Sample transfers or custody changes are documented. Each time the sample is transferred to another unit or agency, the receiving unit or agency must sign the document to show that they have received the sample. (See appendix H for detailed information on transfers and chain of custody.) The least number of transfers maintains the integrity of the sample and minimizes the chance of the sample being compromised. Generally, at the minimum the—

- Transfer of samples occurs between the CBRN R&S element and the sample courier, between sample couriers at different levels, and between the sample courier and the receiving laboratory for first or subsequent analysis.
- Transfer of samples occurs between the escort team and the supporting laboratory or the destination designated by the commander (for example, sample transfer point in an adjoining AOR).

ANALYZE

6-19. Analyzing samples produces the information a commander requires to make decisions. Analyzing a sample to identify its characteristics begins on initial collection and can continue after it arrives at CONUS laboratories.

REPORT

6-20. Reporting the results of an analysis of a suspect CBRN environmental sample can fulfill the IR of the commander. Reporting should occur as new information is discovered about a suspected CBRN hazard and its associated samples. Initial reports will not contain the depth of information that a commander needs to make long-term decisions. Initial reports can provide sufficient information to make immediate decisions needed to save lives and prevent further injuries. See examples of report forms in appendix J.

SAFEGUARD

6-21. Safeguarding samples during transport and storage must occur at all times. CBRN samples are hazardous; and if released inadvertently, they could cause injury or death to those that are exposed to them. A sample must also be safeguarded so that it is maintained to the standards that will ensure its viability until it can be analyzed at its destination laboratory.

TRACK

6-22. Continually throughout the sample management process, the sample must be tracked to ensure positive chain of custody, accountability, integrity of the sample, adherence to time schedules, and visibility of analytical status updates. The task of tracking is critical to supporting objectives established in the sample management plan.

DISPOSE

6-23. CBRN samples must be disposed of properly so that exposure does not occur to unprotected personnel. Once a sample is no longer required, it must be neutralized by the proper decontaminates or taken to an effective storage facility designed to safeguard the sample from inadvertent release.

ROLES AND RESPONSIBILITIES

6-24. The operational theater commander is responsible for CBRN sample collection and identification. When operations involve a known or likely potential for contamination, commanders may consider establishing an integrated crisis action team from the staff (including operations, logistics, intelligence, medical, and CBRN personnel) for managing CBRN sample collection operations in an area/location that is subject to attack or contamination. When preparing a sample management plan, commanders should provide early guidance on the—

- Number of teams to be used and their tasking.
- OEG, military exposure guidelines, and individual protection guidance (see TG 230 and JP 3-11 for further guidance).
- Allocation of operational resources. Missions may result in contamination of equipment, vehicles, and aircraft.

- Intended use of HN assets. The plan may require liaison with diplomats, firefighters, police, laboratories, medical personnel, and other HN assets.
- Media issues, such as rules for engaging the media regarding missions and explaining technical information.
- Requirement for secure communications and reporting chains.
- Designation of logistics priorities regarding safe handling and transporting samples and transporting CBRN R&S elements.
- Intended final disposition and ownership of materials collected.

6-25. The CBRN staff develops and implements sample management plans for CBRN R&S elements. The preparation of this plan should be coordinated with medical and intelligence sections to support the unity of effort for the commander's intelligence requirements and IRs. The CBRN staff may also conduct, or acquire the results of, manual or computer-assisted modeling of potential area/location and downwind hazards. When practical, the modeling will be completed before the teams deploy. Depending on the type of mission and the resources available, the plan should address the—

- Base structure, operations security, and logistic considerations.
- Augmentation to the staff with on-site military or civilian scientific advisors and the issuance of related WARNORDs to parent organizations within and outside the theater or organizations having an off-site technical reachback capability to contact required SMEs.
- Augmentation to the command with trained CBRN R&S elements and the issuance of related WARNORDs to parent organizations within and outside the theater.
- Need for air assets (aerial surveys, rapid transport of samples).

6-26. The commander may designate and allocate the necessary military assets to carry out the sample collection missions. The commander's staff serves as the nerve center and will command, coordinate, and control the operations associated with sample collection.

6-27. The commander's staff may receive reports from the following subordinate elements, depending on the nature and extent of the hazard:

- CBRN R&S elements.
- Surgeon's staff.
- Supporting environmental and clinical laboratories.
- Sample control sites.
- Security forces.
- Escort units.
- Tactical units.

6-28. The responsibilities of the unit staff may include—

- Supporting CBRN R&S elements with transportation, interpreters, security, navigation and communications equipment, food, shelter, medical care, decontamination, collection and decontamination waste disposal, and other functions needed to carry out the mission.
- Ensuring that sample chain-of-custody requirements are met.
- Establishing report protocols with the higher CBRN staff and command.
- Maintaining reports.
- Coordinating the escort of samples.
- Coordinating for the establishment and manning a sample control site.
- Routinely updating the downwind modeling.
- Providing status reports to the operational commander and subordinate units affected by sample collection operations.
- Coordinating sample transport to regional and national identification laboratories for detailed analysis.
- Coordinating special storage, packaging, and handling requirements to ensure the integrity of samples and the safety of personnel escorting or handling the samples.

Sample Collection Personnel

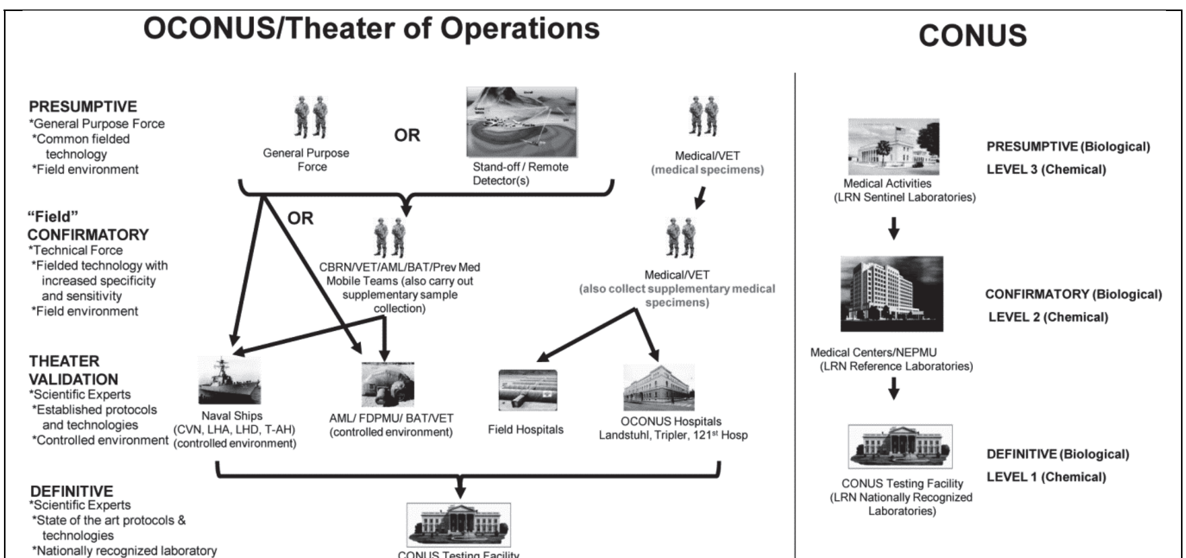
6-29. Generally, the collection of environmental samples is conducted by medical personnel, PVNTMED detachment/personnel, CBRN personnel, damage control personnel, veterinary personnel, public health officers, technical intelligence collection teams, bioenvironmental engineering officers, or other specially trained personnel. Trained personnel ensure uniformity, viability, safety, and accountability in sample collection procedures. For more information on medical sample collection procedures, refer to *Multiservice Tactics, Techniques, and Procedures for Health Service Support in a Chemical, Biological, Radiological, and Nuclear Environment*.

Chemical, Biological, Radiological, and Nuclear Elements

6-30. A CBRN R&S element can be task-organized into different teams such as decontamination teams, an initial entry team, an emergency backup team, and sample collection teams. The size of a CBRN R&S element is determined by the size of the area/location, amount of personnel available, amount of samples to be taken, and the time available for sample collection operations. CBRN R&S elements must have a minimum of two personnel. The primary objective of sample collection is to acquire sufficient agents, precursors, and degradation products for laboratory identification. CBRN R&S elements can be augmented with personnel who are experts in related specialist areas, such as—

- A medical person who is familiar with medical and epidemiological effects of chemical, biological, and radiological agents and who knows epidemiological or forensic medicine.
- An EOD expert who is specialized in chemical, biological, and radiological weapons.
- An intelligence expert familiar with CBRN programs of the target country.
- An interpreter.
- A technical scientist related to the type of CBRN threat encountered (biological, chemical, radiological).

6-31. Samples generated from CBRN R&S elements may be routed to a single sample control site (for example, area medical laboratory) that is responsible for receiving samples and providing theater validation identification. If necessary, the supporting laboratory prepares the sample for shipment to a CONUS laboratory for definitive identification. (See figure 6-2.)



Note. Samples may not require analysis at all four levels of identification.

Figure 6-2. Sample routing

Legend:	
AML	area medical laboratory
BAT	biological augmentation team
CBRN	chemical, biological, radiological, and nuclear
CONUS	continental United States
CVN	aircraft carrier, nuclear
LHA	amphibious assault ship (general purpose)
LHD	amphibious assault ship (dock)
LRN	Laboratory Response Network
NEPMU	Navy environmental and preventive medicine unit
OCONUS	outside the continental United States
T-AH	hospital ship
VET	veterinary

Figure 6-2. Sample routing (continued)

6-32. Technical assistance is drawn from military/civilian national assets (on-site or through technical reachback. They will have detailed knowledge of the agents and sophisticated sample collection procedures. Their expertise can be used for—

- Risk management.
- The interpretation of results.
- Aerial reconnaissance.
- Decontamination and waste management.
- Risk communication and public affairs.
- The transportation of hazardous materials.
- Medical management of casualties.

Note. See *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Consequence Management and Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Aspects of Command and Control.*

6-33. CBRN R&S elements conduct, record, and report surveys of known or suspected incidents. They provide prompt estimates of the severity and extent of hazards using a CBRN warning and reporting message. Additional responsibilities include—

- Collecting, documenting, and initially packaging any samples taken.
- Making prior coordination with intelligence and medical units.
- Adhering to special sample collection tasks provided by the unit commander in the OPORD.
- Coordinating and preparing for decontamination operations before beginning sample collection missions.

6-34. The Laboratory Response Network and military environmental/medical laboratories will be identified to support sample management operations. These laboratories support theater validation identification and/or definitive identification as required. (See *Multiservice Tactics, Techniques, and Procedures for Health Service Support in a Chemical, Biological, Radiological, and Nuclear Environment* for more information on Laboratory Response Network.)

SUMMARY

6-35. The key objective of this chapter is to identify the appropriate doctrine and tactics used for CBRN sample management in a joint operation area. Achieving these sample management activities will allow personnel of all Services to complete their goals. The focus is to place the proper tools and methods into the hands of military personnel, so that they safely obtain a sample that is representative of the environment. Protection, prophylaxis, and treatment decisions can be directly impacted by analyzed results from CBRN sample management. See appendix H for further details on TTP for CBRN sample collection and processing.

Appendix A
Metric Conversion Chart

This appendix complies with AR 25-30 which states that weights, distances, quantities, and measures contained in Army publications will be expressed in both U.S. standard and metric units. Table A-1 is a metric conversion chart.

Table A-1. Metric conversion chart

U.S. Units	***Multiplied By***	***Equals Metric Units***
Feet	00.30480000	Meters
Inches	00.02540000	Meters
Yards	00.91440000	Meters
Miles	01.60934400	Kilometers
Metric Units	***Multiplied By***	***Equals U.S. Units***
Meters	03.28080000	Feet
Meters	39.37000000	Inches
Meters	01.09361000	Yards
Kilometers	0.621371192	Miles

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Appendix B

Planning

This appendix provides planning considerations to support the integration of CBRN R&S through the development of a CBRN ISR plan using the four steps of the IPOE/IPB process combined with the planning process. Tactical, operational, and strategic planning are interrelated, and the actions taken at the tactical level have implications at the operational and strategic levels of war. Planning activities at the tactical level for CBRN reconnaissance and CBRN surveillance operations are similar, but they require different resources and personnel capabilities. One of the goals of CBRN R&S is to produce information that allows friendly force elements to avoid contaminated areas. It also provides technical intelligence concerning adversary offensive CBRN capability and is part of the overall intelligence collection effort. It is performed during preparation for operations, during sustained combat operations, and after conflict resolution to provide information used by the commander to support IRs. The CBRN ISR plan, CBRN ISR synchronization matrix, CBRN collection matrix, and CBRN ISR tasking matrix are typically prepared in spreadsheet format. There is no set format for them, but they do have key pieces of information and should always be accompanied by a CBRN ISR overlay that graphically depicts the information contained in the plan and matrices.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR INTELLIGENCE, RECONNAISSANCE, AND SURVEILLANCE

B-1. Sample CBRN ISR plans and matrices are in the following figures (figure B-1, page B-2 is a CBRN ISR plan; figure B-2, page B-3, is a CBRN ISR synchronization matrix; figure B-3, page B-3, is a CBRN collection matrix; and figure B-4, page B-4, is a CBRN ISR tasking matrix).

DTG	Local	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400
Enemy		*CBRN attacks along the FEBA*									*CBRN attacks along MSRs*								*CBRN attacks C2 and logistics nodes*						
Friendly	Surveillance	*Biological surveillance along FEBA*											*CBRN surveillance on key NAIs*												
Friendly	Reconnaissance	*CBRN recon of suspected CBRN attacks along the FEBA*											*CBRN recon of MSRs and alternate C2 and logistics nodes*												
CBRN ISR Focus	*Identification of CBRN attacks within the operation area and identification of alternate routes around contaminated MSRs*																								
CBRN Surveillance Assets	*76th Chem (BIDS)*	*PL Charlie (array)*																							
CBRN Surveillance Assets	*55th Chem (FOX)*	*NAI 6 (standoff chemical detection)*										*MSR Angel (CBRN convoy escort)*													
CBRN Surveillance Assets	*27th Chem (NBCRV)*	*Algrove airfield and AA Snake (CBRN surveillance)*																							
CBRN Surveillance Assets	*67th Aviation Support Wing (JBPDS)*	*APOE 45 (array)*																							
CBRN Reconnaissance Assets	*88th Chem (NBCRV)*	*AA Lizard (zone recon)*							*NAI 4567 and 6789 (zone recon)*																
CBRN Reconnaissance Assets	*87 Chem (FOX)*	*NAI 688 (chemical standoff surveillance)*							*MSR Orange (route recon)*																
CBRN Reconnaissance Assets	*67th MEU (MAGTF CBRN R&S Element)*						*MSR Gold (route recon)*														*NAI 7577 (area recon)*				
CBRN Reconnaissance Assets	*23rd CRT (TEU)*	*NAI 34 (BE 235674) (exploitation)*																							
CBRN Reconnaissance Assets	*43rd Chem (JNBCRS)*								*NAI 67 (site assessment)*																

Legend:

AA	avenue of approach
APOE	aerial port of embarkation
BIDS	Battlefield Information Distribution System
C2	command and control
CBRN	chemical, biological, radiological, and nuclear
CHEM	chemical
DTG	date-time group
FEBA	forward edge of battle area
ISR	intelligence, surveillance, and reconnaissance
JNBCRS	Joint Nuclear Biological, and Chemical Reconnaissance System
JBPDS	Joint Biological Point Detection System
MAGTF	Marine air-ground task force
MEU	Marine Expeditionary Unit
MSR	main supply route
NAI	named area of interest
NBCRV	nuclear, biological, and chemical reconnaissance vehicle
PIR	priority intelligence requirement
PL	phase line
R&S	reconnaissance and surveillance
recon	reconnaissance
TE	technical escort
TEU	

Figure B-1. Sample CBRN ISR plan

Unit	JTF Rocky	CBRN ISR Plan				Period Covered		From		090001ZJAN2012		To	092401ZJAN2012
PIR/IR	Indicators (Analysis of Intelligence Requirements)	Avenue of Approach Coordinates From: 32UWU45506780 To: 32UWU47006890 Mobility Corridor From: PL Blue To: PL Red				CBRN Assets to be Employed						Hours and Destination of Reports	Remarks
		NAI	Time		SIR or RFI	29th Chem (FOX Plt)	267th BIDS Co	1/7 Cav (NBCRV Plt)	22 SRT Wing (JBPDS)	45th MEU (MAGTF R&S Element)	22nd Chem CRT	36th Chem (JNBCRS Plt)		
			NET	NLT										
1	*Positive BIO detection*	*1*		*001*			*X*		*X*				*As per SOP*	
	Positive BIO detection	*2*	*0001*				*X*							
2	*ID of CBRN agents*	*3*	*1200*			*X*							*As per SOP*	
	ID of CBRN agents	*4*	*1200*							*X*				
	ID of CBRN agents	*5*	*1200*					*X*						
3	*ID of CBRN precursor*	*6*	*1200*								*X*		*As per SOP*	
	ID of CBRN munitions	*7*		*1500*								*X*		

Legend:
BIDS Battlefield Information Distribution System
BIO biological
CBRN chemical, biological, radiological, and nuclear

Figure B-2. Sample ISR synchronization matrix

PIR	Indicators	SIR EEI	NAI	Start time	LTIOV	NBCRV PLT, C Troop 1/15 Stryker	Request to Higher
Will the enemy contaminate north/south MSRs with CBRN Agents?	*Report of artillery attacks along north/south MSRs.* *Positive detection of CBRN agents along North/South MSRs.*	*Report all CBRN attacks along routes Omega and Delta*	*MSR Omega* *MSR Delta*	*170001ZJUL12*	*181200ZJUL12*	●	
	Attack against NAI along north/south MSRs with little to no explosive affects. *CBRN agent poising symptoms around the north/south MSRs.*	*Report all unusual attacks in the vicinity of NAIs*	*4567* *3245* *2345*	*170100ZJUL12* *170300ZJUL12* *170800ZJUL12*	*170300ZJUL12* *170900ZJUL12* *171130ZJUL12*	●	○

Legend:
CBRN chemical, biological, radiological, and nuclear
JUL July
MSR main supply route
NAI named area of interest
NBCRV nuclear, biological, chemical, and radiological vehicle
PIR priority intelligence requirement
PLT platoon
SIR specific information requirement

Figure B-3. Sample CBRN collection matrix

CBRN ISR Tasking Matrix

Period covered from _170001ZAUG12_ **to** _172359ZAUG12_

PIR	CBRN SIR			CBRN reconnaissance and surveillance								Report to	Remarks
				Reconnaissance				Surveillance					
	Indicators	NAI	LTIOV	D Troop NBCRV Plt	USMC MAGTF CBRN ACM Capability Team	23 Chem Co (dismounted)	Other	JBPDS Plt	D Troop NBCRV Plt	USMC MAGTF CBRN Recon Plt	23 Chem Co (dismounted)		
1	*A*	*1*		*/*	*X*								
		2		*X*	*/*								
	B	*1*		*/*	*X*								
		2		*X*	*/*								
2	*A*	*3*						*X*	*/*			*TF*	*BIO related*
		4				*X*						*TF*	*BIO related*
	B	*3*						*X*	*/*			*TF*	*BIO related*

Legend:

/	sensor and unit capable of collecting information
X	sensors and unit tasked to collect information
ACM	air contengency Marine air-ground task force
BIO	biological
CBRN	chemical, biological, radiological, and nuclear
Chem	chemical
Co	company
JBPDS	Joint Biological Point Detection System
LTIOV	last time information of value
MAGTF	Marine air-ground task force
NBCRV	nuclear, biological, and chemical reconnaissance vehicle
PIR	priority intelligence requirement
plt	platoon
recon	reconnaissance
TF	task force
USMC	U.S. Marine Corps
ISR	intelligence, surveillance, and reconnaissance
NAI	named area of interest

Figure B-4. Sample CBRN ISR tasking matrix

INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE PLAN INPUTS

B-2. The IPOE/IPB process is used to determine key parts of the CBRN ISR plan through the following four-step process:

STEP 1—DEFINE THE OPERATIONAL ENVIRONMENT

B-3. The operational environment is defined by identifying the—

- **Limits of the command operational area.** The operational area is the geographical area at which the commander is assigned the responsibility and authority to conduct military operations.

- **Limits of the area of interest.** The area of interest is the geographical area from which information and intelligence are required to permit planning or successful conduct of the commander's operation. Sources of information may include other federal agencies operating within the area of interest (Department of State, national level intelligence agencies) that may have information that will help support the commander's overall situational awareness.
- **Amount of detail required and the amount feasible within the time available.** The time available for completion of the IPOE/IPB process may not permit the luxury of conducting each step in detail (for example, the CBRN and medical staffs must realize the time sensitivity of critical information [the time from the exposure of personnel to a CBRN agent until the onset of symptoms]).

STEP 2—DESCRIBE THE OPERATIONAL ENVIRONMENT BASED ON THREAT AND FRIENDLY CAPABILITIES

B-4. This is accomplished by analyzing the operational environment, which includes an analysis of the existing and projected conditions of the operational environment. The information from the analysis supports the conduct of friendly vulnerability assessments. Planners identify characteristics of the operational environment that could affect friendly target vulnerability, influence the commander's decisions, or affect the COAs available to U.S. forces.

Terrain Analysis

B-5. Terrain analysis reduces the uncertainties regarding the effects of natural and man-made features on friendly CBRN operations. It focuses on the military aspects of the terrain, including:

- **Observation and fields of fire**. Observation is the influence of terrain on reconnaissance, surveillance, and target acquisition capabilities. A field of fire is the area in which a weapon or a group of weapons may cover effectively with fire from a given position.
- **Avenue of approach**. An avenue of approach is a route by which a force may reach key terrain or an objective. NAIs along an avenue of approach that an adversary may target with CBRN weapons are also identified.
- **Key terrain**. Key terrain is any feature or area that would offer a marked tactical advantage if an adversary seized it or gained control of it.
- **Obstacles**. Planners identify the obstacles (natural and man-made) that may be used by an adversary with capabilities (such as persistent chemical agents) to impede or delay the advance of U.S. forces.
- **Cover and concealment**. Planners identify the cover and concealment that may be available to preclude possible targeting by an adversary.

B-6. The terrain analysis is conducted as follows:

- The terrain is evaluated through a map analysis supplemented by CBRN R&S.
- Terrain factor overlays are developed and analyzed, including the identification of contaminated areas.
- Combined-obstacle overlays are developed.
- Avenues of approach are identified and analyzed.
- Avenues of approach overlays are developed.

B-7. Terrain analysis examines the potential impact of surface conditions on contaminants (for example, the surface and soil type affect how readily a chemical agent is absorbed into the soil). The type of surface also affects the persistency of chemical agents. Even though the actual operational environment is a combination of conditions, looking at the general conditions separately (below), will give an indication of what to expect. Surfaces may initially present a contact hazard and later present a vapor hazard during agent off-gassing. Surfaces are as follows:

- **Sand.** A sand surface is generally any surface that has a large amount of sand, and it normally has good drainage. When chemical agents are applied to this surface, they tend to be drawn into the subsurface, lowering the quantity of contamination available for liquid detection.

- **Soil.** Soil is generally any surface that contains quantities of clay and loam. Depending on the relative amount of each soil component, chemical agents react differently. Normally, some percentage of the agent is absorbed into the subsurface (until saturation).
- **Grass**. Grass is generally any surface covered with a layer of grass, from a few centimeters to a half meter in height. A portion of the chemical agent remains on the grass, while the rest is absorbed into the underlying soil. The chemical agent on the grass is available for liquid detection.
- **Mud.** Mud is generally any surface saturated with water, resulting in muddy conditions. The amount of persistent agent that can be absorbed by wet soil is inversely related to the water content of the soil (such as the more water, the less chemical agent absorbed). Under this condition, chemical agents remain on the surface longer, thus increasing the probability of detection.
- **Engineered surfaces**. Engineered surfaces (glass, steel) are nonporous. Artificial surfaces such as asphalt, concrete and wood are porous. Liquid agents are absorbed over time. In the case of asphalt and concrete, this absorption generally takes place within timeframes of seconds to minutes.

B-8. Terrain analysis also examines the impact of surface conditions on detection capabilities. The more absorbent the soil, the less liquid remains on the surface. This decreases the probability of detection by detector paper. The smoother and harder the surface, the higher the probability of detection with a CBRN R&S system. When the CBRN R&S system is detecting on rough surfaces, the sampling wheel tends to bounce, decreasing the probability of detection. On soft or porous surfaces, the ability of the CBRN R&S system to detect contamination can be improved by stopping to lower the probe near the surface. The heated probe causes absorbed chemical agents to vaporize. The vaporized agent can then be analyzed by CBRN R&S assets.

Weather Analysis

B-9. Weather in the operational area is analyzed to determine its effects on friendly and threat operations. The operational and tactical environments require that weather and terrain be considered simultaneously and developed as an integrated product. Weather and terrain can be graphically portrayed to indicate the possible impact of CBRN weapons within an operational area. For example, weather conditions influence the persistency of liquid contamination. Such contamination is detected in two ways—as a vapor (as it evaporates) or by physical contact. As wind speed and temperature increase, the evaporation of liquid contamination increases. This means that there are more vapors present to detect, thus increasing the probability of detection. The following factors should be considered when analyzing weather aspects:

- Wind speed and direction can impact the downwind travel and hazard areas associated with CBRN agents.
- Atmospheric stability can play a key factor in the analysis of when an adversary may use CBRN weapons.
- Temperature and humidity have a direct impact on the performance of personnel and equipment. Temperature extremes and humidity reduce the capabilities of personnel and equipment and may require the use of special personnel shelters or equipment.

Other Analysis

B-10. This includes all aspects of the operational environment that affect friendly or threat COAs not already incorporated into terrain and weather analyses.

STEP 3—EVALUATE THE ADVERSARY

B-11. Adversary evaluation is a detailed study of adversary forces and their composition and organization, tactical doctrine, weapons, equipment, and supporting systems. Adversary evaluation determines adversary capabilities and limitations and how the adversary would fight if not constrained by weather and terrain. The steps in the evaluation process are:

- **Identify adversary capabilities**. Adversary capabilities are broad COAs and supporting operations used by the adversary to influence the accomplishment of the friendly mission. Planners use intelligence information to assess possible adversary offensive CBRN capabilities and to assess the potential impact of agent use.
- **Identify gaps in the current intelligence holdings**. Planners prioritize gaps in the current holdings on adversary offensive CBRN capabilities using the commander's initial IR. The early identification of gaps allows planners to initiate action to collect the CBRN intelligence required to fill the gaps.
- **Create or update threat models.** Threat evaluation is performed by knowing the threat and using decision support tools that would portray how adversary CBRN weapon use could impact the operational area. The use of models and other automated decision tools provides a means to assess the potential footprint for an adversary attack. For example, the CBRN and intelligence sections coordinate and determine how an adversary may use his capability to get the best spread of agent on the target. Figure B-6, page B-29, identifies multiple factors to consider, including weapon fusing, direct or indirect delivery of the agent to the target, downwind hazard estimates, contamination deposition patterns, the theater ballistic missile threat, and CBRN hazards.
- **Create templates.** This process converts the threat doctrine or patterns of operation to graphics (doctrinal templates). Doctrinal templates convert the threat order of battle data into graphics that show how the threat might use its offensive CBRN capability according to doctrine and training, without the constraints of weather and terrain. A template includes a description of threat offensive CBRN capabilities, tactics, and options. It also lists or describes the options available to the threat if the operation fails or if subsequent operations succeed. A template can identify high-value targets, which are assets that the threat commander requires for successful mission completion.

Weapon Fusing

B-12. Weapon fusing affects when a munition detonates. For example, if a munition detonates at ground level, it deposits most of the agent in the shell crater, minimizing the contaminated area. When munitions burst above the target, wind speed and direction directly influence the spread of the agent. As a munition bursts, the heavier droplets fall faster and the smaller ones drift downwind. The most heavily contaminated area is near the attack area. The chemical agent radiates in a bell shape in the direction of the wind, creating a contamination *footprint*. An element conducting CBRN R&S has a higher probability of detecting contamination when traveling crosswind to the footprint. The higher the concentration of the agent, the higher the probability of detection. The concentration of the agent on the ground depends on the type of agent, the time since delivery, the delivery method, and the type of ground surface.

Agent Delivery

B-13. Delivery of the agent may be direct or indirect. Indirect (off-target) delivery is generally upwind of the target area, and the resulting aerosol/vapor cloud or spray stream drifts onto the target. Direct or indirect types of attack can be delivered from a bursting munition or from a spray device. A radiological dispersal device (RDD) can also use a spray device. Munitions or spray tanks can be filled for dissemination as—

- A finely divided powder in aerosol suspension.
- Liquid splashes or droplets or as a finely divided liquid in aerosol suspension.
- A volatile liquid that quickly evaporates into a vapor when released as an aerosol (explosively or from a spray).

Note. Solid agents are unlikely to evaporate quickly enough to form a vapor, although frozen liquids will evaporate when the temperature rises.

B-14. A bursting munition has a thin outside layer filled with an agent; and the agent is dispersed by an air or ground burst. An airburst covers a large area; a ground burst impacts directly on the target. In a ground burst, the explosion drives some of the agent into the crater, where it can persist and remain a hazard (vapor, percutaneous, or ingestion). The types of munitions used are—

- **Point source**. A point source munition disseminates an agent from a single point. Delivery can be an air burst, a surface burst, or a penetrating round. A massive chemical bomb delivered by aircraft, missile, or artillery shell is an example of a point source delivery.
- **Multiple point source**. A number of point source munitions are distributed in an irregular pattern over a target area. Each point source munition spreads the agent as an aerosol or a vapor that merges with other aerosols and vapors downwind. Cluster bombs and multiple rocket launchers are examples of multiple point source delivery systems.

B-15. Spray devices release chemicals from storage tanks or from containers carried by systems, such as aircraft, submarines, patrol boats, missiles, and other vehicles. The degree of dispersion is varied, thus influencing the duration of effectiveness. Spray device delivery is characterized as a *line source*, which simply means that it disseminates agents along a line of release. An aircraft spray system (internally or externally mounted) is an example of a line source delivery system.

Downwind Hazard Estimates

B-16. Downwind hazards from biological weapons have a significantly larger potential area of effect than chemical weapons. If weather conditions are optimal, a downwind hazard can extend to a few hundred kilometers. The quantities required for biological weapons are small compared to those required for chemical weapons, and biological agents can be disseminated crosswind with few, if any, indications of hostile intent. Key variables that affect the downwind hazard area include weather, terrain, the type of agent, particle size, and the type of delivery system.

Contamination Deposition Patterns

B-17. Contamination deposition patterns could result from a bursting artillery attack. The sample surface contamination pattern provides the basis for some general conclusions as follows:

- Agent deposition generally radiates in a bell shape in the downwind direction.
- The heaviest concentrations usually occur closest to where the warhead functions.
- The deposition of the agent is uneven. Deposition concentrations generally decrease in crosswind directions from the downwind path of the agent.
- The contamination deposition footprint lessens over time, and the concentration levels decrease.

Theater Ballistic Missiles Threat

B-18. Theater ballistic missiles (TBMs) have unique characteristics that must be considered when planning defensive actions. For example, no other target system can put a warhead into the theater noncontiguous areas of operation or threaten neutral countries within a matter of minutes. Airburst warheads from a TBM provide effective area coverage and dispersion patterns for chemical-biological agents. When released at optimal burst heights, agents fall to the ground within 5 to 60 minutes in the direction of the prevailing wind.

B-19. Large agent droplets or solids fall more quickly; small droplets fall further downwind at a slower rate. Similarly, the vapor released as these agents evaporate moves from the point of release toward the ground in a downwind direction.

B-20. Secondary threats/hazards may also exist during and after some TBM attacks. TBMs may have warheads that do not separate from the missile body until the warhead functions or the missile hits the ground.

B-21. In addition to the explosive, chemical, or biological hazards, the missile may impact a building or create a crater. When this happens, the impact area/location may contain hazards from the remaining missile fuel and oxidizer or from the facility or structure that the missile hits (fuel, power lines, munitions). Depending on the quantity remaining, the residual fuel and oxidizer (red, fuming nitric acid) can cause detector paper to falsely indicate the presence of chemical agents or to mask the presence of an agent.

Radiological Hazards

B-22. Radiological hazards can include alpha, beta, gamma, and neutron radiation that must be considered when planning reconnaissance missions. The threat to U.S. forces could include the radiological hazards from nuclear facilities, radiological dispersion, improvised nuclear devices, sealed sources, reactor fuel production, or luminescent military commodities.

Nuclear Facilities

B-23. Nuclear facilities may release radioactive material to the environment because of an attack on the installation, sabotage, or an accident (for example, Chernobyl). A damaged reactor can release large amounts of radioactive material, composed of many different radionuclides, over an extended period of time. Radioactive materials of concern include noble gases, halogens (radioiodines), mixed particulate fission products, and transuranics (for example, uranium and plutonium). Consequently, forces downwind from an incident may face the possibility of external and internal exposure over a large affected area and for an extended period of time. The hazard posed by internal exposure to radiation is radionuclide-specific. Therefore, estimates of an effective dosage (that is, the dosage from internally deposited nuclides) highly depend on the identification and quantification of the environmental contamination, particularly airborne contamination.

Radiological Dispersion

B-24. Radiological materials are used in many industrial, research, and medical applications and are increasingly available. Dispersal falls into two categories—simple radiological dispersal and RDDs.

- **Simple radiological dispersal**. Simple radiological dispersal could be any dissemination of radioactive material other than that produced by a nuclear explosive device. It is specifically designed to cause injury or area denial by means of the radiation produced following dissemination. For example, an adversary could create a perceived or real health threat by securing a supply of radioactive material from a medical laboratory, an industry, or another site and dispersing the material into the public water supply or via an aircraft over a troop staging area.
- **RDD**. An RDD can be defined as any device (including a weapon or equipment) other than a nuclear explosive device that is specifically designed to disseminate radioactive materials to cause damage, injury, or area denial via the radiation produced by decaying radionuclides in the material. The use of the explosive or incendiary, mixed with radioactive materials, could create an incident in which the initial explosion would kill persons in the immediate vicinity of the device. The radionuclide decay would continue to threaten first responders and others near the incident area/location.

Improvised Nuclear Devices

B-25. A nuclear detonation is the sudden release of energy from nuclear fission or fusion. The prompt, initial radiation poses a severe external radiation hazard, while fallout poses serious external and internal radiation hazards. The radioactive material produced by a nuclear explosion is composed of the same fission products as those from a reactor accident and may include activation products produced when neutrons from the fission interact with the surrounding environment. Plutonium and/or uranium not fissioned during the nuclear reaction will also be dispersed by the explosion. Because of the large amounts of energy released from a nuclear explosion, the plumes of fallout and airborne contamination can impact massive geographic regions.

Sealed Sources

B-26. It is conceivable that personnel may enter areas where radioactive materials have been left (intentionally or unintentionally). Breakdown in normal control mechanisms, collateral damage caused by combat, or malicious use by adversaries able to acquire medical or industrial sources of radioactive material could result in significant radiation exposures to forces. Sealed sources, by definition, are designed to contain radioactive material inside (for example, radioactive gases in glass vials, radioactive powders double-encapsulated in stainless steel, metal impregnated with radionuclides and then encapsulated). When such sources maintain their structural integrity, they pose an external exposure hazard from the penetrating radiation (neutrons or gamma rays). However, when the integrity of a source is compromised, the source can present a contamination problem and an internal hazard from the nonpenetrating radiation (beta or alpha particles). Commonly found, sealed sources that may pose a significant gamma radiation exposure hazard include iridium-192 industrial radiography sources, cobalt-60 medical teletherapy sources, and cesium-137 calibration irradiator sources.

STEP 4—DETERMINE ADVERSARY COURSES OF ACTION

B-27. Commanders determine the adversary COAs that will influence the accomplishment of the friendly mission. They—

- Identify the likely objectives of the threat and the desired end state.
- Identify the full set of COAs and associated CBRN offensive capabilities available to the threat.
- Evaluate and prioritize each COA, using judgment to rank the threat COAs in their likely order of adoption.
- Develop each COA in the amount of detail that time allows.

B-28. To ensure completeness, integrate the following CBRN considerations:

- **What.** Identify the type of agents that may be used to support adversary COAs.
- **When.** Identify the time the adversary may use his offensive CBRN capability.
- **Where.** Identify the sectors or zones where CBRN agents may be used.
- **How.** Identify the method by which the threat will employ its offensive CBRN capability.
- **Why.** Identify the objective or end state that the threat intends to accomplish.

B-29. For each COA, commanders develop the following products for follow-on analysis and comparison:

- **Situation template.** The situation template is a doctrinal template with terrain and weather constraints applied. It is a graphic depiction of expected threat dispositions for each possible threat COA. It usually depicts the most critical point in the operation as agreed upon by the intelligence and operations officers.
- **Event template.** The event template is a guide for CBRN R&S collection planning. The event template depicts the NAI where activity or the lack of activity may indicate which COA the threat has adopted.
- **Event matrix**. The event matrix provides details on the type of CBRN activity expected in each NAI, the times the NAI is expected to be active, and its relationship to other activities in the operational environment.
- **Decision support template.** The decision support template is a combined intelligence and operations estimate in graphic form. It indicates the points where a decision from the commander may be required, based on input from multiple sources, including CBRN R&S information.

COMMANDER'S INTENT

B-30. CBRN R&S planning is critical, and there is seldom enough time to plan for every possible situation. There are, however, essential elements (such as the commander's intent and a complete mission statement) that must be included in all CBRN R&S plans. These elements provide a level of detail required to ensure total integration and utilization of CBRN R&S assets. The commander's intent for the mission must be clearly identified. The intent is what the commander wants the mission to accomplish when completed—a clear concise statement of what CBRN R&S forces must do and the conditions the force must establish with respect to the adversary, terrain, and civil considerations that represent the desired end state.

INITIAL PLANNING AND COORDINATION

B-31. Plan and prepare for reconnaissance using troop-leading procedures and the situation estimate. Identify required actions to be performed at the objective, and then plan backward to the departure from friendly lines and forward to the reentry of friendly lines. The tactical CBRN R&S element leader normally receives the OPORD in the supported unit TOC, where communications are good and key personnel are available for questions and coordination. Mission coordination must be thorough and detailed since tactical CBRN R&S elements act semi-independently, temporarily move beyond direct-fire support of the supported unit, and occasionally operate forward of friendly units.

B-32. The tactical CBRN R&S element leader normally coordinates directly with the supported unit staff and must continuously coordinate with the support unit staff throughout the planning and preparation phases. Tactical CBRN R&S element leaders must coordinate directly with the element conducting forward and rearward passage of lines and with other units in the operational area and adjacent areas. Items to coordinate with the supported unit include:

- Changes and updates in the adversary and friendly situations.
- The best use of terrain for routes, rally points, and forward reconnaissance bases.
- Light and weather data.
- The security of the CBRN R&S element.
- The use and location of LZs.
- The departure and reentry of friendly lines.
- Fire support on the objective and along the planned routes, including alternate routes.
- Rehearsal areas and times.
- Special equipment requirements.
- HSS (including medical evacuation).
- Logistics support.
- Signal plan call signs, frequencies, code words, pyrotechnics, challenges, and passwords.
- Identification to reduce the incidence of friendly fire.
- CBRN R&S plan completion.

KEY OPERATIONAL CONSIDERATIONS

B-33. Consider the following for planning CBRN R&S operations:

- **Essential and supporting tasks.** Ensure the assignment of all essential tasks to be performed on the objective, at danger areas, at security or surveillance locations, along routes, and during the passage of lines.
- **Key travel and execution times**. Estimate the time requirements for moving to the objective, reconnoitering the objective, establishing security and surveillance, completing assigned tasks while on the objective, moving to and through friendly lines, and conducting operational debriefings.
- **Primary and alternate routes.** Select primary and alternate routes to and from the objective.
- **Signals.** Consider using special signals, including approved hand-and-arm signals, flares, voice, whistles, radios, and infrared equipment.

PLANNING COMPONENTS

B-34. Consider the following CBRN R&S planning components:

- **Missions.** Examine the mission. Ensure that plans cover ways to enhance the survivability and mobility of friendly forces, assist in the regeneration of combat power, and identify forward combat and rear area/support areas.
- **Available resources.** Ensure that plans identify—
  - Organic CBRN R&S assets.
  - CBRN R&S resources available from higher headquarters.
  - CBRN R&S materials and equipment available from the HN.
- **Coordination.** Coordinate CBRN R&S planning with all staff elements, especially operations and logistics sections. The adversary CBRN threat is critical and requires close coordination with the intelligence section. The employment of CBRN R&S capabilities should not duplicate the efforts of conventional reconnaissance assets. Careful deployment and coordination with

adjacent and supported units and fires elements will enhance unit survivability. Friendly units must know the location and intent of all CBRN R&S capabilities to avoid friendly fire.

- **Simplicity.** Exclude unnecessary elements, and reduce essential elements to the simplest form.
- **Organizational relationships**. Clearly define command and support relationships, and assign responsibilities.
- **Continuity.** Designate an alternate headquarters to assume responsibility when the primary headquarters is out of action.
- **Versatility**. Ensure that CBRN R&S capabilities are able to react to unexpected situations.
- **Effective control**. Realize that CBRN R&S capabilities will operate away from their parent units. Electronic and CBRN warfare, along with the sheer size of the operational environment, will make communications difficult. Ensure that the plan establishes a mission command/C2 system and provides specific measures to adopt in the absence of direct communications links or control.
- **Decentralized execution.** Delegate authorities, yet keep necessary control.
- **Habitual relationships.** Be aware that it is beneficial to have the same CBRN unit always supporting the same unit.

PLAN DEVELOPMENT

B-35. The commander implements the concept of operations (CONOPS) for CBRN R&S through planning and implementing risk reduction measures. The command and staff use their situational awareness (visualization of the operational environment) to identify the risk reduction measures that will be implemented in supporting operations plans (OPLANs) and/or OPORDs. Methods that can be used to examine, assess, and implement the risk reduction measures are included in table B-1.

Table B-1. Identify risk reduction measures

Receive and analyze the mission	***Identify the adversary CBRN hazard and friendly CBRN defense capabilities***	***Assess the CBRN hazard and friendly situation (high/ medium/low)***	***Propose risk reduction measures***	***Reassess the CBRN risk (high/ medium/ low)***	***Implement risk reduction measures in the OPLAN/ OPORD***	***Execute the OPLAN/ OPORD***
How (How will U.S. forces detect adversary use of CBRN agents?)	Identify adversary delivery TTP; identify friendly CBRN detection capabilities.	Assess the impact of CBRN use. • Point release. • Line release. • Outside or inside.	Provide a CBRN surveillance employment/ health surveillance and medical surveillance plan.	Assess the probability of detection.	Implement a CBRN surveillance plan (critical-node or area array).	Supervise, provide feedback, and revise as required.
How (How will adversary use of CBRN be confirmed?)	Confirm adversary use of CBRN.	Assess confidence in reported result.	Ensure coordinated health/ CBRN/ information management. Implement the sample evacuation plan.	Assess the quality and timeliness of reports.	Implement the warning-and-reporting network.	Supervise, provide feedback, and revise as required.

Table B-1. Identifying risk reduction measures (continued)

Receive and analyze the mission	***Identify the adversary CBRN hazard and friendly CBRN defense capabilities***	***Assess the CBRN hazard and friendly situation (high/ medium/low)***	***Propose risk reduction measures***	***Reassess the CBRN risk (high/ medium/ low)***	***Implement risk reduction measures in the OPLAN/ OPORD***	***Execute the OPLAN/ OPORD***
What (What agents may be used? How many agents may be used?)	Identify adversary CBRN agents.	Assess the impact of CBRN agents. • Detection capability. • Treatment capability.	Provide CBRN detection capability. • Provide laboratory capability. • Provide courier capability.	Assess whether capability gaps exist.	Deploy and synchronize the required capability.	Supervise, provide feedback, and revise as required.
When (When might the adversary use CBRN agents?)	Identify adversary windows of opportunity.	Assess the time required to implement risk reduction measures.	Provide warning and reporting, and establish trigger points and decision points.	Assess the timeliness and accuracy of the mission command/ C2 system.	Implement the sample evacuation plan and staff working group.	Supervise, provide feedback, and revise as required.
Where (Where is the operational area?)	Identify areas of possible CBRN employ-ment.	Assess the impact of the operational area on CBRN agents and U.S. CBRN detection capability. • Weather. • Terrain. • Background.	Provide a periodic weather forecast and analysis. Provide background monitoring and analysis.	Assess war-game options for threat CBRN use. Assess background data.	Implement the weather forecasting capability, and conduct a routine assessment of background data.	Supervise, provide feedback, and revise as required.
Legend: C2 command and control CBRN chemical, biological, radiological, and nuclear OPLAN operation plan OPORD operation order TTP tactics, techniques, and procedures						

B-36. As a continuous process, CBRN R&S planning employs an iterative method. The different factors interrelate (for example, the linkage between CBRN detection system presumptive and confirmatory identification), support a time-sensitive process, and focus on maximizing the probability of detection.

B-37. Preparation of a CBRN R&S plan entails completing a mission analysis, assessing COAs, preparing staff estimates, and developing the OPLAN and/or OPORD or annex. Critical operational considerations must be assessed during the decisionmaking process.

B-38. The operational-level commander develops an OPLAN and/or OPORD as a directive to issue to supporting or subordinate units that have CBRN R&S responsibilities. Situation, mission, execution, service support, and command and signal are the key data elements in the command OPORD that the supporting or subordinate unit uses to prepare OPORDs or FRAGORDs to support the higher supported commander's intent.

Situation

B-39. The situation paragraph of the CBRN surveillance plan (table B-2) is used to provide the most likely and most dangerous threat COAs. It provides the mission, commander's intent, and CONOPS for the headquarters one and two levels up. The situation paragraph also provides actions that other units (such as flank units) may take that can have significant effects on CBRN R&S operations.

Table B-2. CBRN R&S planning—situation

Situation	*Factor*	*Operational Implications*
Adversary forces (Potential adversary facilities [WMD production facilities]/NAIs with potential of possessing adversary agents/ precursors)	Identify an adversary list of CBRN agents. • Detector/handheld assay tailoring. • Depth of array.	The list of AOR-specific adversary agents can affect requirements for different types of detectors and the specific handheld assays used. Also, the type of adversary agent can drive the depth of the array used. It should be noted that all common surveillance reagents may be initially used, and all attacks may be surprise attacks.
	Identify the dissemination method. • Munitions. • Dispersal systems. • Terrorist-type attack (food/water). • Direct contact with vector or contagious person.	The type of delivery systems the adversary has available can affect how the CBRN detector array is positioned (critical node versus area array).
	Anticipate surprise.	Surprise attacks by the adversary can never be fully planned for. Yet, they can potentially be the most effective. Flexibility, effective mission command/C2, and a robust detection array are keys to providing full-spectrum CBRN R&S operations that can potentially provide coverage against surprise attacks.
	Identify potential CBRN R&S assets within the AOR.	Planning, coordination, and liaison determine what HN or other government organizations and nongovernmental organizations can provide for support of CBRN R&S. The commander and his staff must "think outside the box" about ways they can augment unit CBRN R&S capabilities.
Friendly forces	Identify CBRN R&S assets.	The command and staff analyze the task organization. The review determines what capabilities are available to support CBRN detection, escort operations, and health services support to include medical treatment, medical laboratory, and preventive medicine to assist with health assessment and medical surveillance documentation.
	Review for other units or assets that may possess a CBRN agent detection capability.	The command and staff determine what other military assets are available within the AOR. Some of these assets may include HN and allied military assets.

Table B-2. CBRN R&S planning—situation (continued)

Situation	*Factor*	*Operational Implications*
Attachments and detachments	Review task organization for CBRN R&S assets, mission command/C2 units, technical escorts, and theater medical laboratories.	The established command and/or support relationship must be understood. This will impact factors (reporting, logistics).
	Identify assets available for CBRN R&S operations, to include medical laboratory support and technical escort assets.	Identify required capabilities that are not available. Identify requests for assets to fill shortfalls.

Legend:
AOR area of responsibility
C2 command and control
CBRN chemical, biological, radiological, and nuclear
HN host nation
NAI named area of interest
R&S reconnaissance and surveillance
WMD weapons of mass destruction

Mission

B-40. The mission statement in the CBRN surveillance plan (table B-3) is based on the mission analysis.

Table B-3. CBRN R&S planning—mission

Mission	*Factor*	*Operational Implications*
Planning	Assess the mission statement to determine specified and implied tasks. Use this information for mission analysis.	The mission statement contains the following elements: • Who will execute the CBRN R&S operations? • What are the essential CBRN R&S tasks? • When will the CBRN R&S operation begin? • Where will the CBRN R&S operations occur (operational area, objectives, grid coordinates)? • Why (for what purpose) will the force conduct CBRN R&S operations?

Legend:
CBRN chemical, biological, radiological, and nuclear
R&S reconnaissance and surveillance

Execution

B-41. The execution paragraph of the CBRN surveillance plan (table B-4, page B-16) describes how the commander sees the actions of the subordinate CBRN R&S elements fitting together to accomplish the CBRN R&S mission. It states the missions or tasks assigned to each subordinate CBRN R&S element, to include units that support CBRN R&S operations.

Table B-4. CBRN R&S planning—execution

Execution	Factor	Operational Implications
Maneuver	Timeline	The CBRN R&S plan must emphasize time as a critical factor of effective CBRN R&S. CBRN R&S data and samples are time-sensitive. The window of opportunity to protect the force through warning and protective measures is very small. Samples sent to supporting laboratories for confirmatory identification can deteriorate over time.
	Decision tree • High threat • Medium threat • Low threat	A decision tree can be established that includes the types of decisions to be made at different threat levels. These decision trees should never provide rubber-stamp actions for each threat level. They should identify when a decision is needed and possibly a tentative set of options that have been developed during the war-gaming process.
	Risk • Plan ahead • Redundant systems in place • Protection	The amount of risk the command is willing to assume will impact the monitoring methodology (for example, all systems operational or sample collection interval).
	Confidence in results • Laboratory • Detector	The confidence in a detection of a CBRN attack is affected by how it has been detected. Detection by one CBRN detector has a lower confidence level (medium) than if two CBRN detectors have made the detection (high). Theater validation identification from a supporting laboratory confirms and bolsters medium-confidence detections and further reinforces high-confidence detections. Confidence in CBRN detection will affect how a commander and his staff implement reduction measures. The confidence in a detection of a CBRN attack is affected by how it has been detected. Detection by one CBRN detector has a lower confidence level (medium) than if two CBRN detectors have made the detection (high). Theater validation identification from a supporting laboratory confirms and bolsters medium-confidence detections and further reinforces high-confidence detections.

Table B-4. CBRN R&S planning—execution (continued)

Execution	***Factor***	***Operational Implications***
Maneuver	Postattack • Reduction • Sample collection/ detector operations	After an attack has been identified (through presumptive, confirmatory, and/or theater validation identification), the unit must affect reduction measures. These measures may come in the form of prophylaxis, heightened protective postures, and warning and reporting. Postattack sample collection and detector operations must be addressed (for example, increased or decreased sample collection).
	Controlling headquarters command and staff • Receive • Analyze • Recom-mend • Decide • Dissemi-nate • Execute mission command/ C2	The headquarters command and staff that control the CBRN R&S operations have the responsibility to— • Be the central node for the receipt of any information that may have an impact on CBRN R&S operations. This includes actual detection data and intelligence, meteorological information, and medical information. • Analyze and synthesize all pertinent CBRN R&S related information into reliable action sets. • Recommend COAs in response to CBRN attacks. • Decide on a COA in response to a CBRN attack. • Disseminate information and guidance about COAs in response to a CBRN attack. Provide mission command/C2 of operations conducted in response to a CBRN attack.
	Preplanning (what, when, value, and cost)	The importance of preplanning cannot be overestimated. An effective and well-thought-out plan will save lives. The cost and value of the employment of CBRN R&S assets must always be considered. The costs of an effective CBRN R&S program are weighed against the catastrophic effects of a successful CBRN attack.
	Operational implication	The plan should include the operational impact of CBRN R&S on the force. It provides a clear and concise direct relation between benefits and/or losses and effective and/or ineffective CBRN R&S operations. This should include consideration of the current military medical requirement to document all CBRN exposures and to determine the potential need for long-term medical surveillance of exposed personnel.
ISR	Point detection	Provides critical nodes to be protected.
	Standoff detection	Provides standoff detector guidance (when available).
	Minimum protocols Sample collection intervals Consistency/ standardization	Provides standard operations. Protocols should provide the minimum expected standards of conducting CBRN R&S, such as protocols for use during CBRN R&S minimum sample collection intervals, spacing between detectors, packaging of samples, and the time to execute sample evacuation.

Table B-4. CBRN R&S planning—execution (continued)

Execution	*Factor*	*Operational Implications*
	Logistically supportable	Any standard set should be logistically supportable. For example, if the dry filter units are set with sample collection intervals of 24 hours a day at 6-hour intervals, then each dry filter unit will be using, as a minimum, 4 handheld assays a day. The use rate of consumables will need to be considered when establishing these standards.
	Employment plan • Where to assign assets • Spacing ▪ Lateral ▪ Depth • Number of assets ▪ Prioritize ▪ Allocate	To support the higher command OPLAN, the unit prepares a monitoring plan to indicate how CBRN detectors will be employed. Fixed site (critical node). To support fixed-site requirements, the commander will likely allocate point detector systems or dry filter units. Maneuver force (area array). To support maneuver force requirements, the commander will likely allocate CBRN R&S systems. This monitoring plan should assign assets to specific critical nodes or into area arrays. Spacing guidance should be provided not only for the distance between detectors laterally, but also for depth. Guidance should be provided on what the priority of effort is and how the command will allocate CBRN R&S assets to provide coverage in that priority.
	Fixed sites, ports, and airfields Maneuver land forces or maritime forces	Provide a scheme of maneuver that addresses how CBRN detection assets will best provide coverage against the threat. As part of the process array, placement, with regard to NAI location, is critical for successful probability of detection. The array type used is affected by the size of the area of operation. Mission duration is impacted by factors such as weather.
Air and missile defense	Air defense warning	Other systems within the operational environment can impact how CBRN R&S occurs. The air and missile defense warning system can affect how CBRN R&S is conducted. For example, upon warning of a missile attack, CBRN R&S assets may be directed to switch from periodic to continuous monitoring.
Information operations	Operations security/handheld assay agent codes	Codes have been assigned to the various biological agents that devices detect. The codes on the agent decode list are classified SECRET. The classification of these codes helps to maintain control of how a force reacts to a biological attack. The headquarters that controls the CBRN R&S assets maintains the codes and thus controls the release of detection data.
	Support tools to support decisionmaking	Support tools can assist the commander and his staff in determining the impact of a CBRN attack. Examples of support tools include the Joint Effects Model, Joint Operational Effects Federation, and decision support system. These decision support tools can provide estimates of how far downwind the hazard will travel and an estimated footprint of the CBRN incident.

Table B-4. CBRN R&S planning—execution (continued)

Execution	***Factor***	***Operational Implications***
Information operations (continued)	Support tools to support decisionmaking	Select support tools also have the ability to transmit this data to subordinate, higher, and adjacent units.
CCIRs	Identify locations in space and time for NAIs/PIR	PIRs and CCIRs provide a focus for making the decisions on where to position CBRN detection assets.
Risk reduction control measures	VA outputs	During the planning process, the staff planner must conduct a CBRN VA of the organization. The results of this VA are a set of vulnerability reduction measures meant to lessen the risk and impact of a CBRN attack. The VA can influence how and where CBRN R&S assets are deployed.
Environmental considerations	Meteorological data	There are various sources of meteorological data. The meteorological staff must be consulted to determine which of these sources are appropriate for use with any dispersion predictions. Once identified, these sources should also be disseminated to CBRN R&S assets.
	Effect on detection	The background environmental conditions can also have various effects on CBRN detection operations. (For example, an area with a high pollen count may cause false alerts in some field detectors.) Harsh weather can cause difficulties in conducting CBRN R&S operations. Sandstorms, freezing rain, snow, ice, heat, and high humidity can affect air monitoring, sample collection, and sample transport.
	Terrain • Detector locations • Field behavior • Borders • Samples-resupply	Terrain will also affect how and where detectors should be placed. Terrain can create direct and indirect effects on CBRN agent dispersion and downwind travel. International borders can affect how suspected CBRN samples are transported. They may also affect resupply operations for CBRN R&S assets.
	Background	Assess the impact of background environmental conditions on detection capabilities (for example, background conditions will vary by season and time of day). Determine whether background levels may require the use of alternate procedures for CBRN detectors (for example, a release may not register due to high background and relatively low concentrations or a highly variable background).
Protection	Force protection conditions	Force protection conditions are other tools that influence CBRN R&S operations. The higher the FP condition, the higher the threat. The planner can directly correlate his CBRN detection modes of operations (continuous versus periodic) and sample collection intervals to current FP condition levels.

Table B-4. CBRN R&S planning—execution (continued)

Execution	*Factor*	*Operational Implications*
Protection (continued)	Protection	CBRN R&S can be an integral part of force protection operations (U.S. Army: the protection warfighting function [specifically: survivability, FHP, CBRN and safety]). CBRN R&S provides the tools required to protect force from a CBRN attack.
	Survivability	Inversely, the planner must ensure that CBRN R&S assets are provided the tools and ability to effectively survive. CBRN R&S assets are unique within the operational environment. Their capabilities cannot be easily duplicated or reproduced. Thus, survivability is of key importance when planning CBRN R&S.
Any additional coordinating instructions	Sample evacuation architecture	Sample evacuation is a key element of CBRN R&S. It must be thoroughly planned and executed to be successful. Key components of this plan include escort elements, routes, communications, control and visibility, and designated laboratory facilities.
	TPFDL	A high priority should be given to planning the flow of CBRN R&S assets into the AOR. As forces build up, so must the network of CBRN R&S assets, to conduct health-risk assessment and FHP. This network of CBRN R&S assets not only includes CBRN detectors and samplers, but also the mechanisms needed to affect CBRN R&S (escort, laboratories, CLS).

Legend:

AOR	area of responsibility
C2	command and control
CBRN	chemical, biological, radiological, and nuclear
CCIR	commander's critical information requirement
COA	course of action
FHP	force health protection
FP	force protection
ISR	intelligence, surveillance, and reconnaissance
JEM	Joint Effects Model
JOEF	Joint Operational Effects Federation
NAI	named area of interest
OPLAN	operation plan
OPSEC	operations security
PIR	priority intelligence requirement
PMCS	preventive maintenance checks and services
PMS	planned maintenance system (Navy)
QA/QC	quality assurance/quality control
R&S	reconnaissance and surveillance
TPFDL	time-phased force and deployment list
VA	vulnerability assessment

Service Support

B-42. The service support paragraph of the CBRN R&S plan (table B-5) clarifies the concepts of support, materiel services, medical support, and personnel support.

Table B-5. CBRN R&S planning—service support

Service Support	*Factor*	*Operational Implications*
Support concept	HN support	HN support must be considered when planning CBRN R&S operations. The HN can provide invaluable assistance in characterizing the AOR (developing baseline CBRN background data). It could possibly provide valuable laboratory support and hospital access for mass casualty events.
	CLS	The service support section of the OPLAN/OPORD should indicate key information that includes: • The CLS arrival time. • CLS operating locations. • The CLS support concept. • Restrictions on the use of CLS within the AOR. • Retrograde instructions for CLS line replacement units or supplies.
	Standard military support	Wherever possible, the use of standard military support is encouraged. Many CBRN R&S assets use unique items not normally found using standard military logistics channels. Many such systems are supported by CLS. The planner must be aware that even though a CBRN R&S asset may have CLS available for its unique supply and maintenance requirements, they also require standard military support for all classes of supply and maintenance on common service items.
	Waste	Packaging, transport, and disposal of CBRN sample collection and decontamination waste should be considered and included in the R&S support concept.
Transportation	Transport for CBRN R&S assets	Transportation for CBRN assets must be planned well enough in advance to not hinder operations.
	Transport of samples	Transportation of samples occurs— • From the detection area/location to the sample transfer point or directly to the supporting theater laboratory. • From a sample transfer point to a supporting theater laboratory or back to CONUS. • From a supporting theater laboratory back to CONUS. The plan must address what assets will be required to make the transport happen. Time plays a critical factor in transporting samples. Samples can be perishable and will lose their efficacy over time. Also, the longer it takes to accurately identify the CBRN agent, the more casualties should be expected.
	Transport of CLS	Movement of CBRN R&S assets may be complicated by the requirement for their maintenance and support sections (often times CLS) to move parts and personnel within the AOR and back to CONUS.

Table B-5. CBRN R&S planning—service support (continued)

Service Support	*Factor*	*Operational Implications*
Materiel services	Quality management, QA, and QC • Tracking sample information • Coordination • Shelf life of supplies • PMCS/PMS • Cost of consumables • Safety	The effectiveness of CBRN R&S operations greatly rests on how QA and QC checks are accomplished. Establishing a chain of custody from the theater of operation sample takers to the sample evaluators and to the archives requires a comprehensive understanding of the end-to-end sample flow, including intermediate custodians and their ability to execute their portion of the chain without compromising sample integrity. QA and QC must be maintained to track sensitive limited shelf life items such as handheld assays. The quality of the maintenance and storage of certain items affects the quality and effectiveness of CBRN R&S operations. Safety must be addressed during all aspects of CBRN R&S. The collection, transport, and analysis of potentially dangerous CBRN agents must always be conducted with the utmost care. Deliberate planning and precise execution of developed plans should provide the framework for safe and effective operations. The cost of consumables must always be deliberately planned. Heightened threat levels will cause a higher rate of consumption of resources. For example, sample collection intervals during these higher threat levels can impact on national/wholesale supply systems.
Laboratory support	Laboratory support	Laboratory support for CBRN R&S must be identified and defined in the plan. Understanding the capabilities of the supporting theater laboratories is of key importance. The planner must understand the number of samples expected to be produced and sent to the laboratory, the surge capabilities of the laboratory, and the expected turnaround time for the analysis of the suspected CBRN samples. If the supporting laboratory cannot process the expected volume of samples, an alternate COA must be developed quickly to ensure timely confirmatory identification. These alternate COAs could include the use of HN laboratories, requests for and augmentation of laboratory capabilities, or prioritization of samples. Laboratory considerations need to be made for clinical and environmental samples.
Personnel service support	Personnel assignments	Many CBRN detectors do not specifically come with dedicated operators. As such, operators must be identified. These operators can be regularly assigned personnel, augmentation personnel, or contracted personnel.
	Personnel training	The planner must ensure that personnel identified to operate CBRN detectors are properly trained not only on the operation of their systems, but on other tasks (packaging samples, reporting, supply, and maintenance procedures).

Table B-5. CBRN R&S planning—service support (continued)

Legend:	
AOR	area of responsibility
CBRN	chemical, biological, radiological, and nuclear
CLS	combat lifesaver
COA	course of action
CONUS	continental United States
HN	host nation
OPLAN	operation plan
OPORD	operation order
PMCS	preventive maintenance checks and services
PMS	planned maintenance system (Navy)
QA	quality assurance
QC	quality control
R&S	reconnaissance and surveillance

Command and Signal

B-43. Table B-6 identifies the chain of command and its location and provides signal operating instructions, required reports and formats, and times the reports are to be submitted.

Table B-6. CBRN R&S planning—command and signal

Command and Signal	*Factor*	*Operational Implications*
Command	Who makes decisions regarding— • Prophylaxis • Protection • Warning	The plan must identify the person that will make decisions concerning prophylaxis, protection, and warning. The plan must be clear and concise and leave no doubt which level of command will make each specific decision. When this decisionmaking is delegated to subordinate commanders, a clear understanding of the process of reporting changes in prophylaxis, protection, and warning must exist.
Signal	Communications support architecture	The plan must include communications support architecture. This architecture will include how communications will occur among— • The CBRN R&S asset. • Supporting laboratories. • Sample escort assets. • Mission command/C2.
	Reachback capability	Reachback assets should be provided in the plan, and information on how to communicate with reachback assets.
	Reports	Required CBRN-surveillance reports should be identified, along with instructions on how and when they are to be submitted.
Legend:		
C2	command and control	
CBRN	chemical, biological, radiological, and nuclear	
R&S	reconnaissance and surveillance	

B-44. Planning CBRN R&S operations includes the integration of METT-TC/METT-T considerations and CBRN R&S assets. This integration provides the commander with the ability to protect the force while efficiently executing his assigned missions. Example employment planning considers the following factors:

- **Mission.** The CBRN staff receives mission guidance to provide maneuver forces and critical fixed-site assets with CBRN-surveillance support.
- **Enemy.** The IPOE/IPB indicates that the adversary has CBRN agents and line- and point-source delivery systems.
- **Terrain and weather.** The terrain is relatively flat and dusty (an arid environment), and the wind speed and direction favor threat use of agents.
- **Time.** Based on the time required for field confirmatory identification, postattack medical prophylaxis is a viable option for the protection of U.S. forces.
- **Troops available.** Joint task force assets include multi-Service CBRN R&S capabilities.

B-45. The commander integrates the CBRN R&S assets into the command overall CBRN R&S plan to support the command maneuver forces and fixed sites.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE PLANNING

B-46. CBRN reconnaissance includes actions that confirm or deny the presence of CBRN contamination and associated hazards. The goal of CBRN reconnaissance is to produce information that allows commanders to assess the impact of contaminated areas on their scheme of maneuver, and support force and health protection decisions. It can also provide a means for the commander to evaluate the adversary's CBRN capabilities. Reporting and developing the situation accurately and rapidly allow commanders to make informed decisions on current and future operations.

B-47. CBRN reconnaissance planning follows the MDMP/MCPP, with increased emphasis on IPOE/IPB and the development of PIR. The CBRN reconnaissance plan provides guidance by assigning missions and priorities to answer the commander's PIR. The IPOE/IPB and PIR determine what the commander wants or needs to know about the adversary (to include CBRN capabilities), the adversary's purpose, and terrain and weather considerations.

B-48. CBRN reconnaissance planning concentrates on the capabilities of organic, supporting, and adjacent units. It also focuses on the size and location of the operational area. The following must be considered:

- Before executing a CBRN reconnaissance operation, command guidance should include:
  - Boundary of the route, area, or zone to be reconnoitered. The boundaries represent the limit of possible contamination to unprotected personnel and serve as the point for donning IPE/PPE and monitoring devices. Without a defined boundary, the CBRN reconnaissance mission may be too large to execute.
  - IPE/PPE level and dosimetry required.
  - Turn-back dose rate and OEG.
  - Location and nature of medical support available.
  - Mission command/C2 relationships.
  - Communication protocols.
- Planning for a CBRN reconnaissance operation should include considerations for determining the appropriate level of IPE/PPE. The levels of IPE/PPE discussed are defined in the *MultiService Tactics, Techniques, and Procedures for Nuclear, Biological, and Chemical (NBC) Protection*. The decision to assume different levels of protection during a CBRN R&S mission can be based on many factors, such as threat, temperature, hydration, and mission requirements. The goal of choosing the right IPE/PPE is to balance protection requirements with necessary mission performance requirements. There must always be a risk/benefit analysis, made with consideration of regulations and policy, when selecting the equipment to be worn. Some consideration for selecting the proper IPE/PPE are:
  - Selection of the appropriate IPE/PPE is a complex process which should take into consideration a variety of factors. Key factors involved in this process are identification of the hazards, or suspected hazards; their routes of entry (inhalation, skin absorption, ingestion, and eye contact); and the capability of IPE/PPE to provide a barrier against these hazards. The amount of protection provided by IPE/PPE is material-hazard specific. That is,

protective equipment materials will protect well against some hazardous substances and poorly, or not at all, against others. In many instances, protective equipment materials cannot be found which will provide continuous protection from the particular hazardous substance. In these cases, the breakthrough time of the protective material should exceed the work durations. Wearing IPE/PPE can create significant hazards to the user, such as heat stress, physical and psychological stress, impaired vision, constricted mobility, and limited communication capabilities.

- Other factors in this selection process to be considered are matching the IPE/PPE to the user's work requirements and task-specific conditions. The durability of IPE/PPE materials, such as tear strength and seam strength, should be considered in relation to the tasks to be performed. The effects of IPE/PPE in relation to heat stress and task duration are a factor in selecting and using IPE/PPE. In some cases, layers of IPE/PPE may be necessary to provide sufficient protection, or to protect expensive IPE/PPE inner garments, suits, or equipment.
- The more that is known about the hazards in the area, the easier the job of IPE/PPE selection becomes. As more information about the hazards and conditions at the reconnaissance area becomes available, the area supervisor can make decisions to upgrade or downgrade the level of IPE/PPE.
- Protective headgear is needed where head hazards are present and may need to be secured to the user's head.
- Leather palm gloves will help protect the chemical-resistant gloves from puncture when required to work with or around sharp objects.
- Disposable boot covers will assist with removal of gross contamination prior to decontamination.
- Operations that require entry into confined spaces, such as caves and traversing high terrain, may require the use of a harness. Note that harnesses are not worn over Level A protective suits due to this causing a loss of integrity to the suit material. The preferred level of protection for operations requiring body harnesses is Level B or lower.

B-49. CBRN reconnaissance planning for fixed sites, shipboards, and installations requires the CBRN staff and leaders to develop plans to execute rapid postattack response actions to detect, identify, and/or segregate contaminated resources and areas. CBRN reconnaissance planning considerations include key military aspects, such as maneuver spaces, choke points, natural harbors, anchorages, ports, airfields, and naval bases. Coastal terrain features are also critical factors in planning and conducting CBRN reconnaissance.

B-50. Planning considerations for CBRN reconnaissance operations also include the impact of mounted versus dismounted operations on the current mission. Figure B-7 outlines some considerations when planning for reconnaissance operations.

PLANNING CONSIDERATIONS

B-51. The following are planning considerations:

- Friendly and adversary situations in the area requiring reconnaissance—based on METT-TC/METT-T and intelligence.
- Time constraints affecting reconnaissance operations.
- Level of accuracy required to detect and identify agents.
- Relocation for direct attacks on fixed sites such as airbases, ports, and occupied facilities in the attack areas.
- Split-MOPP operations for fixed sites and installations such as air bases.
- Requests for specialized assets (CBRN reconnaissance teams, chemical-biological incident response forces, hazardous material teams, damage assessment and response teams, and contamination control teams) to verify initial positive indications, identify agents, and survey unmonitored areas.
- Mission command/C2 relationships.
- Communication protocols.

- Additional personnel to provide security for the R&S element.
- Coordination with adjacent and subordinate elements within the operational area.
- Plotting and tracking procedures for surveyed areas to avoid multiple surveys of the same area, route, facility, or NAI.
- Levels of IPE/PPE and dosimetric devices required.
- Turn-back dose and turn-back dose rate for radiological surveys.
- Use of aerial assets for radiological surveys for speed and reduction in radiation exposure.
- Marking procedures (see appendix I).
- Number and types of vehicles to use.
- Logistics and immediate medical support for the R&S element.
- Location of the decontamination site.
- Location and nature of medical support available.
- Actions to take involving casualties from CBRN contamination or hazards.
- Location, quantities, and types of TIMs at storage facilities.
- Transportation routes and means of transportation for TIMs.

B-52. Other reconnaissance planning considerations are the types of reconnaissance and key tasks associated with the mission. Planning considerations for reconnaissance survey and sample collection activities are as follows:

- Determining the overall size, extent, area, and exact boundaries of the actual contamination or hazard.
- Equipping the reconnaissance team with the right equipment to conduct the operation.
- Using trained personnel to execute accurate detection and identification.
- Obtaining a complete or incomplete survey.
- Reporting procedures and procedures to manage and track reports received.
- Selecting personnel trained to collect samples.
- Determining the size of the sample collection team and designating a sample collection team leader.
- Selecting critical areas to collect samples.
- Protecting and ensuring the integrity of the samples to reduce contamination or dilution of evidence.
- Documentation of procedures, including sketches and locations of samples, for prosecution and violations of treaties and agreements.
- Coordination of the sample transfer point.
- Labeling, packaging, and preservation procedures.
- Decontaminating equipment and disposing of decontamination waste.

Note. The most accurate identification can only occur in the laboratory.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR SURVEILLANCE PLANNING

B-53. CBRN surveillance planning supports the commander's CONOPS. The commander's clear, concise statement of where, when, and how he intends to concentrate combat power to accomplish the mission uses CBRN surveillance to maintain the required situational awareness. The commander's concept broadly outlines considerations necessary for developing viable CBRN surveillance. CBRN surveillance is conducted from peacetime to war. The nature of the threat and the technical complexity of conducting and maintaining adequate detection, identification, and warning against a CBRN attack necessitate CBRN defense capabilities and the facilitation of appropriate and prompt medical actions. CBRN detection planning occurs at all levels of operations, from the strategic to the tactical levels, and across the spectrum of military operations. Planning for CBRN detection provides the opportunity for leaders to limit the impact threat CBRN agents have on operations.

B-54. CBRN surveillance planning consists of activities required to monitor aerospace, surface areas, places, persons, or things by visual, electronic, or mechanical means; warn and protect personnel; and treat personnel contaminated with CBRN agents, materials, and associated hazards. CBRN surveillance includes positioning personnel in the adversary's areas of interest to collect information by physical observation of their activities (using human intelligence [HUMINT] or electronics) to mitigate the CBRN affects on friendly forces.

B-55. CBRN detection equipment is integrated into the unit ISR plan. CBRN detection equipment requirements are employed based on an assessment of the adversary's CBRN capability. The commander will prioritize the use of available assets and establish a plan that integrates the use of all available capabilities. The combatant commander's CBRN surveillance plan integrates using the following:

- **Land-force CBRN detection assets.** Land-force CBRN detection assets are employed in arrays designed to optimize the probability of detection consistent with the security requirements. Assets will be located based on METT-TC/METT-T factors, ability of the sensors, and the size of the critical asset to be protected. The CBRN detection assets that comprise the Service-specific CBRN defense architecture will be optimally placed according to system attributes. This will ensure adequate coverage of the node area to be protected so that adequate warning is provided to prevent a large part of the force from becoming incapacitated.
- **Fixed-site CBRN detection assets.** Fixed-site CBRN detection assets are placed on or upwind of a location to provide CBRN detection and confirm or deny the presence of CBRN agents. Fixed-site CBRN operations focus-specified targets including ports, aerial port of debarkation, or SPODs. CBRN detection assets are placed anywhere upwind or within the location to confirm or deny the presence of a CBRN agent. METT-TC/METT-T analysis will determine the number of systems required as point detectors for critical nodes such as logistics bases or major airfields and/or air bases, naval bases, or ports. CBRN detection systems can also be placed on ships for improved operational dispersion. Detectors and collection devices can also be placed inside critical facilities to monitor for CBRN agents.

Note. Detectors may be repositioned according to seasonal wind patterns that would change the physical location of an *upwind* location.

- **CBRN detectors.** CBRN detectors are used to support monitoring operations while ships are underway, in port, or operating close to land masses.

B-56. The CBRN staff recommends the employment of CBRN surveillance assets. Many factors impact employment and the plan may be adjusted based on changes in the weather, threat, and available assets. No employment tactic is 100 percent successful in detecting and identifying all CBRN threats and hazards. For example, an adversary could employ a single point-source CBRN munition without the release being detected by a CBRN detection array. Factors that are considered in the employment of CBRN-surveillance assets include:

- Estimating separation distances between detectors and/or collectors at critical nodes or area arrays.
- Recommending employment tactics for detectors and/or collectors of the array.
- Determine the number of available assets.
- Determine the size of the operational area.

Separation Distances Between Chemical, Biological, Radiological, and Nuclear Detectors and/or Collectors at a Critical Node

B-57. The estimated separation distance between detectors and/or collectors will vary depending on terrain, weather conditions, plume model output, and the performance characteristics of the system; however, the following are suggested separation distances:

- For point vapor or aerosol, the preferred distance between detector and/or collectors is 200 to 400 meters. A 200- to 400-meter separation distance is a general rule of thumb for the approximate cloud radius after agent dissemination.
- For stand-off detection systems with a large field of view and regard, and the ability to overlap observation zones, the distances between detectors and/or collectors may be as far as 800 meters. The actual distance will be determined based on the number of detectors and/or collectors available, their capability, and the area to be covered.

SEPARATION DISTANCES BETWEEN CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR DETECTORS AND/OR COLLECTORS IN AN AREA ARRAY

B-58. Again, taking into consideration the terrain, weather conditions, plume model output, and the performance characteristics of the system, the following are suggested:

- To estimate line source separation distances for CBRN detectors in an area array, consider the size (in width) of the area to be protected, an estimate of the length of the line source, and the number of detectors that should be in the cloud path to support CBRN event-tracking. For example, in the following formula, if the width of the area to be protected equals approximately 60 kilometers, the estimated length of a chemical-biological (CB) line source is 20 kilometers, and the commander determines that he wants two detectors intersecting with the cloud, then a total of seven detectors would be required. The following formula is a generic way to estimate separation distance (divide the number of required detectors into the width of the sector being protected). Each sensor has its own capability and that capability should drive actual separation distances if the number of sensors is available to provide coverage over the intended area.

$$\left(\frac{Width\ of\ sector\ being\ protected}{Estimated\ length\ of\ line\ source} \times Number\ of\ detectors\ intersecting\ with\ the\ cloud\right) + 1 = Number\ of\ detectors\ required$$

$$\left(\frac{60\ kilometers}{20\ kilometers}\right) + 1 = 7\ detectors$$

- Separation between CBRN collectors and/or detectors to protect against a point source release should ensure even spacing across the area to be protected.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR DETECTOR EMPLOYMENT TACTICS

B-59. The CBRN staff will recommend a CBRN detection and collection employment plan. The employment tactic for detectors and collectors will be based on the capabilities and concept of employment for the systems. The specific employment tactics that may be used will vary based on factors such as the following:

- The CBRN risk assessment and IPOE/IPB (delivery system, delivery tactics).
- Terrain and weather conditions.
- The location and size of assigned NAIs.
- The number of detection and/or collection assets that are available/required.
- Distance from objects that may impede air flow.
- Detector height.
- The distance of the alarm from personnel to help ensure that alarms are heard.
- Verification of detection using alternate means or technologies.
- The commander’s guidance.
- The desired confidence level to be achieved from the CBRN detection array.

B-60. CBRN detection array employment tactics include:

- **Dice five.** The dice-five pattern of deployment refers to the deployment of detectors or samplers in the pattern represented for the number 5 on a die. The dice-five array (figure B-5) is well suited for employing a detector or collector on an aerial port of debarkation or SPOD (with one detector for each cardinal direction—north, south, east, and west). Detectors or collectors could be shifted in the event of a detector failure, weather pattern shifts, or other METT-TC/METT-T factors. The dice-five tactic provides the most flexibility and is particularly applicable for support of critical node (fixed site) or area array operations. The dice-five tactic is also adaptable to a varying number of detectors or samplers (such as seven or nine detectors or samplers). This tactic provides depth to an array (if an aerosol cloud misses one detector, another detector deeper in the array should detect the cloud). A dice-five tactic is a preferred tactic because in-depth features should increase the probability of detection.

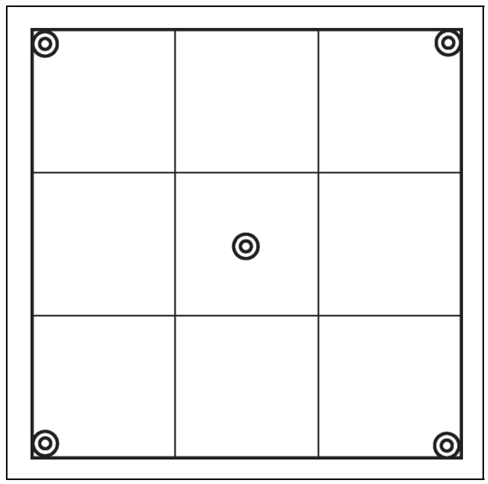

Figure B-5. Dice-five array

- ***Circle.*** Employment of detectors or samplers in a circle configuration provides 360° coverage. This tactic is effective when wind directions are constantly changing. Figure B-6 provides an example of a circle employment of samplers or detectors. The circle tactic is particularly applicable to critical-node operations. However, this tactic could be resource intensive (based on the size of the base) and does not provide the depth of coverage provided by other tactics.

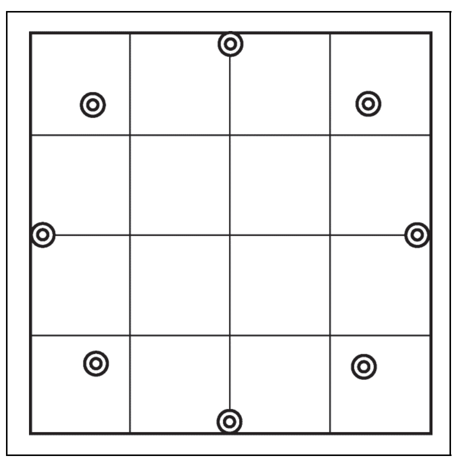

Figure B-6. Circle employment

- ***Picket line.*** The picket line is designed to capture a CB-aerosol attack coming from a specific direction. Ideally, it is placed upwind of friendly positions to capture a line source attack. Figure B-7, page B-30, is an example of a picket line employment of detectors and collectors. The picket line tactic would be particularly applicable for support of a maneuver land force;

however, CBRN detectors may require relocation if the wind direction shifts. This employment tactic provides no depth to the array and has a limited application.

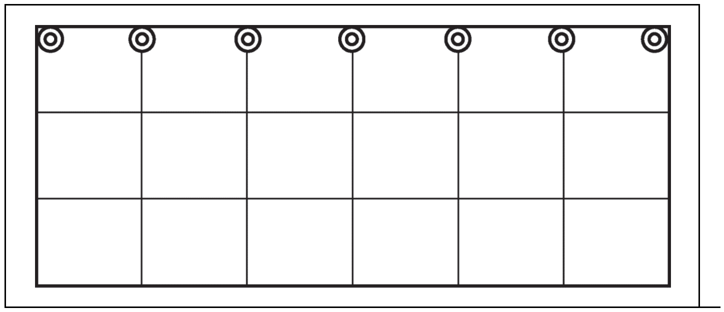

Figure B-7. Picket line employment

- **Semicircle.** The semicircle employment of detectors and samplers provides approximately 180° coverage. It is still directional in that it protects from an upwind line source release, yet gives more coverage than a picket line, and provides for moderate wind direction changes. Figure B-8 provides an example of a semicircle employment of detectors and collectors. The semicircle tactic could be used to support fixed-site or maneuver forces; however, this tactic does not provide detectors in depth.

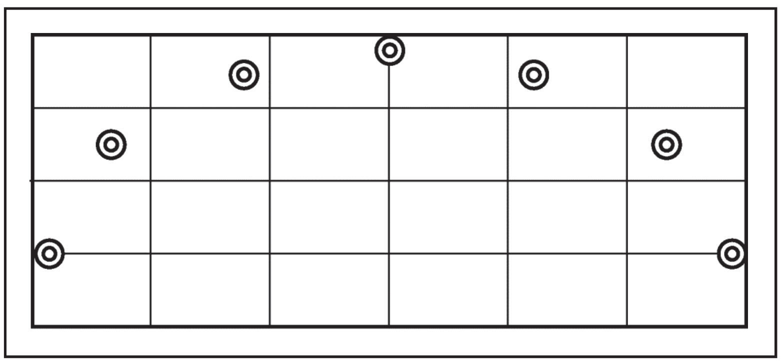

Figure B-8. Semicircle employment

- **Dense picket.** The dense picket employment of detectors and collectors provides higher density coverage against line and point source attacks than the other employment strategies. It is resource intensive and requires large numbers of detectors and sensors. Figure B-9 provides an example of a dense picket employment of detectors and collectors. The dense picket tactic could be used for support of fixed-site or maneuver forces.

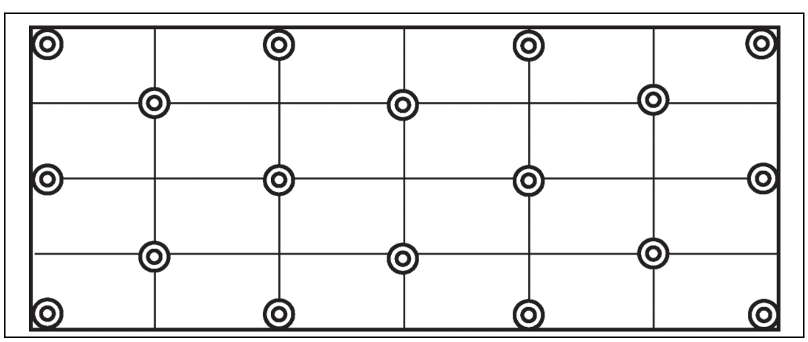

Figure B-9. Dense picket employment

B-61. As a function of CBRN surveillance, area monitoring provides early warning and useful information. The types of area monitoring are—

- **Periodic monitoring.** Periodic monitoring is conducted at defined or predetermined intervals.
- **Continuous monitoring.** Continuous monitoring involves uninterrupted surveillance for CBRN hazards in the area.

B-62. As a function of CBRN surveillance, the following are monitoring techniques:

- **Direct monitoring.** Direct monitoring is the simplest, most precise monitoring technique. Direct monitoring is used to get "eyes on" an area that is selected for surveillance or to get an unshielded (outside) reading. Direct monitoring may be periodic or continuous. Periodic monitoring is favored for accurate readings and detection and limits exposure. Continuous direct monitoring will increase exposure.
- **Indirect monitoring.** Indirect monitoring is used to take readings from inside a shielded location and may be periodic or continuous. Indirect monitoring may compromise the accuracy of readings and detection. Indirect monitoring is preferred when conducting continuous monitoring operations.

B-63. Planning CBRN monitoring activities during surveillance operations includes the following:

- Using the appropriate detector to provide early warning.
- Employing standoff capabilities.
- Planning for upwind, downwind, and crosswind surveillance to maximize the advantages of each.
- Planning additional food and water for the surveillance team.
- Providing relief teams during long-term operations and at fixed-site locations such as naval ports and airbases.
- Ensuring that necessary medical pretreatments, barrier creams, prophylaxes, decontamination kits, waste disposal bags or containers, medical countermeasures, and professional gear are accessible after donning IPE/PPE.
- Establishing mission support sites.
- Maintaining a low signature to avoid detection by the adversary.

B-64. As a compliment to CBRN surveillance, medical surveillance is conducted by medical personnel to establish baseline health conditions and monitor for subsequent deviations. Medical surveillance focuses on ensuring that CBRN detection and collection operational requirements are met. (Refer to *Multiservice Tactics, Techniques, and Procedures for Health Service Support in a Chemical, Biological, Radiological, and Nuclear Environment*.) Planning must include the medical and PVNTMED staff. Critical planning factors must ensure that—

- CBRN detection requirements are resourced (for example, operators are trained and tasked to operate CBRN detection systems).
- Sample collection techniques and procedures are rehearsed and understood.
- A CBRNWRS is established and provides the required reports to higher and adjacent commands.
- The sample evacuation process is rehearsed and understood.
- CBRN detection resources are integrated into CBRN surveillance plans.
- Surveillance for outbreaks of disease is performed on and off the installation to identify a possible biological attack.
- Personnel, food, drinking water, air, the environment, and equipment are monitored for CBRN contamination and the effectiveness of decontamination measures.
- Accurate records are kept to monitor personnel for long-term health problems that could be operationally related.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE AND SURVEILLANCE LOGISTICS SUPPORT AND ENVIRONMENTAL PLANNING

B-65. Planning for logistics support to CBRN R&S includes tailoring, task organizing, reorganizing, consolidating, and echeloning forces and materiel and movement requirements. The following considerations should be addressed:

- Tailoring a general-purpose element to be CBRN R&S capable by adding trained personnel and equipment, which may require more logistics support for the missions.
- Logistics for postmission activities such as decontamination, waste disposal, and recovery.
- Reconstitution operations in preparation for follow-on missions.
- Establishing an OEG managed by the CBRN staff to prevent overexposure to radiation and planning to replace personnel for follow-on missions.

B-66. Understanding CBRN environments will aid in the assessment of critical reconnaissance/survey information. Environmental planning considerations affecting the detection of contamination hazards are soil composition, vegetation, terrain contours, and meteorological conditions.

- Soil composition will influence the detection capabilities of reconnaissance efforts. For example, areas with a large amount of sand will draw certain liquid agents to the subsurface, lowering the quantity of available agent for detection, whereas other certain liquid agents may tend to pool at the surface.
- Vegetated areas facilitate detection by concentrating agents and reducing the effects of weathering.
- Terrain contours influence the flow of agent clouds as they influence airflow. Agent clouds tend to flow over low rolling terrain and down valleys and settle in hollows and depressions. High concentrations are hard to obtain on a crest or the sides of ridges or hills.
- Meteorological conditions influence persistency and hazard area coverage.
  - High wind speeds (more than 10 kilometers per hour) cause rapid dispersion of vapors and aerosols.
  - Higher temperatures increase the rate of evaporation of liquid contamination. While this may aid aerosol detection, it leaves little liquid agent available for detection.
  - Precipitation is extremely effective in washing vapors, aerosols, liquids, and particulate matter from the air, vegetation, and other materials.

TASK ORGANIZATION OF CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE AND SURVEILLANCE CAPABILITIES

B-67. Planning for CBRN R&S operations requires task organization of unit CBRN R&S capabilities (from organic or supporting assets) to provide the commander with critical information that support situational awareness. Task organization of unit CBRN R&S capabilities also consists of designating trained tactical personnel who can provide commanders with a rapid means of locating contamination and identifying and marking hazards in the absence of CBRN personnel who are specifically trained to conduct CBRN R&S operations.

B-68. The commander plans, prepares, executes, and continuously assesses CBRN R&S capabilities to ensure the organized and uninterrupted flow of tactical units throughout the operational area. The objective of a successful CBRN R&S operation is for the unit to arrive at its destination in a condition suitable to its probable employment. The goal of all movement planning is to retain flexibility to execute a variety of plans to meet ever-changing conditions. The commander ensures that his CBRN R&S unit movement SOP contains specifics, and he conducts rehearsals so that personnel and subordinate leaders understand them. The SOP should use a standard task organization to simplify planning, provide flexibility, and allow greater responsiveness.

B-69. A commander bases the exact task organization of CBRN R&S capabilities on the factors of METT-TC/METT-T and his CONOPS for the CBRN R&S mission. The commander task organizes his CBRN R&S capabilities, each with a specific purpose and task. The size of the CBRN R&S task organization is based on the available intelligence about the size of the operational area and type of CBRN hazard. (See *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Aspects of Command and Control* for further discussion on task organizing CBRN assets.)

B-70. The minimum number of personnel in a CBRN R&S element is two. One member maintains a constant watch for hazards, provides security, and calls for assistance if an emergency occurs, while the second member conducts the R&S tasks. There is no maximum number of personnel for a CBRN R&S element; however, the element size should be kept to a minimum to reduce the number of personnel exposed to postattack hazards.

B-71. Task organization drives the command or support relationship decisionmaking process. At each echelon, the commander task organizes his available capabilities to accomplish the mission. The commander’s purpose in task organization is to maximize subordinate commanders’ abilities to generate a combined arms effect consistent with the CONOPS. Commanders and staffs work to ensure the distribution of capabilities to the appropriate components of the force to weight the decisive operation.

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Appendix C
Preparation

This appendix provides preparation considerations for CBRN elements prior to conducting CBRN R&S missions. This appendix provides preparation considerations for CBRN reconnaissance and CBRN surveillance.

ACTIVITIES

C-1. CBRN R&S preparation activities include time to conduct PCC, inspections, and rehearsals; incorporate security measures for the operations; conduct leader's reconnaissance when feasible; and conduct movement and coordination for additional support. CBRN R&S preparation plans are established to help reduce the exposure of the CBRN R&S elements to a CBRN incident and to mitigate the effects of an incident on operations should it occur. During the CBRN R&S preparation activities, CBRN personnel systematically initiate vulnerability reduction measures that have been incorporated into their latest CBRN R&S plan. CBRN R&S activities are conducted to support the commander's decisions on how to employ and protect combat power against the adversary.

C-2. The level of difficulty and detail required to accomplish the R&S mission directly relate to the intensity of preparation. For example, positive responses to the following questions would likely increase the level of preparation and should be provided to the CBRN element leader:

- Is there a storage facility?
- Are there munitions in the building?
- Are they CBRN munitions?
- What agent is in the CBRN munitions?
- Has a threat assessment been conducted?

C-3. During CBRN R&S preparation, the commander and staff monitor preparation activities and track the higher and adjacent organizational situations, placing emphasis on the adversary situation. The commander and staff refine plans based on additional reconnaissance and updated intelligence information. The staff continues to disseminate these modifications directly to the CBRN R&S teams throughout the preparation phase. Preparations focus on planning those additional ISR operations required to answer the CCIR, refining the plan, increasing coordination and synchronization, and conducting shaping actions within the force's capability and operations security guidelines.

C-4. Preparation begins when the WARNORD is received. The CBRN R&S element leader provides the WARNORD or movement order to the R&S element and directs the initiation of preoperational checks. Following the preparation of the WARNORD, many key factors are verified or researched. These factors could include planning estimates for the potential size and area/location of the suspected CBRN hazard areas that must be surveyed and evaluated. War-gaming provides estimated downwind distances for CBRN threats/hazards. This premission planning is conducted in coordination with the intelligence section and is used to help determine the task organization and locations for CBRN R&S missions. During the final preparation activities, CBRN R&S teams consider and confirm what tactics will be used for the missions.

C-5. Because CBRN R&S planning and preparations activities overlap, the CBRN R&S element leader briefs the OPORD and/or FRAGORD to the CBRN R&S element. The R&S element OPORD and/or FRAGORD are oral or written. They outline important elements that include routes to and from the CBRN R&S mission (normally two entry and exit routes will be planned).

C-6. If the CBRN R&S element is not collocated at the supporting area of operation, the CBRN R&S element moves to the designated staging area. Movement is reported according to the OPORD or SOP. On arrival, the CBRN R&S element completes preparation of the appropriate equipment, conducts PCCs/PCIs on the expected system to be used, and conducts PMCS on the equipment according to the appropriate technical manual. During the final CBRN R&S mission preparation, the CBRN R&S element follows the action lists found in figures.

C-7. CBRN R&S preparation includes planning for security when selecting areas/locations for CBRN detection devices. This reduces the possibility that preselected and routinely checked sites could be mined or that teams could be targeted for ambush during routine operations. As a general rule, do not conduct CBRN R&S operations outside established perimeters unless they are coordinated with and approved by security forces. The commander ensures close coordination among his subordinates. During the preparation phase, the commander can take CBRN R&S element leaders to a vantage point in the main battle area to rehearse the battle and plan coordination among their units, if such a site is available. This helps the commander in transmitting his intent and in establishing common control measures for subordinate units.

C-8. Night movements require special preparation because not all personnel may have night-vision devices. These special preparations include marking vehicles and equipment for easy identification by friendly forces and repositioning vehicles and personnel closer together so they can detect each other's movement.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE AND SURVEILLANCE PREPARATION CONSIDERATIONS

C-9. CBRN R&S requires specific considerations to successfully prepare for a mission. Conducting PCCs/PCIs, rehearsals, leader's reconnaissance, coordination, movement, and coordination for additional support will ensure that a CBRN R&S element is prepared for its CBRN reconnaissance or surveillance missions.

PRECOMBAT CHECKS/PRECOMBAT INSPECTIONS

C-10. The CBRN R&S elements will conduct thorough PCC/PCI of R&S element and personal equipment. Any detection equipment that requires periodic field calibration will be serviced and calibrated prior to departure from the staging base. All R&S element PPE and dosimetry devices will be inspected and readied for operation.

REHEARSALS

C-11. When time and the situation do not permit actual training in the operational area, the CBRN R&S element replicates the conditions of the operational area as much as possible. The CBRN R&S element will rehearse the mission using a map or terrain board. The CBRN R&S element conducts rehearsals that will allow element members to adjust to the actual mission to identify and correct shortfalls that may occur during the operation. They incorporate security and additional support so that their role will not interfere with the mission. It is critical that the R&S element rehearse their actions from departure, to arrival at the area/location, until the mission is complete. Emphasis should be placed on executing contingencies (man down, adversary contact, communications loss, equipment failures). If used, replacement elements need to rehearse with the primary CBRN R&S element when operations exceed long periods, such as, two weeks. Conduct the rehearsal and prioritize tasks/events.

- Conduct combined arms rehearsals.
- Develop or refine a detailed standard operating procedure.
- Tie mission orders to a purpose or intent.
- Establish high standards so that they are met.
- Provide feedback to the commander/unit leader.

LEADER'S RECONNAISSANCE

C-12. If possible, the CBRN R&S element leader and assistant R&S element leader will conduct a leader's reconnaissance of the target area so that they are at the proper location. When performing a leader's reconnaissance, personnel should ensure that they have alarming radiation dosimeters or radiation detection, indication, and computation (RADIAC) meters with them so that no undetected radiation threats/hazards exist. The following steps are for performing leader's reconnaissance:

- **Step 1.** Pinpoint the objective. If possible, accomplish this by checking terrain features in the area, not by directly approaching the objective.
- **Step 2.** Locate observation or surveillance positions, routes, and security positions.
- **Step 3.** Locate positions to emplace standoff capabilities that can be observed from a distance.
- **Step 4.** Determine or confirm the adversary situation in the objective area, locate adversary observation posts (OPs), determine adversary security status and activity, and adapt the patrol to the local sounds in the area.
- **Step 5.** Designate the release point and the positions for the reconnaissance, control, and security elements.

Note. Ideally, at least two CBRN R&S element members are left behind to keep watch on the objective from the time that the leader's reconnaissance ends until the remaining R&S element deploys. However, because of the limited density of CBRN assets and the fact that most leaders' reconnaissance efforts will be conducted using maps and any supported imagery, leaving two members of the R&S element will not likely be possible.

COORDINATION

C-13. The CBRN R&S element leader, with support from the higher headquarters if needed, must make coordination with all supporting elements (for example, decontamination and medical support). In most cases, direct liaison should be authorized between the supporting units and the unit supported. For those elements supporting the R&S element during the execution of the mission, a linkup point and time should be coordinated and verified by all leaders. Linkup information must be provided (for example, frequencies, call signs, and communications security [COMSEC] codes). Rehearsals with these elements are crucial to success. Decontamination teams must review and rehearse how to decontaminate the specific R&S equipment, sample transfer should be rehearsed to ensure the safety and integrity of the chain of custody, and security elements must practice how they will be incorporated into the maneuver of the CBRN R&S operation.

C-14. Coordination actions including the following:

- Intelligence exchange.
- Standard operating procedures.
- Frequencies.
- Call signs.
- Visual signals.
- Priorities of protection.
- Linkup time and place.
- March order.
- Logistic support requirements.
- Command relationships.
- Risk assessment.
- Personal protective equipment and dosimetry device selection.
- Personal protective equipment and dosimetry device checks completed.
- Practice runs through decontamination line.
- Instruments calibrated.
- Sample management plan.
- Communications check.

- Required forms.
- Contaminated materials disposal.
- Convoy operations.
- Security.
- Medical support.
- Linkup unit location and date-time group.
- Decontamination support.
- Logistics support (all classes of supply).
- Maintenance.
- Supported and supporting units.

MOVEMENT

C-15. Preparation for movement requires the CBRN R&S element leader or the leader responsible for the movement to establish control measures from the assembly area to the reconnaissance area and follow-on orders upon completion. The following movement measures are not limiting but must be considered:

- Map of route, including graphic control measures (routes that provide the greatest cover and concealment to reduce vulnerability).
- Tactical march technique (open column, close column).
- Movement formation (wedge, column, echelon left).
- Movement technique (traveling, traveling overwatch, bounding overwatch).
- Established checkpoints; release points.
- Forward passage of lines (friendly).
- Rearward passage of lines (friendly).
- Bypass criteria (adversary).
- Defensive actions.

RECEIVE THE MISSION

C-16. The following are part of receiving the mission:

- The team leader conducts mission analysis with R&S element, including—
  - Analyzing current intelligence products.
  - Submitting requests for information.
  - Determining initial routes into areas/locations.
  - Identifying first dismount and observation points on a map.
  - Integrating security elements.
  - Integrating other elements into planning (explosive ordnance disposal, medical, and other personnel).
  - Preparing an OPORD.
- The R&S element leader briefs the commander on the mission plan (OPORD format).
- The R&S element develops load plans based on the number of personnel and equipment.
- The R&S element conducts precombat inspection of equipment.
- The R&S element conducts rehearsals.
- Entry procedures.
- Decontamination line procedures.
- Emergency action procedures.
- Reactions on contact.
- Movement rehearsal.
- Mission rehearsal with each R&S element member back-briefing his duties and responsibilities.

COORDINATION FOR ADDITIONAL SUPPORT

C-17. Based on METT-TC/METT-T considerations, the R&S element may require additional support to complete the assigned reconnaissance mission. Types of additional support the R&S element could require include—

- Security.
- Dosimetry devices.
- Force health protection.
- Decontamination.
- Sample transfer and evacuation.
- Logistics. (Logistics includes food, water, fuel, ammunition, and equipment needed to detect and identify CBRN threats/hazards, and equipment for waste disposal. Commanders should account for follow-on missions such as surveys and provide logistics support during extended operations.)

FORCE PROTECTION/FORCE HEALTH PROTECTION PREPARATION

C-18. CBRN force protection/FHP preparation includes the command and staff assessment of CBRN threats/hazards. In response to a CBRN hazard, the applicable OPLAN and/or OPORD outlines the priorities of effort and trigger events (decision points) that will result in a response that includes CBRN defense countermeasures. Preparations to conduct CBRN force protection/FHP include activities to:

- **Warn.** The decision to warn, if applicable, is based on the assumption that there is a threat of an upwind aerosol cloud moving toward the warned forces. It can also be a notification or warning that exposure may have already occurred. A notification or warning should include protection guidance and/or treatment to ensure a consistent, effective response.
- **Protect.** The decision to assume a protective posture, if applicable, must take force capabilities and vulnerabilities into account. Implemented control measures could include using available protective equipment, conducting detection and identification of biological agents, and assessing unit vulnerability to a suspected agent (vaccinated or unvaccinated forces).
- **Treat.** Treat the following:
  - **Chemical.** For chemical agent exposures, the decision to administer postexposure treatment is made by the commander, with the advice/recommendation of the command surgeon.
  - **Biological.** For biological agent exposures, the decision to administer postexposure treatment is made after there is evidence of likely exposure to a biological agent. The commander makes the decision with advice from the command surgeon and supporting input from the CBRN officer and intelligence staff. The command surgeon will recommend the appropriate prophylaxis or treatment regimen.
  - **Radiological.** For radiological exposures, the decision to administer postexposure treatment is made by medical personnel**.**
- **Conduct prophylaxis and treatment.** Prophylaxis is preventive action taken before infection or exposure. Treatment is the care of personnel after they have been exposed to a CBRN agent. For some biological agents, there is a window of opportunity between infection and the onset of symptoms where medical treatments are particularly effective. Medical treatments that are initiated outside the window of opportunity are less effective. Therefore, it is critical to ascertain which agents were used in the attack and when the attack occurred to mitigate the effects. Some prophylaxis and treatment preparation actions are:
  - Prepare for any unusual occurrence of simultaneous cases of illness with similar presenting symptoms, especially in regions with a higher likelihood of biological attack.
  - Prepare to initiate protective measures, such as vaccines or antibiotics, for those who are exposed but not yet sick.
  - Prepare to document the affected population, possible routes of exposure, and signs and symptoms of disease.

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Appendix D

Mounted Chemical, Biological, Radiological, and Nuclear Reconnaissance and Surveillance

This appendix provides mounted CBRN R&S TTP. Mounted CBRN R&S provides speed and added protection to CBRN R&S elements when conducting their mission. This appendix provides guidance on mounted CBRN R&S techniques for leaders and personnel who are conducting missions. Mounted CBRN R&S enables tactical forces to conduct missions, while mitigating the effects of CBRN threats/hazards on personnel who are executing the mission. Military vehicles provide some shielding from radiological and nuclear hazards while those with collective protection may protect against certain chemical and biological hazards and allow forces to move on avenues along unrestricted or restricted terrain at a faster pace than if conducted dismounted. Even though personnel may be mounted when entering areas that contain CBRN hazards during CBRN R&S operations, it may be necessary for them to dismount to conduct a survey of an area or move to surveillance positions in areas not accessible to vehicles.

ADVANTAGES AND DISADVANTAGES

D-1. Mounted CBRN reconnaissance provides advantages and disadvantages. Speed and momentum are typically critical to the successful execution of operations that the CBRN reconnaissance mission may support. Commanders decide when to use mounted reconnaissance over dismounted operations based upon task-organized assets.

D-2. A key factor in mounted CBRN reconnaissance execution is the time available to conduct the reconnaissance mission. The commander must recognize that there is increased risk to the R&S element and the main body when the pace of the reconnaissance is accelerated. This risk can be somewhat offset by employing air reconnaissance and technical means to cover open terrain or areas of lower threat.

D-3. The following are advantages of mounted CBRN R&S:

- When time is limited, conducting the reconnaissance mission mounted without exiting the vehicle provides the commander faster feedback and the capability to cover large areas.
- Vehicles provide the R&S element additional protection from CBRN and conventional hazards. These advantages depend on the specific vehicle employed. Reconnaissance vehicles can include the following:
  - Armor protection.
  - Enhanced navigation and communications capability.
  - Enhanced optics.
  - Limited firepower.
  - Collective protection.
  - Meteorological data.
  - Amphibious capability.
  - Remaining mounted allows the R&S element to conduct detailed CBRN reconnaissance while maintaining the speed and momentum required for the CBRN reconnaissance operation.
  - Increased mobility in open terrain.

D-4. The following are advantages of CBRN R&S:

- Loss of stealth due to the visual, noise, and thermal signatures of vehicles.
- Loss of accuracy to pinpoint actual contamination.
- Higher probability of false positives.
- Higher probability of false negatives.
- Decontamination requirements for personnel and vehicles.
- Increased decontamination and disposal requirements.
- CBRN reconnaissance vehicles are often not equipped with dismounted reconnaissance capabilities for buildings or other places not accessible by vehicles.

PLANNING

D-5. Planning for CBRN R&S operations has been discussed previously in chapter 2 and appendix B. There are key planning factors that must be considered when planning for mounted CBRN reconnaissance.

UNDERSTANDING THE MISSION

D-6. When given the mission, it is imperative that the CBRN R&S element fully understands the mission and the tasks associated with it. Many times a single word in a mission statement implies very complex TTP. Words such as *confirm or deny* can be insignificant compared to words such as "exploit" and *characterize*. A thorough task analysis is imperative when planning mounted CBRN R&S operations.

PRIORITY INTELLIGENCE REQUIREMENTS

D-7. The CBRN R&S element must understand what information is important to the commander. Although most information has value to someone, the CBRN R&S element must key in on the information the commander has deemed priority. For instance, a mounted CBRN R&S element could be sent along a MSR on a route reconnaissance mission using a lane technique in order to determine if an adversary has contaminated a critical logistics asset.

D-8. The commander provides success criteria for each mission in terms of measures of performance (MOP). Success can be gauged using MOP at the tactical level. MOP are used to assess friendly actions that are tied to measuring task accomplishment. A CBRN reconnaissance mission can be considered successful when the CBRN R&S element reports what it has found prior to the LTIOV. If required to provide samples as a measure of performance, success can be when the CBRN R&S element successfully transfers its samples to a receiving party (for example, TE, laboratory, or courier).

PREPARING

D-9. Preparation for CBRN R&S missions has been covered in chapter 3 and appendix C. Key factors when preparing for a mounted CBRN mission are discussed in the following paragraphs.

COORDINATION

D-10. Coordination with other elements is paramount to making the mission successful. Capabilities such as security, decontamination, sample transfer and transport, and communications can all play an important role in the success of a mounted CBRN reconnaissance mission success. Coordinate for contingencies such as encountering adversaries, encountering hazards such as IEDs, and medical evacuation. See chapter 3 for further discussion on coordination and preparation activities.

EQUIPMENT PREPARATION

D-11. Effective identification of key equipment to perform the mounted CBRN reconnaissance mission is critical to the success of the CBRN R&S operation. Taking the wrong equipment, not preparing equipment properly (for example, performing PMCS on CBRN R&S platforms), insufficient protective equipment, and inappropriate sample collection equipment are examples of things that can cause a CBRN mission to fail.

D-12. Determining if a CBRN R&S element is prepared for its mission is a commander's decision and is based on his level of acceptable risk. Very rarely is an element 100 percent prepared for every aspect of a mission. As long as any perceived risks that exist are acceptable to the commander, then the mission should be executed. (Refer to chapter 3.)

EXECUTING

D-13. Executing mounted CBRN R&S operations should be conducted in a deliberate and controlled manner to ensure safety and success of the mission. Table D-1 provides an example of some procedures associated with executing mounted CBRN R&S operations. These steps are divided into phases for ease in understanding and, eventually, execution.

Note. Not all of the steps and supporting tasks in table D-1 are required in support of CBRN R&S procedures.

Table D-1. Sample mounted CBRN R&S procedures

Step	*Supporting tasks*
Occupy assembly area in vicinity of target area	• Determine IPE/PPE decision. • Conduct leader's reconnaissance. • Establish mission command/command and control. • Set up technical decontamination station.
Conduct sample collection (if required)	• Revise sample management plan. • Perform sample collection operations. • Collect items of intelligence value. • Perform analysis.
Clear area	• Perform decontamination. • Make initial report. • Coordinate with area security force.
Move to operating base	• Conduct movement (ground or air).
Conduct recovery	• Transfer samples and material if collected. • Perform postoperational checks and services. • Conduct further decontamination if necessary. • Submit completed reports.
Legend: IPE individual protective equipment PPE personal protective equipment	

OCCUPY AN ASSEMBLY AREA IN THE VICINITY OF THE RECONNAISSANCE AND SURVEILLANCE MISSION

D-14. A CBRN R&S element should approach a CBRN survey area from upwind. The element will stop prior to actually entering the suspect area or point to set up its operations. The distance from the actual reconnaissance site is determined by various factors such as, local weather data/conditions and geography (altitude), terrain, suspected agent, and security concerns. Guidance may be given by the higher command, but normally this distance is in element SOPs and may be based on standoff distance provided in the Department of Transportation (DOT), *Emergency Response Guidebook,* 2008, or other such documents.

D-15. The CBRN R&S element leader and assistant element leader will conduct a leader's reconnaissance and initial assessment of the area, identify the location of security forces (if required), and acquire overall situational awareness. This is conducted from the operational area to help develop the plan before the initial survey. Details include identify a potentially safe route and describe the area (obstacles, types of containers, azimuths (including area location), and potential hazards) with photographs, sketches, and distances. The command post (CP) location will also serve as the element staging area. The CBRN R&S element leader will also designate general area for the decontamination station, entry and exit locations, and select one or more rally points.

D-16. Once mission command/C2 is established and all the steps and tasks in table D-1, page D-3, have been accomplished to occupy the assembly area, the mission command/C2 element—

- Obtains information relating to the area and weather conditions.
- Prepares a downwind hazard plot using DOT, *Emergency Response Guidebook,* 2008, or another method.
- Establishes staging areas upon approach (upwind and upgrade whenever possible) for arriving personnel.
- Designates a tactical radio frequency to be used.
- Establishes CP location upwind/upgrade and at a safe distance from the area in a place away from direct involvement with casualties and personnel.
- Identifies the location of CP and staging areas for follow-on units.
- Initiates accountability system for all involved. (May need to assign an accountability officer.)
- Coordinates with security.
- Ensures security sweeps the area for secondary devices at the CP and staging areas.
- Establishes minimum protective posture for all personnel in the area.
- Formulates plan and disseminates to all sectors.
- Establishes and maintains direct communications with all elements such as, decontamination element, sample collection element, security element, and others as necessary.
- Determines protective action distances if required.
- Has common radio channels/frequencies assigned to sectors to improve operational control and efficiency.
- Establishes contaminated waste area.
- Makes arrangements for replacement of contaminated protective clothing.
- Schedules periodic situation briefings.
- Reviews and reevaluates personal protective levels.
- Maintains a log of incident operations.
- Establishes personnel accountability.
- Initiates air monitoring.
- Notifies the local/HN authorities of the protective action distances that extend into civilian sectors if required.
- Establishes water supply, hose lines, and suppression as appropriate.
- Notifies supporting medical personnel of the potential for receiving CBRN casualties.
- Monitors (controls, if possible) water runoff.
- Issues access credentials if needed.

CONDUCT INITIAL AREA SURVEY

D-17. It is critical to survey the overall area since intelligence analysis and information reporting only provides an idea of what the target is and its composition. No intelligence is 100 percent accurate and conducting an overall initial area survey will provide the R&S element an understanding of the current status of the area.

D-18. The key tasks accomplished during the initial area survey are listed below in priority order:

- Determine radiological levels.
- Determine and revaluate the appropriate IPE/PPE.
- Reevaluate protective posture for R&S element.
- Determine the priority of effort.

- Prepare an area sketch to include determining the Global Positioning System (GPS) coordinates and other location identifying information (for example, street addresses).

D-19. The initial area survey could be a relatively rapid task or a more prolonged task, depending on the size and complexity of the area. Decisions can be made regarding the appropriate level of IPE/PPE for follow-on R&S elements collecting samples or conducting presumptive or field confirmatory identification. During initial survey observations—

- Look for anything obvious while securing and during initial survey of area.
- Determine if CBRN agents are being produced, stored, or weaponized in the area.
- Be alert for booby traps/IEDs.
- Note instrument readings and/or detections.

D-20. When a suspicious item is encountered, the entry R&S element must first assess the "big picture," look for all hazards before proceeding, document its location and the surrounding area, and finally, determine if it is an item of interest. Is this item CBRN-related and was it expected or not? If it is not CBRN, is it hazardous and does it pose a threat?

D-21. When approaching the item of interest—

- Photograph/document the undisturbed item.
- Determine if the item recognizable?
- Move toward the item.
- Watch for dangers.
- Record all actions with the item.
- Initiate detection procedures.

D-22. If possible, the survey R&S element should sketch out the structure as they move through it. This may be difficult given a complex structure, but it will allow the R&S element to better document their findings and develop the sample management plan. It also provides better clarity to those reading the assessment report.

Sample Management Plan

D-23. The development of a sample management plan is discussed in appendix H.

Sample Collection

D-24. Sample collection TTP are discussed in appendix H.

Exit Procedures/Decontamination

D-25. Prior to exiting the area, the CBRN R&S element must communicate ahead so that the decontamination personnel are prepared to receive them.

D-26. The method of decontamination is determined based on the time available, threat level, and IPE/PPE worn. As a minimum, decontamination of boots/footgear is necessary for all personnel and equipment.

D-27. If the situation is permissive and the CBRN R&S element is supported by a decontamination unit, a thorough decontamination operation should be undertaken. This will limit the possible spread of contamination and negate the need for further decontamination operations. See *MultiService Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Decontamination* for more information.

Packaging/Documentation/Transport

D-28. Sample packaging, documentation, and transport are discussed in appendix G.

REPORTING

D-29. Reporting should normally occur as a two-part process:

- **Initial assessment report.** The first report of the initial findings will occur upon completion of the mission or upon identification of PIR. Reporting of an identified PIR will occur immediately when found.
- **Suspect area survey report.** The final postmission report will be delivered to the higher headquarters, normally within 48 hours unless otherwise specified in the order, SOPs, or command guidance. The report format can be found in appendix H.

MOUNTED CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE OPERATIONS

D-30. Mounted CBRN reconnaissance provides the tactical commander the ability to use speed when time is critical. The key tasks for mounted CBRN reconnaissance are detect, locate, identify, quantify, collect samples, survey, mark, and report. (Detailed information on sample collection is located in appendix G, reporting in appendix H, and marking in appendix I.) The commander considers the factors of METT-TC/METT-T to determine whether to conduct mounted reconnaissance. A mounted reconnaissance is conducted when—

- Time constraints based on METT-TC/METT-T.
- Detailed reconnaissance is not required (for example, complete survey).
- Air units are available to perform coordinated reconnaissance with the ground assets.
- The IPOE/IPB process has provided detailed information on the adversary.
- Terrain is relatively open (for example, roadways or axis is capable of sustaining type and weight of vehicle used for the reconnaissance).
- Environmental conditions permit this type of reconnaissance (deep snow and muddy terrain greatly hinder mounted reconnaissance).
- Dismounted reconnaissance cannot complete the mission within existing time constraints, and a mounted reconnaissance can.
- Mounted reconnaissance, with built-in collective protection, provides a degree of protection to reconnaissance personnel not afforded by dismounted reconnaissance.

D-31. During mounted reconnaissance operations, the commander may direct a CBRN R&S element to conduct a route, zone, or area reconnaissance mission. Time is the critical factor for the mission; however, mounted operations reduce the time and mitigate the effects of CBRN hazards. Mounted reconnaissance generally requires more decontamination assets than dismounted reconnaissance to accomplish operational decontamination. Decontamination can be a resource intensive operation and is typically conducted in a permissive environment. The aim is to gather information on the actual extent of the contamination to aid commanders in their decisions and to prevent U.S. and allied forces from unknowingly entering the contaminated area. Surveys require applied judgment based on METT-TC/METT-T. The mission, the terrain, and the adversary dictate which survey technique should be used. The detection equipment used to conduct surveys varies based on the situation and the threat. Equipment and system operating instructions are found in applicable operator and crew service and technical publications. A complete survey occurs when the entire extent of the contamination has been identified. An incomplete survey occurs when the entire extent of the contamination has not been identified, such as when a survey to find a bypass route is conducted.

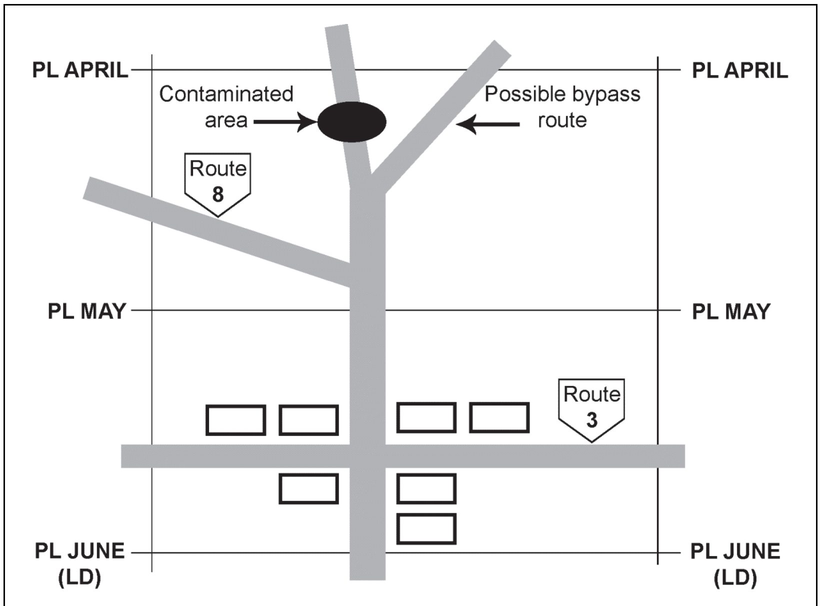
D-32. The procedures associated with CBRN surveys are—

- Locate the general boundaries of the contaminated area.
- Place warning markers at specified intervals around the contaminated area and at all entry points.
- Determine the intensity of the contamination.
- Report information using the CBRN4 report.

D-33. Commanders may use one of three forms of CBRN mounted reconnaissance, or a combination of the three. The three forms of CBRN mounted reconnaissance are route, area, and zone.

ROUTE

D-34. Route reconnaissance (figure D-1) is a form of reconnaissance that focuses along a specific line of communications, logistics, and travel (a road, railway, cross-country mobility corridor). CBRN route reconnaissance provides new or updated information on route conditions such as, obstacles and bridge classifications, and adversary and civilian activity along the route. A route reconnaissance includes not only the route itself, but also all terrain along the route from which the adversary could influence the movement of friendly forces.



Legend:

LD	line of departure
PL	phase line

Figure D-1. CBRN route reconnaissance

D-35. The commander normally assigns this mission when he wants to use a specific route for friendly forces movement. When the commander's IPOE/IPB indicates that there is a high likelihood of contamination along the route, a unit (particularly a CBRN R&S element) is given the specific mission to conduct a CBRN route reconnaissance. The CBRN route reconnaissance proceeds faster than a CBRN zone reconnaissance. The route length and the time available dictate the size of the R&S element. Once contamination is detected, the R&S element has the following options:

- Conduct a CBRN survey to define the boundaries of the contamination to determine the extent of contamination.
- Locate and mark clear bypass routes. (This does not require determining the entire extent of contamination.)
- Report and mark CBRN hazards along the route.

D-36. The following critical tasks are conducted during a route reconnaissance:

- Reconnoiter terrain along the route.
- Locate and mark the near side and far side of contamination on the route.
- Report all information.

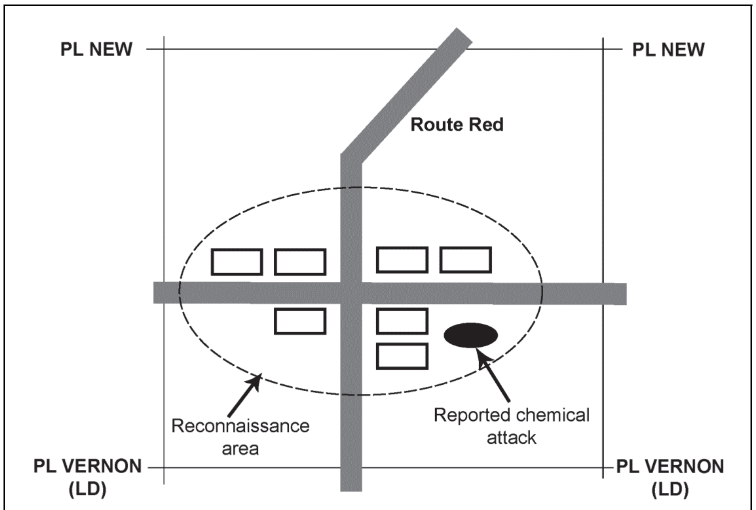
D-37. Typical CBRN route reconnaissance procedures are—

- Locate, survey, and report contamination that can influence movement along the route.

- Reconnoiter terrain that the adversary can use to dominate movement along the route, such as, choke points and ambush sites within the CBRN hazard area.
- Reconnoiter built-up areas, contaminated areas, and lateral routes along the route.
- Locate any fords, crossing sites, or bypasses for existing and reinforcing obstacles (including built-up areas) along the route that can be used to avoid or bypass the CBRN hazard.
- Identify obstacles in the execution of CBRN route reconnaissance.
- Report and mark CBRN hazards along the route.
- Conduct CBRN survey to define the boundaries of the contamination.
- Report information according to the communication plan when initiating the CBRN route reconnaissance mission, including a sketch and a CBRN4 report.
- Mark the contaminated area.
- Request decontamination support if necessary.

AREA

D-38. Area reconnaissance (figure D-2) is a directed effort to obtain detailed information concerning a specific area, such as a terrain feature or facility (for example, an adversary storage facility). An area reconnaissance is a specialized form of zone reconnaissance that proceeds faster since the effort is focused on a specific piece of terrain.



Legend:
LD line of departure
PL phase line

Figure D-2. CBRN area reconnaissance

D-39. An area reconnaissance mission is typically assigned when employing a CBRN R&S element to reconnoiter a reported/suspected CBRN attack/hazard in a specific area. CBRN area reconnaissance is conducted during fixed-site operations (naval seaports, airfields, land component operations). Once contamination is detected, the R&S element usually performs a survey to define the boundaries of the contamination. If contamination is found, the CBRN reconnaissance unit has the following options:

- Conduct a CBRN survey to determine the extent of the contamination.
- Locate and mark CBRN hazards within the area.
- Terminate the mission with permission of the headquarters controlling the mission.

D-40. The following critical tasks are conducted during an area reconnaissance:

- Reconnoiter terrain within the area.
- Locate and mark CBRN hazards within the area.
- Locate bypass routes around identified contaminated areas.

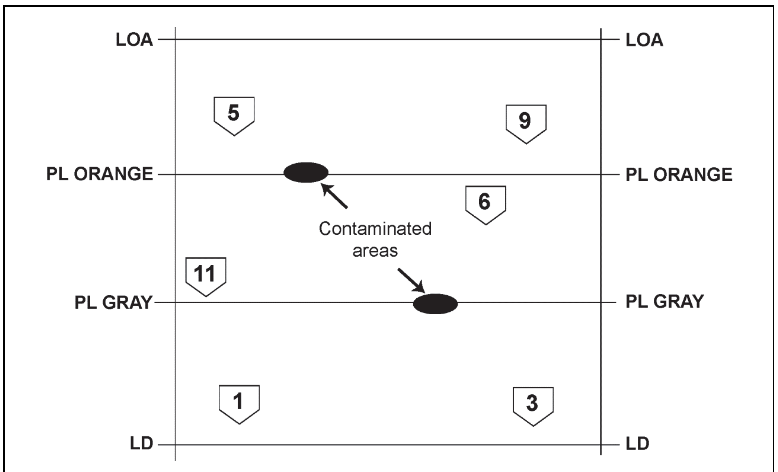
- Report all information.

D-41. The typical CBRN area reconnaissance procedures are—

- Reconnoiter terrain within the area for contamination.
- Check all water sources for contamination.
- Locate any fords, crossing sites, or bypasses for existing and reinforcing obstacles (including built-up areas) within the area to avoid or bypass CBRN hazards.
- Identify all obstacles in the execution of CBRN area reconnaissance.
- Report and mark CBRN hazards within the area.
- Locate and mark bypass routes if contamination is encountered.
- Report information according to the communication plan when initiating the CBRN area reconnaissance mission.
- Conduct CBRN survey to define the boundaries of the contamination (a sketch, a CBRN4 report).
- Mark contaminated area.
- Request decontamination support if necessary

ZONE

D-42. Zone reconnaissance, figure D-3, is a form of reconnaissance that involves a directed effort to obtain detailed information on routes, obstacles, terrain, and adversary forces within a zone defined by boundaries. Obstacles include existing and reinforcing, and areas containing CBRN hazards.



Legend:
LD line of departure
LOA limit of advance
PL phase line

Figure D-3. CBRN zone reconnaissance

D-43. The commander assigns a zone reconnaissance mission when additional information is needed in a zone before committing other forces to occupy or pass through the zone. Zone reconnaissance is appropriate when the adversary situation is vague, existing knowledge of the terrain is limited, or combat operations have altered the terrain. A commander will make the decision to conduct a zone reconnaissance based upon the organic assets or additional assets from higher headquarters. A zone reconnaissance may include several route or area reconnaissance missions assigned to subordinate units. A zone reconnaissance is a deliberate, time-consuming process that requires a substantial expenditure of resources. Typically, a zone reconnaissance is performed to determine the suitability for large unit assembly areas or logistics bases. Previous reports or intelligence may indicate a high probability of past CBRN attacks within the zone. Once contamination is detected, the R&S element has the following options:

- Conduct a CBRN survey to define the boundaries of the contamination.

- Locate and mark clean bypass routes around the contaminated area within the zone.
- Terminate the mission, and move to the coordinated decontamination point.

D-44. Unless specifically directed by the commander, critical tasks must be accomplished during a zone reconnaissance. The commander may direct the reconnaissance toward specific IR only, based on the time available and his intent. The following critical tasks are conducted during a zone reconnaissance:

- Reconnoiter terrain within the zone for contamination.
- Locate previously reported CBRN attack areas, and determine if there is still a hazard.
- Locate possible contamination within the zone.
- Check water sources for contamination (for example, conduct sample collection and forward samples for testing).
- Verify the location of commercial toxic industrial material (TIM) facilities, and check for possible contamination.
- Report information.
- Mark contaminated areas.
- Locate routes to bypass contamination.

D-45. The typical zone reconnaissance procedures are—

- Locate all previously reported CBRN attack areas and determine if there is still a hazard.
- Reconnoiter all terrain within the zone for contamination.
- Check all water sources for contamination.
- Locate any fords, crossing sites, or bypasses for existing and reinforcing obstacles (including built-up areas) within the zone to avoid or bypass CBRN hazards.
- Identify all obstacles in the execution of CBRN zone reconnaissance.
- Report and mark all CBRN hazards within the zone.
- Locate and mark bypass routes if contamination is encountered.
- Conduct a CBRN survey to define the boundaries of the contamination.
- Report information according to the communication plan when initiating the CBRN zone reconnaissance mission, including a sketch and CBRN4 report.
- Mark contaminated areas.
- Request decontamination support if necessary.

MOUNTED CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE TACTICAL FORMATIONS

D-46. The CBRN R&S element uses standard movement formations and techniques to get to its assigned area. Once at the mission area, the R&S element selects the appropriate CBRN survey technique to perform its mission. CBRN reconnaissance leaders must exercise mission command/C2, maximize the use of terrain, and apply the following fundamentals of movement:

- Move on covered and concealed routes.
- Do not move directly forward from covered and concealed positions.
- Avoid likely ambush sites and other danger areas.
- Enforce camouflage, noise, and light discipline.
- Maintain all-around security, including air guards.
- Use terrain for protection.
- Avoid possible kill zones.
- Maximize vehicle capabilities such as collective protection and standoff detections systems.

D-47. There are five formations for mounted reconnaissance movement—column, staggered column, wedge, V, and echelon.

COLUMN

D-48. The column formation, figure D-4, is used for rapid movement when time is limited; however, it provides little flank security. This formation is primarily used when no adversary contact is expected and time is critical.

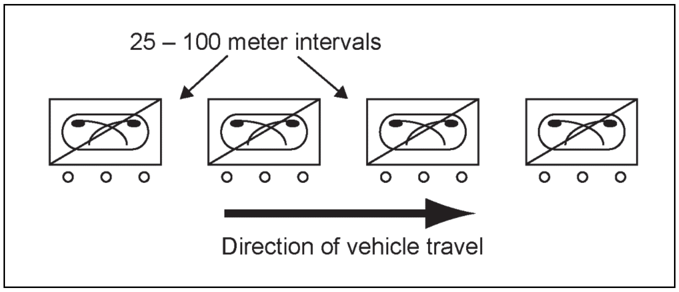


Figure D-4. Column formation

STAGGERED COLUMN

D-49. The column formation is used for road marches, for reconnaissance movement during limited visibility, and when passing through defiles or other restrictive terrain. The unit can deploy rapidly from the column formation into other formations, and the column formation simplifies control and provides good security. The staggered column formation, figure D-5 is used for rapid movement across open terrain. It affords all-round observation and fields of fire. The unit leader positions himself to best control the unit. Reconnaissance vehicles should maintain 25- to 100-meter intervals and lateral dispersion. Each vehicle commander maintains observation of his designated sector. The exact distance between vehicles depends on METT-TC/METT-T, weather conditions, and visibility.

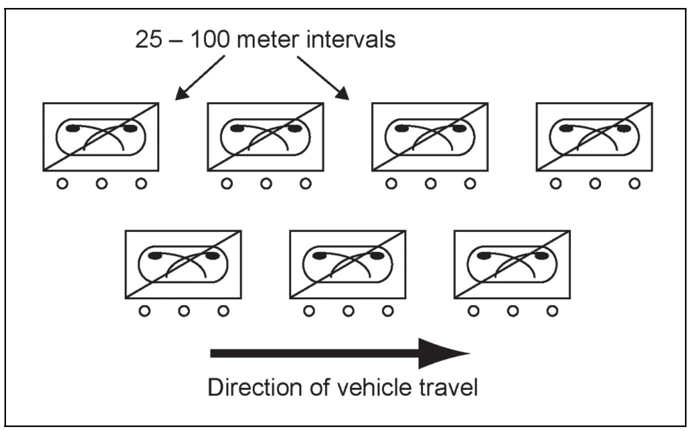


Figure D-5. Staggered column formation

WEDGE

D-50. The wedge formation, figure D-6, page D-12, is one of the most frequently used unit movement formations. It allows for optimum flexibility and security and facilitates mission command/C2. Vehicle dispersion and intervals depend on METT-TC/METT-T and visibility. When spreading out in open, flat terrain, each vehicle operator must maintain visibility of the vehicle in front of him. Each reconnaissance vehicle commander maintains observation of a designated sector. A column of wedges formation is used when adversary contact is possible (figure D-7, page D-12). It is best employed when traveling or traveling overwatch conditions are warranted.

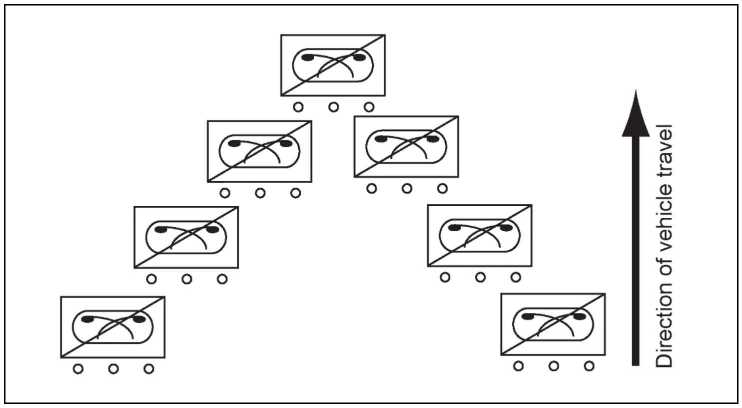


Figure D-6. Wedge formation

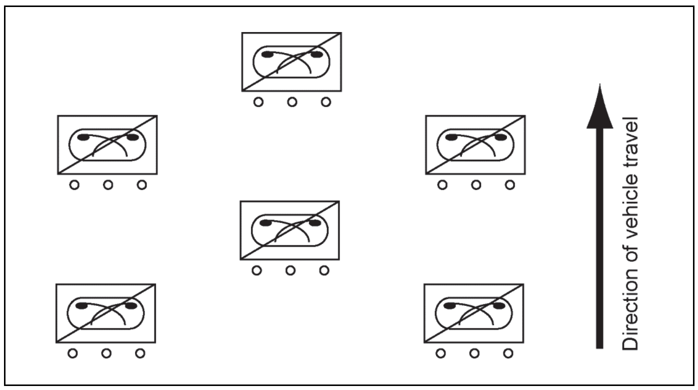


Figure D-7. Column of wedges formation

V Formation

D-51. The V formation (figure D-8) affords good security, speed, and mission command/C2. The split V formation (figure D-9) can be used when two units are operating on different routes. These formations are used when contact is possible, but speed is desirable. The lead V R&S element moves along covered and concealed routes for protection. The trail R&S element moves at a variable speed, continually overwatching and providing security. The trail R&S element must always maintain visual contact with the lead R&S element and may stop periodically to observe.

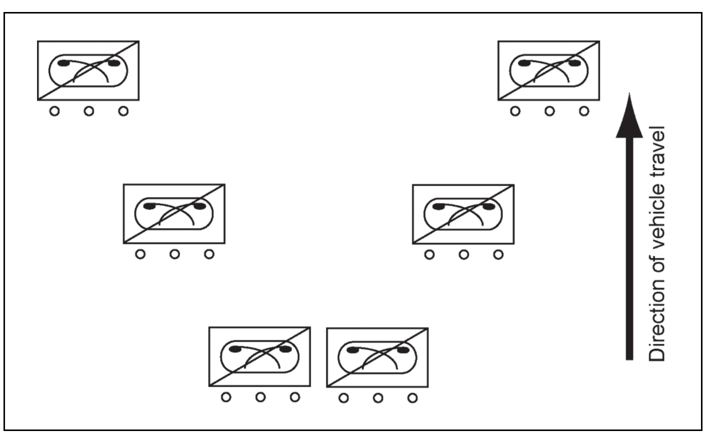


Figure D-8. V formation

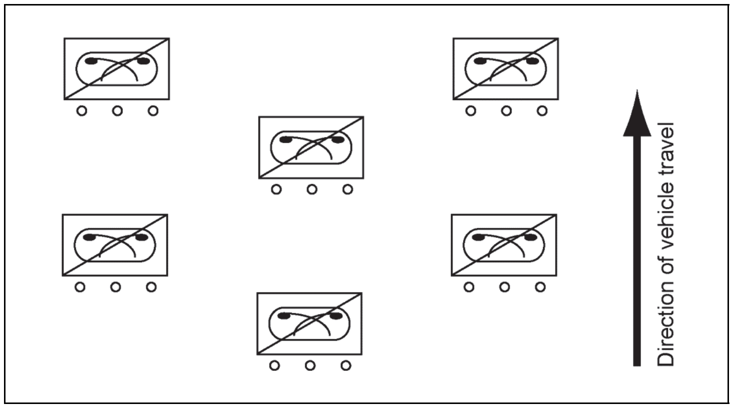


Figure D-9. Split V formation

Echelon (Left or Right)

D-52. The echelon formation (figure D-10) provides coverage of an area. It provides flexibility and speed, but does not provide sufficient security if adversary contact is possible or expected.

Note. Echelon right mirrors the formation of echelon left.

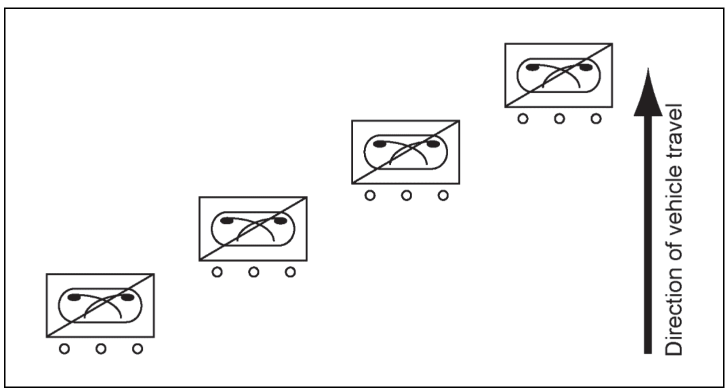


Figure D-10. Echelon left

Support Area

D-53. The ability to sustain combat operations in the support area is vital to operational success. If contaminated by attack, organizations identify clear areas and move to a predesignated area to avoid CBRN hazards effects.

- Organizations at fixed sites may fall within the range of adversary air and surface weapon delivery systems armed with CBRN weapons or industrial storage facilities with TIM.
- The areas of greatest vulnerability are large fixed sites (for example, ports of debarkation), staging and marshaling areas, hubs, bases, assembly areas, MSRs, and sites involved in early force buildup activities.

MOUNTED CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR LOCATE TECHNIQUES

D-54. CBRN locate techniques are conducted to locate suspected or actual CBRN agents or hazards from an attack within the AOR. CBRN locate is conducted on a continuous basis to detect hazards along routes, in areas, or in selected zones or sectors of interest. Locate techniques can use point or standoff capabilities to find contaminated areas. CBRN locate techniques require applied judgment based on METT-TC/METT-T. The terrain and the adversary dictate which technique to use and the level of detail possible. More than one technique may be executed during a single mission. There are four techniques to locate possible contamination in the AOR. They are zigzag, lane, cloverleaf, and grid.

D-55. Mounted CBRN reconnaissance techniques provide advantages and disadvantages. Table D-2 provides an overview of those advantages and disadvantages.

Table D-2. Mounted CBRN reconnaissance technique advantages and disadvantages

Technique	*Speed and resources requirements*	*Limit contamination contact*	*Detail of results*
Zigzag	Fair	Fair	Good
Lane	Fair	Fair	Poor
Cloverleaf	Fair	Fair	Poor
Nearside-farside	Poor	Poor	Good
Box	Poor	Good	Good
Bounce-and-bypass	Fair	Good	Fair
Star	Good	Poor	Fair
Grid	Poor	Fair	Good
Course leg	Good	Good	Good
Preselected dose rate	Good	Good	Good
	Good = Area covered with a low amount of travel, personnel, and detection points	Good = Does not continue through contaminated area	Good = All contamination boundary limits found
	Fair = Area covered with a moderate amount of travel, personnel, and detection points	Fair = Does not return through contaminated area	Fair = Some of the contamination boundary limits found
	Poor = Area covered with a large amount of travel, personnel, and detection points	Poor = Returns through contaminated area	Poor = Contamination only generally located

D-56. Terrain analysis may be used to determine the appropriate technique to be applied to the specific mission. For example, the zigzag locate technique may not be appropriate in urban areas, but the lane locate technique allows the CBRN R&S element to use roadways that are generally parallel.

ZIGZAG

D-57. The zigzag locate technique (figure D-11) is used to locate contaminated areas during route, zone, or area reconnaissance missions. Depending on the terrain, the distances could be larger or smaller. The zigzag locate technique has a higher probability of detecting contamination because the surface area not traversed by the R&S element is less than that of other locate techniques. The following are procedures for the zigzag locate technique:

- The R&S element begins its assessment at the deployment (start) line, maintaining 200-meter intervals between vehicles.
- The R&S element moves forward along a line that is oriented 45° from the start line.
- The R&S element monitors identification equipment for indications of contamination.
- After the R&S element has moved 500 meters along the first zig, it turns 90° and zags.

- After traveling 500 meters, it turns 90° for a second zig.

Note. Depending on the terrain, the distances could be larger or smaller.

- The R&S element continues to zigzag until it has reached its limit of advance.
- Once the entire mission area has been assessed, the R&S element reports the results normally using the CBRN4 report.
- If the R&S element did not assess the entire mission area, it begins a new sweep.
- The R&S element repeats the process until contamination is detected or the entire mission area is assessed.

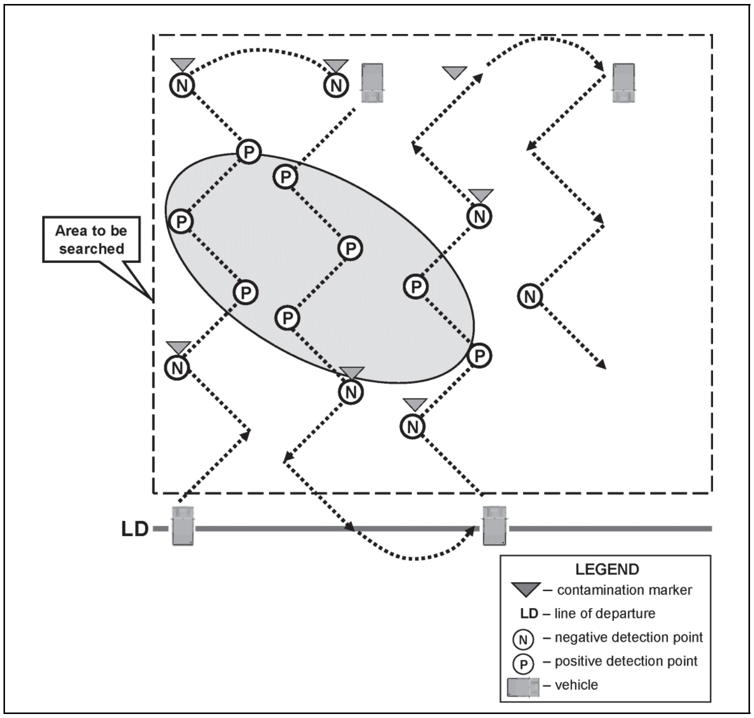


Figure D-11. Zigzag locate technique

LANE

D-58. The lane locate technique (figure D-11) is used to locate contaminated areas. It is very similar to the zigzag locate technique, but is primarily used during route reconnaissance missions. It can also be used for area reconnaissance of long, narrow pieces of terrain, such as defiles. The following are procedures for the lane locate technique:

- The R&S element begins its assessment at the LD with an interval of less than 200 meters between vehicles.
- The R&S element moves in a staggered column formation.
- Each R&S element moves along a line until it reaches the limit of advance.
- The R&S element begins a new sweep and repeats the process until contamination is detected or the entire mission area is assessed, if the R&S element did not assess the entire mission area.
- If contamination is found on a route, create and submit a CBRN4 report and continue lane.
- Once the entire mission area has been assessed, the R&S element reports the results.

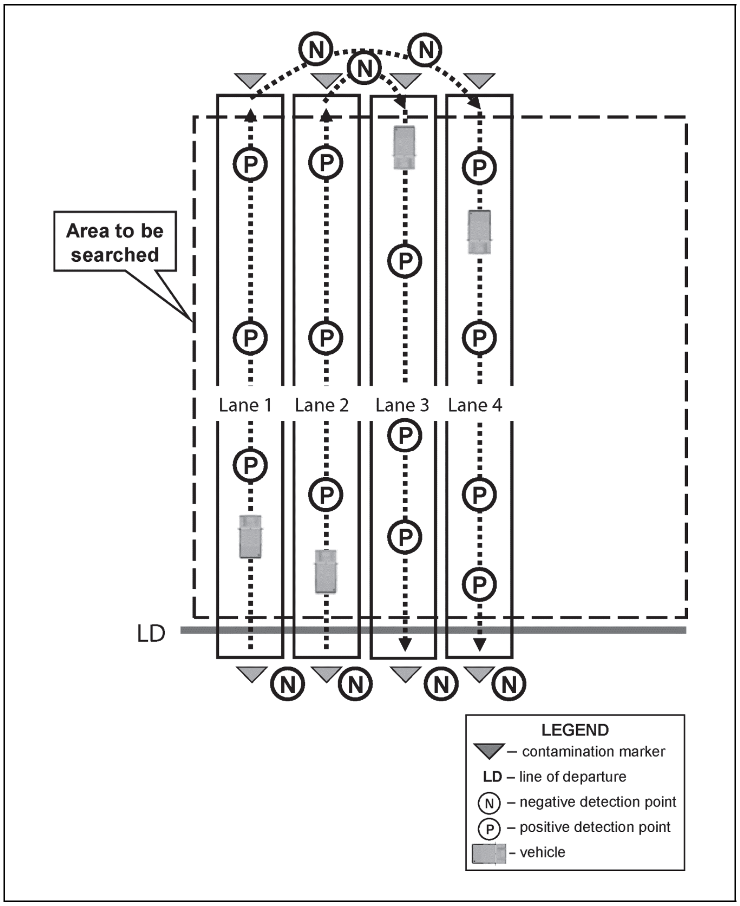


Figure D-11. Lane locate technique

CLOVERLEAF

D-59. The cloverleaf locate technique is primarily used in restricted access or terrain or so that sites for high-value facilities (mission command, centers, are free of contamination. The cloverleaf locate technique is time-consuming; however, it provides detailed coverage and information about an area. The path to travel is illustrated in figure D-13 reading intervals are determined by the terrain and information outlined in the OPORD. The following are procedures for the cloverleaf locate technique:

- The R&S element begins its cloverleaf at a starting point central to the area to be checked.
- The R&S element moves in a figure-8 pattern using the start point as the center of the 8. If a second vehicle is used, the second vehicle conducts the same pattern moving 90º direction from the first vehicle. If only one vehicle is conducting the cloverleaf, it completes one figure 8 and then conducts a second figure 8 at a 90º angle from the first figure 8.
- The R&S element monitors identification equipment for indications of contamination.
- The R&S element can conduct continuous monitoring along its route, or if rough terrain, it will conduct checks at set intervals along its route.

Note. Depending on the terrain, the distances could be larger or smaller.

- The R&S element reports the results by using the CBRN4 report.
- A new cloverleaf is begun within the area, if the R&S element did not assess the entire mission area.

- The R&S element repeats the process until contamination is detected or the entire mission area is assessed.

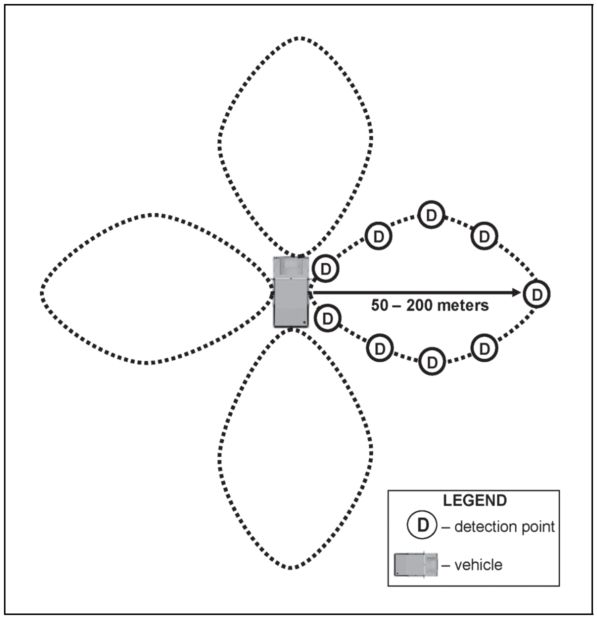


Figure D-12. Cloverleaf locate technique

GRID

D-60. The grid technique is employed by R&S elements conducting mounted reconnaissance, where accuracy is important. It is employed by superimposing a grid over the R&S element maps, which enables them to rapidly communicate locations for detections, where samples were collected, and the locations of casualties. Numbers and/or letters are assigned to each detection point associated with a predetermined GPS location. (See figure D-13.)

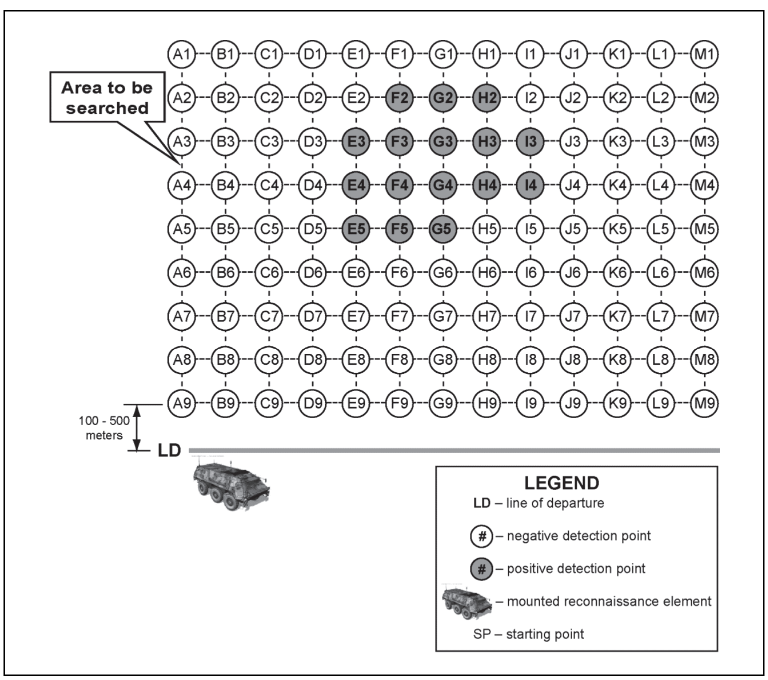


Figure D-13. Mounted-grid locate technique

D-61. The following are procedures for the grid technique:

- The CBRN R&S element establishes the boundaries of the area to be checked.
- The CBRN R&S element preselects points within the area that it will check for contamination.
- Normally the points to be checked are laid out in an evenly spaced grid pattern.
- The CBRN R&S element conducts checks at each point within the grid.
- The CBRN R&S element reports the results, normally by using a CBRN4 report.
- The CBRN R&S element coordinates for decontamination.
- The CBRN R&S element may transition to a CBRN survey if contamination is found

MOUNTED CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR SURVEY TECHNIQUES

D-62. CBRN surveys define the boundaries of contaminated areas. CBRN survey techniques require applied judgment based on METT-TC/METT-T. The mission, terrain, time, and adversary situation indicate the technique that should be used. There are six survey techniques that can be employed once the contamination is located—nearside-farside, box, star, bounce-and-bypass, course leg, and preselected dose rate.

D-63. CBRN survey techniques can be conducted by a mounted or dismounted R&S element. The distances suggested for each technique vary depending on METT-TC/METT-T.

NEARSIDE-FARSIDE

D-64. The nearside-farside survey technique (figure D-14) is used by an R&S element whenever they enter the contaminated area. It is possible that the left and right limits of the contamination are not identified, even though the left and right R&S elements determined a nearside and a farside. In this case, the R&S element can shift to the left and right to find the boundaries. The lateral spacing between R&S elements is important to quickly locate all boundaries of the contaminated area. Once the boundaries are located, clear bypass routes can be easily established.

D-65. The following are procedures for the nearside-farside survey technique:

- All vehicles stop to determine if the R&S element is in the contaminated area.
- If an R&S element is in the contaminated area, it moves back along its original path every 200 meters and checks for contamination until CBRN contamination is no longer detected.
- Once out of the contaminated area, appropriate warning markers are emplaced.
- Once the initial vehicle or individual has found the nearside boundary of contamination, it moves forward across the contaminated area, testing every 200 meters.
- When contamination is no longer detected, the R&S element moves forward another 200 meters and checks again.
- If no contamination is detected, it places a CBRN warning marker.
- This process is repeated until it is clear of the contamination.
- Using multiple vehicles, each R&S element executes this process to determine the nearside and farside boundaries of the contamination.

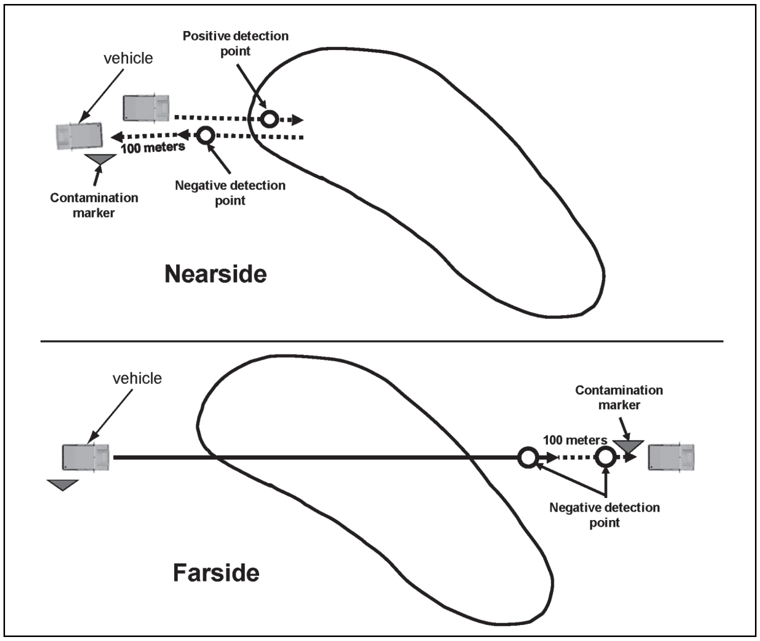


Figure D-14. Nearside-farside survey technique

Box

D-66. The box survey technique (figure D-15, page D-20) is used to determine the general dimensions (length and width) of a contaminated area. The CBRN reconnaissance vehicle crew uses the decision matrix to determine which direction and distance to proceed. The R&S elements start a parallel course toward the suspected contamination along predetermined grid squares, conducting sample collection at each grid intersection. If the length of the reconnaissance area is covered without finding contamination, the R&S elements should increase the distance between them and return in the same direction. This can continue until the entire area is covered, or contamination is found. The following are box survey technique procedures:

- The R&S elements stop and check for contamination in their immediate areas.
- The first R&S element to report contamination becomes the base element.
- If any other R&S element is located in the contaminated area, they must back out of the contamination.
- Other R&S elements should orient on the base element.
- At least one R&S element should be to the left and one element to the right of the base element.
- When contamination is found, a CBRN4 report is generated and the R&S element turns 180° and returns to a grid intersection.
- A CBRN marker is placed if the grid intersection is far enough away from the contamination. (If not, the R&S element moves out further to place CBRN marker.)
- The left element turns 90° to the right and bounds to the next grid intersection to determine the extent of the contamination. (Conversely, the right element turns 90° to the left and bounds to the next grid intersection to determine the extent of the contamination.)
- This process is continued until the presence of, or the extent of, contamination is confirmed and until the elements meet.

Note. The movement of the R&S element depends on the orientation of the contaminated area.

- This process of going straight or turning continues in a boxlike movement until the R&S element has crossed the initial farside line; this is the initial right limit of the contamination.

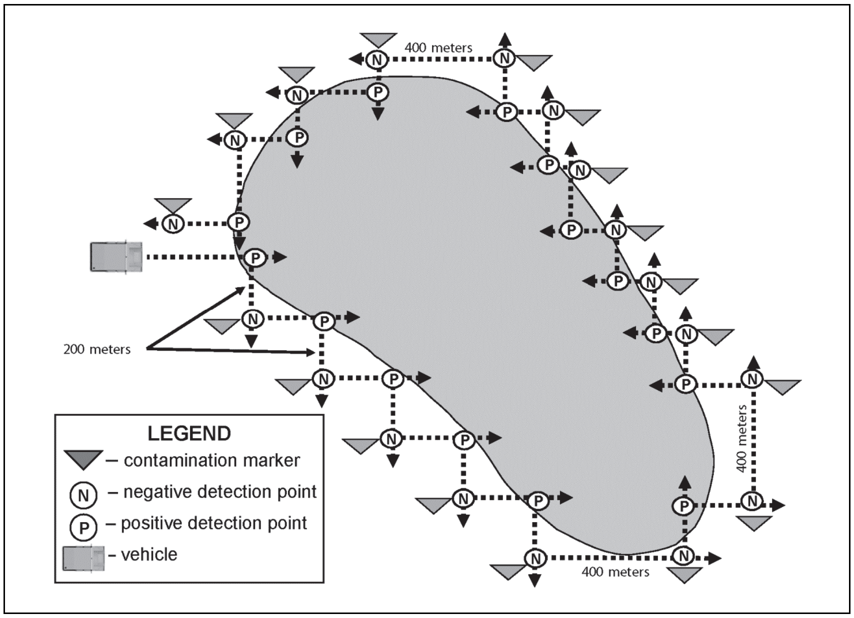


Figure D-15. Box survey technique

STAR

D-67. The star survey technique (figure D-16) is a very quick way to determine the rough limits of a contaminated area. Use the star technique to get the CBRN R&S element in and out of the contaminated area in the shortest possible time. The following are procedures for the star survey techniques procedures:

- The R&S element that encounters the contamination moves their vehicle back from the contaminated area 200 meters from the initial positive reading.
- This point is the base of the star.
- The R&S element posts a CBRN marker and proceeds forward to find the farside, detecting every 200 meters until no contamination is detected.
- The R&S element proceeds another 200 meters, checks again so that no contamination is detected, and posts a CBRN marker.
- This ends the first leg of the star.
- The R&S element turns about 135° and travels in that direction, detecting every 200 meters.
- If no contamination is detected on this leg, the R&S element does not travel any longer than the length of the initial leg.
- The R&S element repeats this process until it arrives at or near the base of the star.
- The R&S element reports the results normally using a CBRN4 report showing the five points of the star.
- This technique can be used by two or more R&S elements to obtain more detecting points, increasing the accuracy of the survey.

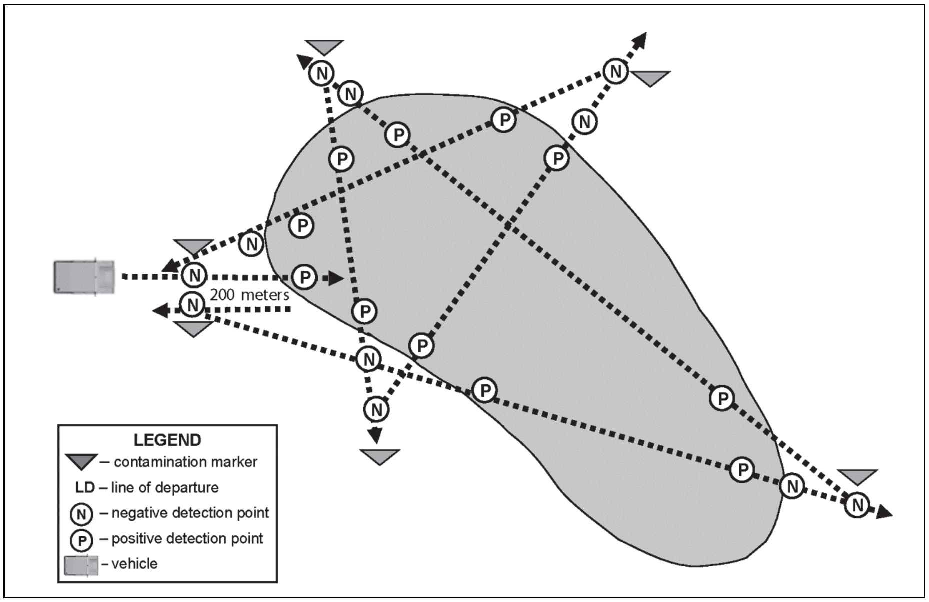


Figure D-16. Star survey technique

BOUNCE-AND-BYPASS

The bounce-and-bypass survey technique (figure D-17, page D-22) is used to locate the general boundaries of a CBRN contaminated area. The R&S element places CBRN markers at specified intervals around the contaminated area and at all entry points. This technique can also be used to support a radiological survey. The R&S element reports the intensity of radiation at the contamination boundary. The following are procedures for the bounce-and-bypass survey technique:

- The R&S element stops and checks for contamination in their immediate area.
- If no contamination is detected, the R&S element proceeds forward until contamination is detected.
- Once contamination is detected, the R&S element proceeds out of the contaminated area and places a CBRN marker where no contamination is found.
- The R&S element proceeds along a general axis, moving in the appropriate cardinal direction away from the initial start point at least 200 meters or as prescribed in the OPORD.
- The R&S element then turns in the same cardinal direction toward the contaminated area until contamination is detected again.
- Once contamination is detected, the R&S element proceeds out of the contaminated area and places a CBRN marker where no contamination is found.
- This process will continue until no contamination is found.
- A CBRN4 report is submitted.

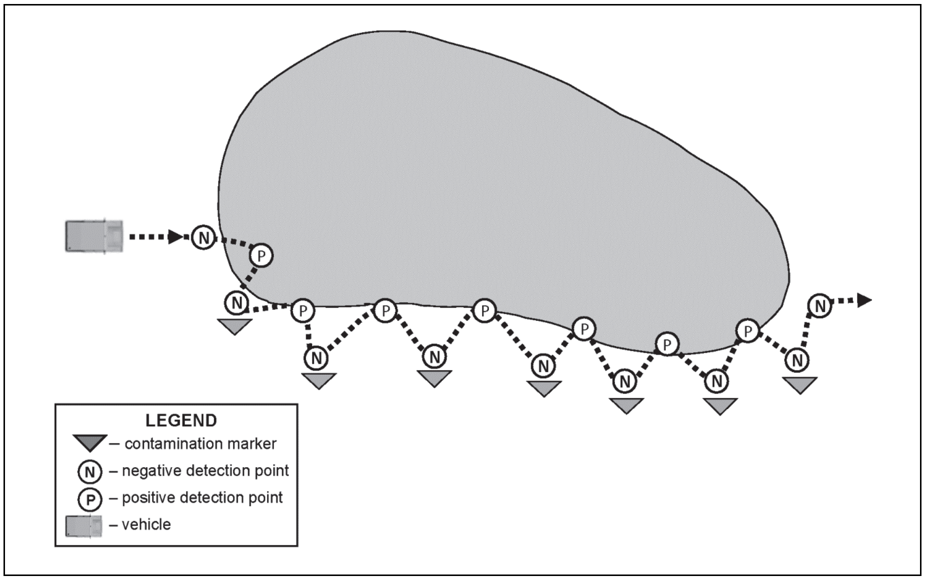


Figure D-17. Bounce-and-bypass survey technique

COURSE LEG

D-68. The course leg technique is used primarily during aerial reconnaissance (see appendix F) but may be conducted mounted. The course leg technique is used to find the extent and intensity of radiological contamination. The CBRN R&S element moves between two checkpoints; for example, from Point A (top of a hill) to Point B (top of another hill). Readings are taken at given intervals along the route between the two checkpoints. When conducting a mounted radiological course leg, the element must be given a turn-back dose and turn-back dose rate. Reporting results of mounted course leg techniques may be done in various ways. Normally a survey data sheet can be filled out and turned in to the tasking headquarters at the end of the mission or the data can be sent via a CBRN4 report. Figure D-18 outlines and illustrates the course leg technique.

> ***Note.*** Conducting mounted versus aerial radiological course legs results in higher radiation doses to personnel. Further guidance on radiological aspect of conducting a course leg technique can be found in *MultiService Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Avoidance*.

D-69. The following are procedures for the course leg survey:

- The CBRN R&S element reads the survey meter and records the dose rate at the start point of the course leg.
- The CBRN R&S element reads the survey meter and records the dose rate at each preselected interval along the course leg. Under no circumstances should the element continue further into a contaminated area if it reaches its turn-back dose or turn-back dose rate.
- The CBRN R&S element reads the survey meter and records the dose rate at the end point of the course leg.
- The CBRN R&S element reports the results using the CBRN4 report.
- The CBRN R&S element coordinates for decontamination.
- The CBRN R&S element rechecks and zeros the RADIAC meter before each course leg to assure proper operation.

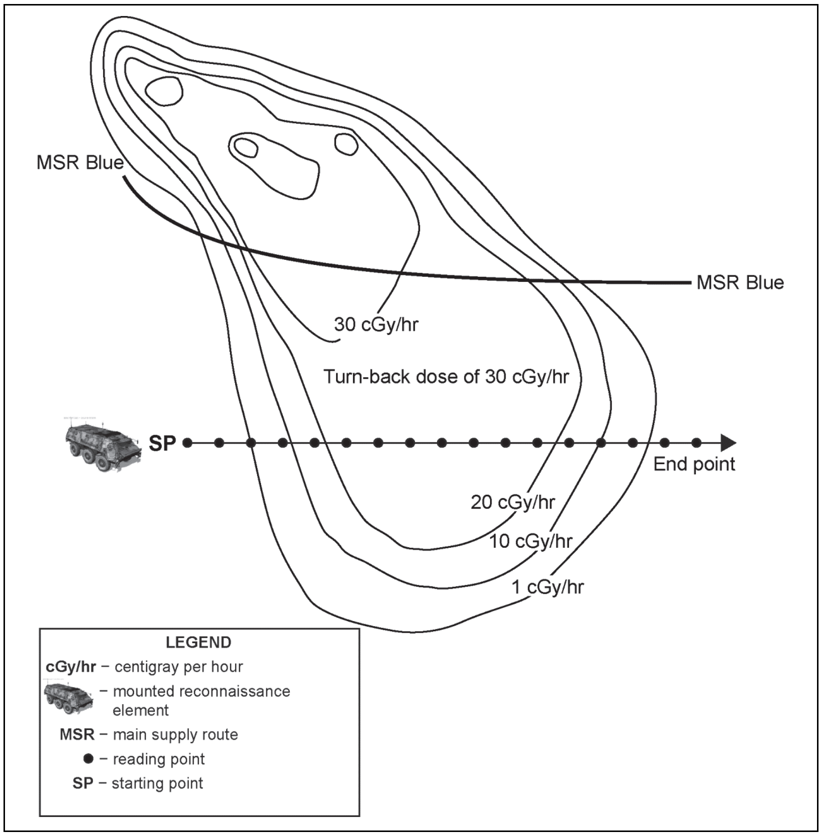


Figure D-18. Course leg technique

PRESELECTED DOSE RATE

D-70. Preselected dose rate techniques are used as a form of route technique where the R&S element is sent along a route and told to report and or mark at preselected dose rates. This is used for radiological surveys and, once multiple preselected dose routes have been conducted, the points can be correlated to show the contour lines of radiological contamination fallout. Figure D-19, page D-24, provides an example.

MOUNTED CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR SURVEILLANCE

D-71. Reconnaissance is the first step in CBRN surveillance site selection. Begin with a map reconnaissance. Use the map reconnaissance to determine initial surveillance areas that support the employment tactic, and then select primary, alternate, and supplemental surveillance sites within each surveillance area. Some rules of thumb for the reconnaissance include:

- Reconnoiter the detection and surveillance areas and potential sites firsthand, if possible.
- Coordinate with the terrain owner before conducting the reconnaissance.
- Ensure that the CBRN R&S element includes the designated serial leaders, including—
  - **Observation post site selection.** The supported unit leader or the CBRN R&S element leader selects the general location for the observation post (OP). The leader considers METT-TC/METT-T factors, the intelligence collection plan, and the ISR plan when determining the general positioning of the OP site.
  - **Attack indicators.** Agents can be disseminated by using overt or covert methods. Explosive delivery systems or spray tanks (artillery, rockets, and missiles detonating) have a distinctive visual signature during the day and at night. Aircraft spraying agents have distinctive flight patterns along with the signature of the liquid being released. While these

indicators are not positive proof that an attack has occurred, they indicate an increased probability that it has. Depending on METT-TC/METT-T, the CBRN R&S element occupying the OP can survey the NAI to confirm or deny the presence of contamination.

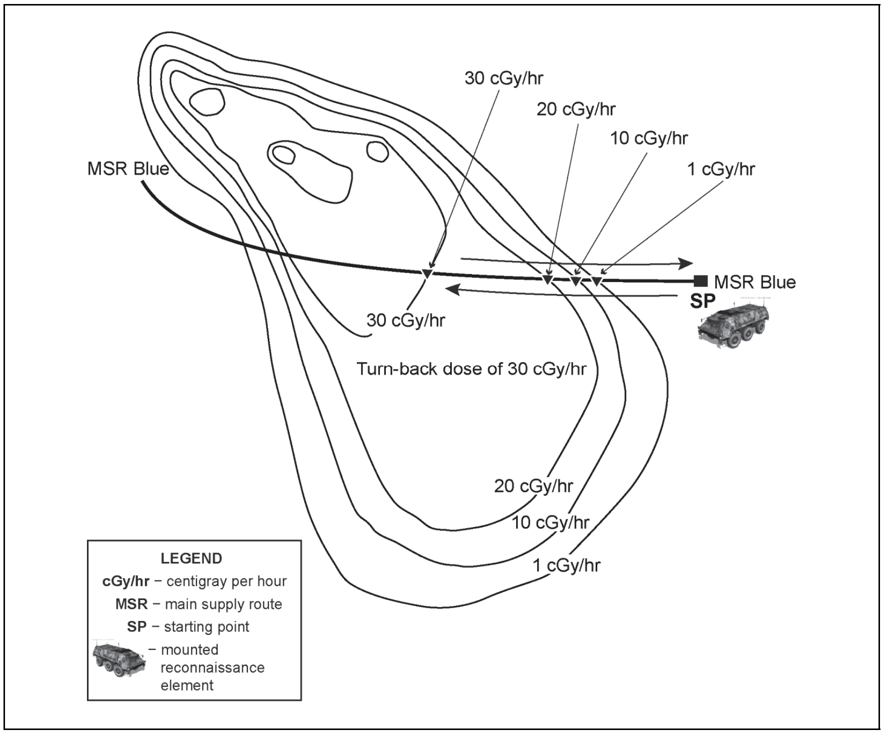


Figure D-19. Sample preselected dose rate technique

D-72. CBRN surveillance (figure D-20) is the systematic observation of aerospace, surface and subsurface areas, places, persons, and things by visual, aural, electronic, or other means to detect CBRN incidents and hazards. The key tasks for CBRN surveillance are—observe, monitor, detect, identify, quantify, sample collection, and report. Detailed information on sample collection is located in appendix H and on reporting information in appendix I. CBRN R&S elements monitor their areas directly or indirectly using detection capabilities to provide early warning. CBRN R&S elements, given the mission to perform CBRN surveillance, observe specified areas for indications of CBRN incidents. This can be accomplished through direct visual means or the use of sensor and standoff capabilities.

D-73. All units are trained to perform CBRN surveillance operations (for example, detector emplacement within the unit's perimeter). They can also be given the mission to perform CBRN surveillance by observing specified areas, such as NAIs, for indications of an attack. The goal of CBRN surveillance operations is to report information accurately and rapidly, including answering the requirements that prompted the surveillance operation.

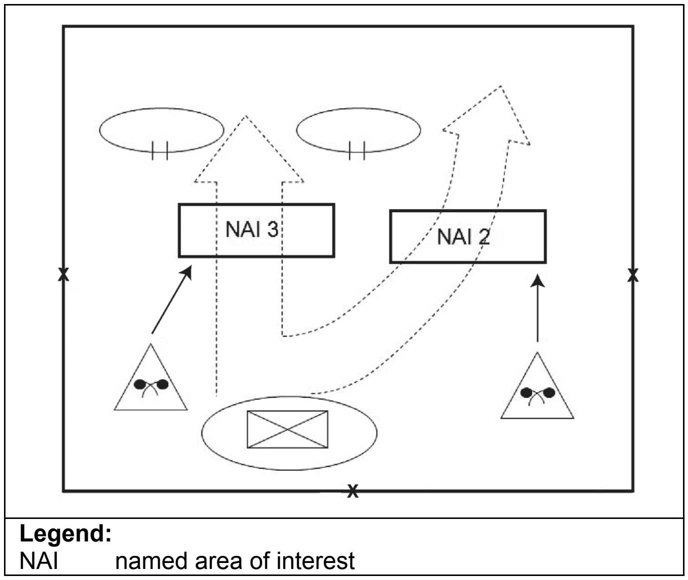


Figure D-20. CBRN surveillance

D-74. CBRN surveillance can be supported by several systems with the capabilities of remote sensing, standoff chemical agent detectors, and biological point detectors that can be integrated to form a detection network. After observing the indications of a CBRN attack during CBRN surveillance, the CBRN R&S element has the following options:

- Locate and mark clear bypass routes.
- Terminate the mission, and move to the coordinated decontamination point.
- Continue the mission.
  - Depending on the duration of the mission, the commander must consider sustainment of the CBRN R&S element by providing and maintaining levels of personnel and materiel required while continuing the operation throughout its duration.
  - Personnel considerations include replacing individuals for extended durations or providing food, water, and other perishables to replenish the CBRN R&S element.
  - Materiel considerations include the use of standoff and remote capabilities.

MOUNTED CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR OBSERVE TECHNIQUES

D-75. The CBRN surveillance task of observing is accomplished by two techniques: critical node and area array.

CRITICAL NODE

D-76. In support areas, mounted CBRN R&S elements may be assigned CBRN surveillance missions to observe designated areas for CBRN attacks. MSRs and areas to be occupied by logistics and mission command/C2 facilities may also be checked for CBRN hazards before their occupation. The following are procedures for the critical-node technique:

- Occupy observation points to overwatch the designated area.
- Report all indications of a CBRN attack.
- Employ monitoring capabilities.
- Operate and perform operator's maintenance on CBRN monitoring equipment.
- Conduct CBRN monitoring operations.
- Provide data for the completion of CBRN reports.

D-77. Mounted CBRN R&S elements observe specified areas or NAIs for indications of a CBRN attack. Based on IPOE/IPB and vulnerability planning, the commander prioritizes the use of available collection assets against designated NAIs; and R&S elements employ observation and detection procedures on designated areas for indications of an attack.

D-78. The primary means of surveillance may be from OPs. An OP is a position occupied to observe a designated area. The mounted CBRN R&S element reports any indication of a CBRN attack or adversary activity. Another means of mounted CBRN surveillance is conducting routine patrols through the operational area. This is normally conducted in support areas along MSRs and road networks.

AREA ARRAY

D-79. An area array is established in order to maximize the probability of CBRN hazard detection over a large area of interest. The primary objective is to detect a hazard upwind of the operational area of concern and to provide the greatest potential warning to those in the hazard area. The specific architecture of the array is designed by the CBRN staff in close coordination with operations, intelligence, and medical staffs. Refer to appendix B for more specific information on surveillance planning considerations and detector employment tactics. The following are area array techniques procedures:

- Consider threat, terrain, weather conditions, performance characteristics, and the quantity of CBRN detector assets.
- Determine the appropriate separation distances between CBRN detectors.
- Operate and perform operator's maintenance on CBRN monitoring equipment.
- Report all indications of a CBRN attack.
- Conduct CBRN monitoring operations.
- Provide data for the completion of CBRN reports.

MOUNTED CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR MONITOR TECHNIQUES

D-80. The CBRN surveillance task of monitoring is accomplished by two techniques: periodic and continuous.

PERIODIC

D-81. As the name implies, periodic monitoring is accomplished by employing CBRN detector assets at predetermined intervals of time. Prior to an incident, the time between monitoring is determined based primarily on the threat assessment. When intelligence estimates deem that there is a reduced likelihood of a CBRN incident, the commander is more apt to call for periodic monitoring of the area of concern. In doing so, CBRN resources (equipment and personnel) are conserved and power consumption (fuel and batteries) is reduced.

D-82. Following a CBRN incident, the periodic monitoring technique may be utilized over an extended period of time to determine whether hazardous effects remain in the area.

CONTINUOUS

D-83. Conversely, the continuous monitoring technique is accomplished by employing CBRN detector assets uninterrupted over the duration of the monitoring operations. Similar to periodic monitoring, the threat assessment will be the prime determinant in deciding to apply the continuous monitoring technique. When an incident is anticipated, continuous monitoring provides the greatest opportunity for warning the area of concern of impending hazardous conditions.

D-84. During and immediately following a CBRN incident, the continuous monitoring technique is employed to note the dissipation or proliferation of the hazard area and to estimate the duration of CBRN effects.

D-85. Continuous monitoring will place a much heavier burden on personnel (operators and maintainers) and logistics (detectors, batteries, fuel). These factors should be considered and adequately coordinated throughout the staff.

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Appendix E

Dismounted Chemical, Biological, Radiological, and Nuclear Reconnaissance and Surveillance

This appendix provides TTP for leaders and personnel who are conducting CBRN R&S missions. It describes elements of dismounted reconnaissance (route, area, and zone) and how they are best performed. This appendix focuses on ensuring that personnel fully understand the mission and the tasks associated with it. To ensure safety and success of the mission, guidance is provided for coordination, equipment preparation, and execution of dismounted CBRN reconnaissance so that it will be conducted in a deliberate and controlled manner. This appendix provides guidance on dismounted TTP for leaders and personnel who are conducting CBRN R&S missions. Dismounted reconnaissance is a mode of reconnaissance that can be conducted using any of the forms of CBRN reconnaissance (route, area, and zone), while CBRN surveillance operations utilize the various forms of CBRN surveillance (area, point, and medical). Dismounted reconnaissance is best performed for an area in which the size is conducive to military personnel operating on foot. This appendix will focus on dismounted point and area R&S TTP, and provide zone, route, and standoff considerations. Dismounted CBRN R&S operations may be conducted using a variety of tasks and techniques. CBRN R&S routinely utilizes locate, survey, or monitoring tasks and oftentimes includes more than one task. For instance, a dismounted CBRN R&S element may be asked to locate and determine the extent of a contaminated area. They would first conduct an assessment of the given area to locate the contamination. Once found, the CBRN R&S element would then conduct a survey of the area to determine the size of the contaminated area and other key information, such as the type of agent and the delivery means. Finally, the CBRN R&S element would monitor the contaminated area to gain an understanding of the duration of effects.

ADVANTAGES AND DISADVANTAGES OF DISMOUNTED CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE

E-1. Commanders decide when to use dismounted CBRN reconnaissance instead of mounted reconnaissance. Adequate time must be available to conduct a dismounted reconnaissance mission, and the commander must recognize that there is increased risk of exposure to the R&S element.

E-2. The following are advantages of dismounted CBRN reconnaissance missions:

- Allows for stealthy movement.
- Allows CBRN R&S elements on foot to benefit from the concealment offered by vegetation and terrain.
- Does not emit a significant visual or audio signature as do mounted reconnaissance missions.
- Provides the ability to conduct reconnaissance operations when the CBRN hazard is in close proximity to adversary positions.
- Conducts reconnaissance operations in restricted terrain areas that vehicles cannot traverse.
- Provides a higher confidence level in the results.

E-3. The following are disadvantages to dismounted CBRN reconnaissance missions:

- A relatively slow rate of movement, increasing time to complete the mission.
- Fatigue.
- Extensive requirements for detailed preliminary planning and coordination.
- Considerable risk to Service members conducting dismounted CBRN reconnaissance operations.
- The range of communications capabilities may be limited.
- Reduced protection from—
  - CBRN threats/hazards.
  - Adversary fires.
  - Booby traps.
  - IEDs.

PLANNING FOR DISMOUNTED CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE AND SURVEILLANCE OPERATIONS

E-4. Planning for CBRN reconnaissance has been discussed previously in chapter 2 and appendix B. The key planning factors that must be considered when planning for dismounted CBRN reconnaissance are discussed in the following paragraphs.

UNDERSTANDING THE MISSION

E-5. When given the mission, it is imperative that the CBRN R&S element fully understands the mission and the tasks associated with it. Many times a single word in a mission statement implies very complex TTP. Words such as *confirm* or *deny* can be insignificant when compared to words such as *exploit* and *characterize*. A thorough task analysis is imperative when planning dismounted CBRN reconnaissance operations.

PRIORITY INTELLIGENCE REQUIREMENTS

E-6. The CBRN R&S element must understand what information is important to the commander. Although most information has value to someone, the CBRN R&S element must key in on the information the commander has deemed priority. For instance, a CBRN dismounted R&S element could be sent into a bunker facility to conduct a preliminary survey and provide information about the number of CBRN rounds, type of rounds, and their markings.

E-7. The commander provides success criteria for each mission in terms of MOP. Success can be gauged using MOP at the tactical level. MOP are used to assess friendly actions that are tied to measuring task accomplishment. A CBRN reconnaissance mission can be considered successful when the CBRN R&S element reports what it has found prior to the LTIOV. If required to provide samples as MOP, success can be when the CBRN R&S element successfully transfers its samples to a receiving party (for example, TE, laboratory, or courier).

PREPARING FOR DISMOUNTED CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE AND SURVEILLANCE

E-8. Preparation for CBRN reconnaissance missions has been covered in chapter 3 and appendix C. Key factors when preparing for a dismounted CBRN mission are discussed in the following paragraphs.

COORDINATION

E-9. Coordination with other elements is paramount to making the mission successful. Capabilities such as security, decontamination, sample transfer and transport, and communications play an important role in the success of a dismounted CBRN reconnaissance mission. Coordination for contingencies (encountering hostiles, encountering hazards [IEDs, medical evacuation]) is discussed in chapter 3.

EQUIPMENT PREPARATION

E-10. Effective identification of key equipment to perform the CBRN reconnaissance mission can make or break a mission. Taking the wrong equipment, not preparing it properly (for example, no air in the self-contained breathing apparatus [SCBA] or low batteries), not enough sample collection containers, and inappropriate decontaminant are examples of things that can cause a CBRN mission to fail.

E-11. Determining if a CBRN R&S element is prepared for its mission is a commander's decision and is based on his level of acceptable risk. Very rarely is an element 100 percent prepared for every aspect of a mission. As long as any perceived risks that exist are acceptable to the commander, then the mission should be executed. (Refer to chapter 3.)

EXECUTING DISMOUNTED CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE AND SURVEILLANCE

E-12. Executing dismounted CBRN R&S should be conducted in a deliberate and controlled manner to ensure safety and success of the mission. Table E-1 provides an example of some procedures associated with executing dismounted CBRN R&S operations. These steps are divided into phases for ease in understanding and eventually, execution.

Note. Not all of the steps and supporting tasks in table E-1 are required in support of all reconnaissance procedures.

Table E-1. Sample dismounted CBRN reconnaissance procedures

Step	*Supporting tasks*
Occupy assembly area in vicinity of target area	• Approach the assembly area from upwind. • Determine the initial predicted hazard/exclusion area. • Coordinate with existing security forces, to include obtaining updated intelligence and local weather. • Determine the CP location. • Determine the IPE/PPE decision. • Perform leader's reconnaissance. • Establish hot, warm, and cold zones. • Establish entrance and exit locations. • Establish mission command/command and control. • Set up a technical decontamination station.

Table E-1. Sample dismounted CBRN reconnaissance procedures (continued)

Step	Supporting tasks
Conduct area survey	• Assess the overall area for reconnaissance. • Develop an initial survey plan. • Assess the exterior of the structure. • Conduct first entry procedures. • Assess each floor within structure. • Survey each room on each floor.
Conduct sample collection (if required)	• Revise the sample management plan. • Perform sample collection operations. • Collect items of intelligence value. • Perform an analysis.
Clear area	• Perform decontamination procedures. • Make an initial report. • Prepare for movement. • Coordinate with the area security force.
Move to operating base	• Conduct movement (ground or air).
Recovery	• Transfer samples and material if collected. • Perform postoperational checks and services. • Conduct further decontamination if necessary. • Submit complete reports.
Legend: CP command post IPE individual protective equipment PPE personal protective equipment	

OCCUPY AN ASSEMBLY AREA IN THE VICINITY OF THE TARGET

E-13. A CBRN R&S element should approach a CBRN survey area from upwind. The element will stop prior to actually entering the suspect area or point to set up its operations. The distance from the actual site is determined by various factors such as local weather data/conditions and geography (altitude), terrain, suspected agents, security concerns, and target size. Guidance may be given by the higher command, but normally this distance is in element SOPs and may be based on standoff distance provided in the DOT, *Emergency Response Guidebook*, 2008, or other such documents. Once the standoff (exclusion zone) distance is determined, the R&S element moves from the assembly area to where the CP is to be set up. This may be within the avenue of approach or where the CBRN R&S element commander determines.

E-14. The CBRN R&S element leader and assistant element leader will conduct a leader's reconnaissance and initial site assessment of the target area to ensure that they are at the proper location, to identify the location of security forces (if required), and to acquire overall situational awareness. This is conducted from the operational area to help develop the entry plan before the initial survey. Details include identify a potentially safe route to the target void of physical hazards, attempt to identify the target, and describe the area (types and number of buildings, obstacles, types of containers, azimuths and location in the area, potential hazards) with photographs, sketches, and distances. This activity is conducted while the CP is setting up and the rest of the R&S element is preparing their mission equipment. The key task during this reconnaissance is to determine the general location of the working zones (cold, warm, and hot) and select the location of the CP. The CP location will also serve as the element staging area. The CBRN R&S element leader will designate a general area for the decontamination station identity, entry and exit locations, and select one or more rally points.

E-15. A "hot line" is established that identifies the transition between the "hot zone" and "warm zone." This line is also referred to as the "liquid control line." The area between the cold zone and the hot zone is considered the "warm zone" and the line that transitions from the "warm zone" to the "cold zone" is also referred to as the "vapor control line." A majority of the decontamination process occurs in the "warm zone." After the establishment of the hot, warm, and cold zones, anything in the hot or warm zone is considered potentially contaminated and must be checked. If contamination is detected, it must be decontaminated and rechecked for cleanliness prior to passing into the cold zone.

E-16. A specific entrance and exit of the cold zone should be established. At the entrance to the warm and hot zones, a final check of personnel and equipment is done to ensure readiness prior to passing into these potentially hazardous zones. At the established exit point of the hot and warm zone, a monitoring and decontamination point is set up. Personnel and equipment are monitored for contamination and are processed through the decontamination line.

E-17. To track downrange personnel and equipment, a log must be maintained of personnel and equipment that are in the hot zone or warm zone or have been left in the hot or warm zone. A log is kept at the TOC concerning area operations/events, and a log is kept by the element that conducts sample collection in the hot zone. The log will include entry times and expected exit times.

E-18. Before anyone enters the hot or warm zone, the decontamination station must be set up and manned. Also a back-up entry element must be ready. The back-up entry element will serve as an emergency extraction element and a relief element, should assessment be extensive and the operation take more time than expected.

E-19. Once mission command/C2 is established and the steps and tasks in table E-1 have been accomplished to occupy the assembly area in the target area, the mission command/C2 element—

- Obtains information relating to the area and weather conditions.
- Prepares downwind hazard plot using DOT, *Emergency Response Guidebook*, 2008 or other method.
- Establishes staging areas upon approach (upwind and upgrade whenever possible) for arriving personnel.
- Determines whether to request additional resources, based on information received.
- Designates the tactical radio frequency to be used.
- Establishes the CP location upwind/upgrade and at a safe distance from the area in a place away from direct involvement with casualties and personnel.
- Identifies the location of CP and staging areas for follow-on units.
- Initiates the accountability system for those involved. May need to assign an accountability officer.
- Coordinates with security.
- Ensures that security sweeps the area for secondary devices at the CP and staging areas.
- Establishes minimum protective posture for personnel in the area.
- Formulates a plan, and disseminates it to the appropriate sectors.
- Establishes and maintains direct communications with all elements such as, the decontamination element, initial entry element, sample collection element, security element, and others as necessary.
- Determines protective action distances if required.
- Continues to emphasize awareness for the possibility of secondary devices and perpetrators.
- Has common radio channels/frequencies assigned to sectors to improve operational control and efficiency.
- Establishes casualty collection points.
- Isolates the protective clothing worn by responders, and treats the clothing as contaminated until proven otherwise.
- Establishes a contaminated waste area.
- Makes arrangements for the replacement of contaminated protective clothing.

- Schedules periodic situation briefings.
- Plans/implements crew rotation (work/rest cycles).
- Reviews and reevaluates personal protective levels.
- Maintains a log of incident operations.
- Establishes personnel accountability.
- Initiates air monitoring.
- Notifies the local/HN authorities of the protective action distances that extend into civilian sectors if required.
- Establishes water supply, hose lines, and suppression as appropriate.
- Notifies supporting medical personnel of the potential for receiving CBRN casualties.
- Monitors (controls if possible) water runoff.
- Issues access credentials if needed.

CONDUCT INITIAL AREA SURVEY

E-20. It is critical to survey the overall area since intelligence analysis and information reporting only provides an idea of what the target is and its composition. No intelligence is 100 percent accurate and conducting an overall initial area survey will provide the R&S element an understanding of the current status of the target.

E-21. An initial entry element is sent in to conduct a thorough initial area survey (actual entry element actions for follow-on sample collection are addressed in appendix H). The following are key tasks (in priority order) accomplished during the initial area survey:

- Determine oxygen levels.
- Monitor for upper explosive limit (UEL) and lower explosive limit (LEL).
- Determine volatile organic compound (VOC) levels.
- Determine radiological levels.
- Determine and revaluate the appropriate IPE/PPE.
- Reevaluate protective posture for entry element.
- Identify all structures in the area that are to be assessed.
- Determine priority of effort.
- Prepare an area sketch to include determining the GPS coordinates and other location identifying information (for example, street addresses).
- Designate buildings by numbers and rooms by letters (this is important later when assessing the material collected from the target).

E-22. The initial entry element will consist of a minimum of two personnel. In the case where unexploded explosive ordnance (UXO) and IEDs exist, EOD personnel must be the initial entry element to render safe the devices. EOD personnel ensure that the area is clear of any additional IEDs, or booby traps. In the case of open areas (fields), a preliminary sweep will be conducted ensuring the same. When it is not practical to clear all IEDs, booby traps, or similar devices from the area, the EOD element will clear and mark a path to the sample collection area if sample collection is required. The initial entry element leader will determine the best placement for the path. Duties will have to be divided up among the element members to record the area, monitor the site for hazards, and communicate. If possible and manpower is available, additional personnel should be added to conduct the initial area survey.

E-23. In unknown environments, the initial entry element will use the appropriate level of protection. If the use of Level A or Level B using supplied air is required, then multiple entries into the site may be necessary to conduct the initial area survey. This is driven by the capacity (time) of the air supply available and if decontamination is required after each entry.

E-24. The initial area survey could be a relatively rapid task or a more prolonged task, depending on the size and complexity of the target area. This is primarily a "walk around" the area; maximum use of looking through windows will be utilized to observe inside structures. The recorder, with guidance from the initial entry element leader, will prepare the area sketch (figure E-1). Within the context of confined spaces, once the area has been properly surveyed (oxygen levels, UEL and LEL, VOC levels, liquid/vapor hazards, and radiation levels have been determined), decisions can be made regarding the appropriate level of IPE/PPE for follow-on elements collecting samples or conducting presumptive or field confirmatory identification.

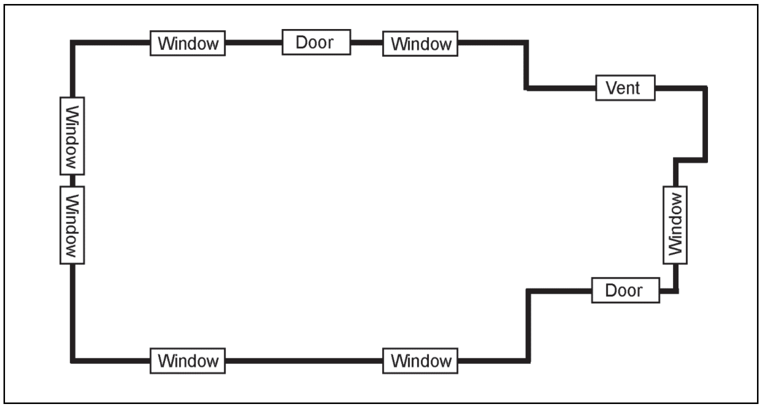


Figure E-1. Sample initial building sketch

E-25. As previously discussed, the element will approach the area from upwind. They will use separate entry and exit locations when entering and leaving the hot and cold zones. The reason behind not using the same route in as out, is that the follow-on element risks immediately becoming contaminated by taking the same route as a dirty element. Figure E-2 illustrates this concept.

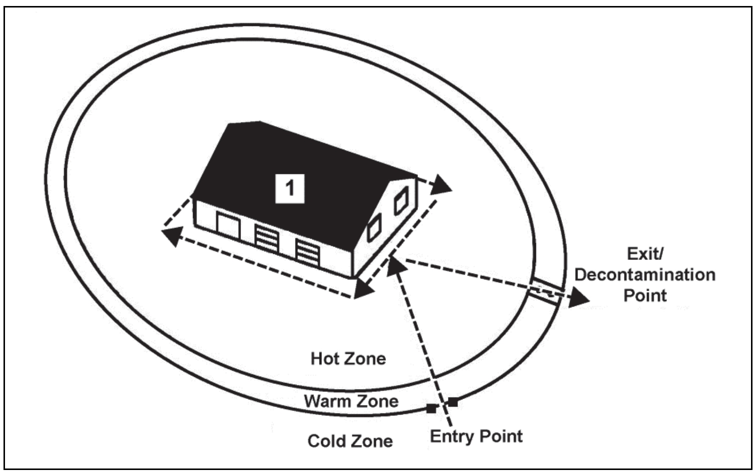
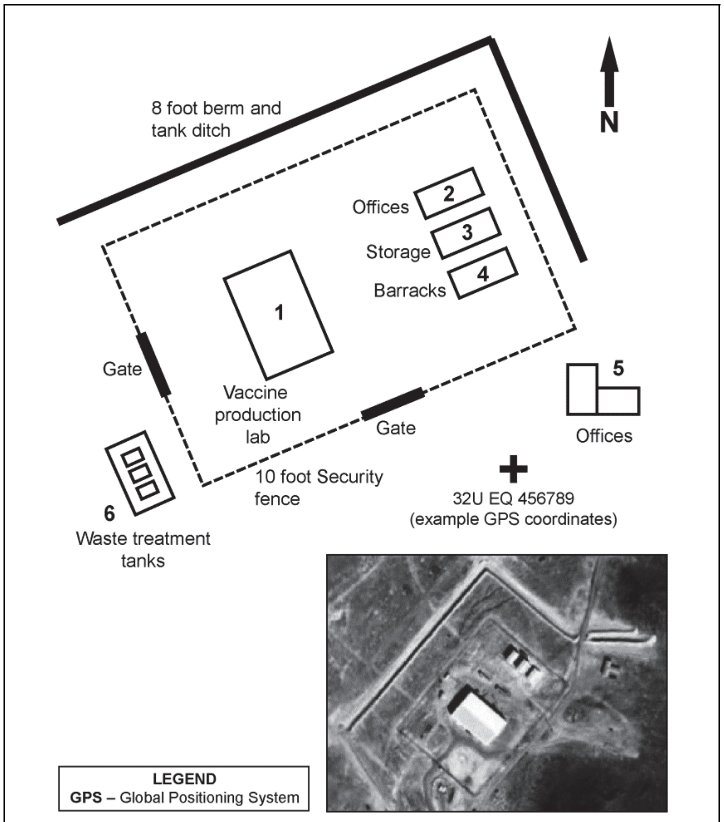


Figure E-2. Sample building survey

E-26. Prior to entering any structure, a GPS coordinate of the structure will be taken and entered on a diagram/sketch form (see figure E-3, page E-8) for an example). If there are streets running near the structure, the names of the streets, if known, will be entered and the proper address. The element moves in a clockwise (left to right) movement around the building to determine the size, number of entry points, and possible function of the building.

E-27. To assist in the initial area survey, all buildings in the area will be assigned a numeric designator (for example, Building 1, Building 2). Within each building, all rooms will be identified by a letter designator (for example, Room A, Room B). Entrances to each building are noted on the area sketch, along with the number of floors and if the building extends below ground (see figure E-4, page E-8, and figure E-5, page E-10). This will provide a structure for tracking collected material (samples, documents, and other items of interest). It will also enhance mission command/C2.



Legend:

GPS	Global Positioning System
N	North

Figure E-3. Sample area sketch

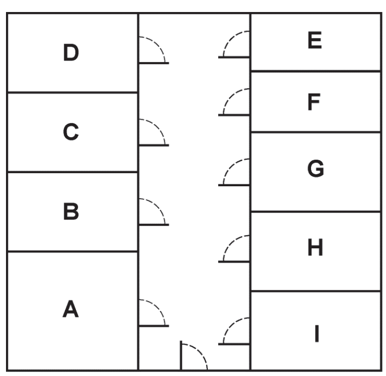
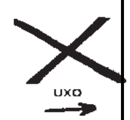


Figure E-4. Sample room identification and sequence

E-28. The entry element will mark the door with a slash. This indicates that an element has entered through that doorway. When they exit, they will mark the same door, leaving an *X.* This indicates that an element has entered and exited. They will also place the room designation on the door; *A* for the first room. (See table E-2 for marking scheme.)

Table E-2. Door and entrance marking

Location	
When marking doors, place the markings on the door if possible. This avoids confusion if doors are close to each other. The second location is on either side of the door. If there is a potential for confusion as to which door is being marked, an arrow in the information section of the marking can be used. The third location is on the floor immediately in front of the door in question. Route markings that indicate direction are placed on the walls at eye level to indicate the direction an element has moved. Colored chalk, tape, or permanent marker can be used to mark. When possible, markings are made at eye level. Markings will be large and clearly legible.	
Element has entered a room/passed through a doorway, and has not exited. A single slash is placed on the door.	
The element has entered/passed through and has exited. This marking is a continuation of the original slash placed on a door where entry was made.	
The element has cleared the room and needs to be reviewed by follow-on elements. This could mean that there are potential samples or other items of interest to follow-on elements.	
Information provided at the base of the marking is reserved for things of immediate importance to an element making an entry, that is; UXO, booby traps, flammable atmosphere readings, other possible dangers, or other information important to follow-on elements.	
Element has moved in the direction indicated. The design of the arrow is of little importance, as long as it clearly shows the direction of movement by the element.	
Legend: UXO unexploded ordnance	

E-29. The initial entry element will conduct first-entry monitoring of the area for the presence of a hazardous environment. First-entry monitoring can also assist to determine sample priorities. For confined space, or limited ventilation areas, the initial-entry element will check air quality for explosive hazard, or lack of oxygen by using an appropriate detector. Prior to opening the door, the entry element will use the detector with the sampling probe if so equipped. The probe will be slipped under the doorframe if possible. If not, the element will carefully crack the door open, observe for booby traps, and insert the probe into the room. The element will use the detector to determine the room's oxygen level, if there are combustible gases present (LEL), and if VOCs are present in the atmosphere. The element will also check radiation levels. The lack of oxygen (not applicable if the element is using their SCBA systems), presence of combustible gases, a high concentration of VOCs, or radiation above a predesignated level would cause the element to abort their entry. In the case of VOCs, the element would have to determine what compounds are present before making a determination if it safe to enter and if a change in IPE/PPE is necessary.

E-30. If the detector readings are acceptable, the element will proceed. Continuing to check for booby traps, the element will fully open the door. The door should be jammed open. The element will carefully enter the structure. Once inside, the element will gain situational awareness. The element must survey and assess the structure. If possible, the element should start at the lowest level. Whatever level they begin on is designated as floor one.

E-31. The initial entry element will move through the structure in a clockwise (left to right) movement. While in the structure, the element will make radio checks with the command every five minutes. During this radio check, the element will apprise the CP of their location and actions. If the element loses communication with the CP, they will retrace their movement until communications can be reestablished. If communications cannot be reestablished, the element will execute their contingency for communications loss such as sending the back-up entry element to reestablish communication.

Note. In no instance should a single person be sent into the hot zone.

E-32. The initial entry element will survey the room using a search pattern. The room should be divided into quadrants. The element should search the room starting at the door and work from left to right. The initial sweep of the room is to observe for key items of interest and hazards. The element will designate the room walls with numbers so to better record what they see (see figures E-5 and E-6). The element will be alert to the presence of radiation (using a RADIAC detector) and CW agents (using chemical detectors such as the lightweight chemical detector/joint chemical agent detector). The element members will continually check the device for readings.

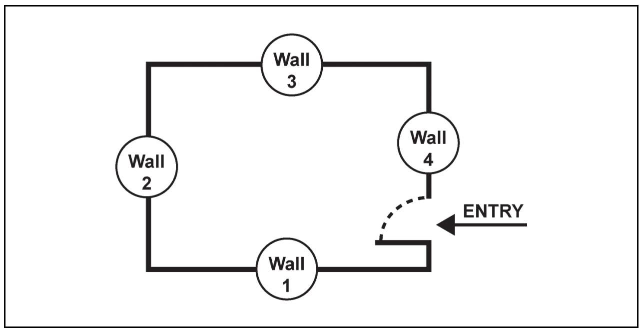


Figure E-5. Numeric designation of room walls

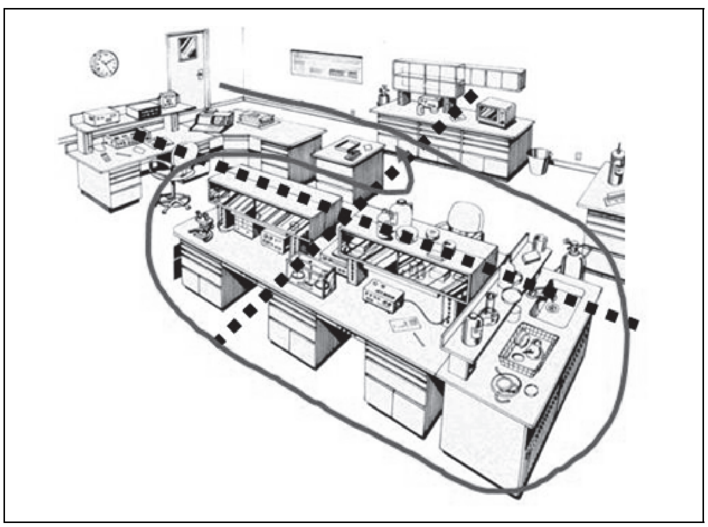


Figure E-6. Initial room sweep

E-33. The initial entry element should be alert for the presence of booby traps. The element should touch nothing during the initial sweep. They should note the location of closed containers and items of key interest. The initial sweep is to obtain information to facilitate detection and identification operations. The second element member should use a digital video camera to record the room.

E-34. The initial entry element will mark safety hazards, access and egress areas, and any challenges that may affect the operational effort of the sample collection element. Marking may be used using red chemlights to mark (identify) potential forms of harm: thermal, radiological, asphyxiation, chemical, biological, mechanical, and structural. Green may be used to mark access/egress routes, and clear paths of travel. Each CBRN R&S element should have internal marking procedures in its SOP. Chemlights may also be used to mark rooms to be exploited by follow-on elements.

Note. Area survey rule of thumb: *turn nothing off that is on and nothing on that is off.*

E-35. During the initial sweep of the room, the initial entry element should locate items of interest (warning signs, added or extra ventilation, markings on containers, chemical symbols or notation, paperwork, drawings, sketches). The element should look for items relating to CBRN, such as the following:

- Containment.
- Processing equipment.
- Waste disposal.
- Signs of release.
- Safety equipment.

E-36. The equipment can be varied and may never have been intended for the purposes it is now being used. Additionally, the safety considerations for handling and storing material may be very different than that of a western nation.

E-37. Initial survey observations are—

- Look for anything obvious while securing and during initial survey of area.
- Determine if CBRN agents are being produced, stored, or weaponized at this location.
- Be alert for booby traps/IEDs.
- Note instrument readings and/or detections.
- Consider if layout of area is consistent with facility (false walls/rooms).

D-86. When a suspicious item is encountered, the entry element must first assess the "big picture," look for all hazards before proceeding, document its location and the surrounding area, and finally, determine if it is an item of interest. Is this item CBRN-related and was it expected or not? If it is not CBRN-related, is it hazardous and does it pose a threat?

E-38. When approaching the item of interest—

- Photograph/document the undisturbed item.
- Determine if the item recognizable?
- Move toward the item.
- Watch for dangers.
- Record all actions with the item.
- Initiate detection procedures.

E-39. Once the initial sweep of the room has been completed, the entry element should proceed to the next room. Once the entire building has been surveyed, the entry element should move to the element control point. Depending on the size and complexity of the target, the initial surveys may take a short period of time or could require a substantial amount of time. Depending on the IPE/PPE and detection equipment (based on hazard) requirements, there may be multiple trips required to complete the initial survey.

E-40. If possible, the R&S element should sketch out the structure as they move through it. This may be difficult given a complex structure, but it will allow the element to better document their findings and develop the sample collection plan. It also provides better clarity to those reading the assessment report.

E-41. The initial entry element leader will mark possible sample collection points by priority (the preferred method is to use 3- by 5- inch cards with the number one as the top priority), but the priorities are subject to change based on METT-TC/METT-T.

E-42. Using the diagram/sketch form, the sample element leader will start to sketch the layout of the area where sample collection is to take place. This is done in each room/area where sample collection is projected to occur. Particular attention will be paid to determining potential sample collection locations. Sketch the layout of the room/field with dimensions, measurements, and items that may be of interest. The diagram/sketch form may be used to brief the sample collection element and will be used for further analysis of the sample collection area. The sample collection element may use this form when conducting sample management operations. Relevant reference points, hazards, and control areas should be annotated on the form. Numbered index cards that are indicated in the diagram/sketch form can be linked with the photographic log. In this way, sample collection locations have a commonality throughout the operation.

E-43. On completion of photographing, filming, and surveying, the R&S element will place documentation into a large zip top bag with information facing outward so it may be read. Photographic equipment will be bagged, unless equipment was placed in an underwater camera case before entering the contaminated area, and processed through technical decontamination. Care must be exercised in the handling of possibly contaminated equipment with sensitive electronics. Denatured alcohol may be used to wipe down equipment. If contamination is suspected on the device, use liquid crystal displays on video camera and digital camera to review area information without removing the photographic equipment from their clear overpacks, a 6-milliliter bag or zip top bags.

E-44. Based upon the area assessment, the element leader will revise his plan for assessment and collection. A priority of effort for sample collection will be developed.

E-45. Based on METT-TC/METT-T the R&S element leader may execute one of the following COAs:

- Call forward the sample collection element and begin sample management operations. Ensure that sample element brings all required equipment to the sample area. Sample collection element leader will brief his personnel on sample collection operations concept. This occurs when limited time is available and adequate protection is available for the R&S element to stay longer. This method allows for the leader to actually be present and show further sample collection and exploitation elements where to collect samples. A drawback is the guidance and briefing to the arriving element will be done while in protective posture and giving an effective briefing in this type of situation may not be conducive to good communications. This includes additional entry elements continuing the area assessment and rest periods per entry element.
- Sample collection element leader will process through technical decontamination with the EOD element and recorder. After processing through technical decontamination, the sample collection element leader will formulate the sample management plan based on any intelligence, photographs, and area sketches obtained of the sample area. This method is used when there is enough time and equipment (for example, IPE/PPE, dosimetry devices, and decontaminants) available.

E-46. After processing through technical decontamination, the reconnaissance leader will brief the sample collection element members. They will review any digital photographs, video, and the diagram/sketch form. As part of this area overview, the reconnaissance leader will identify all hazards noted. At this time, the initial entry element leader will review possible sample collection points with sample collection element leaders so that the sample collection points are valid. The R&S element leader will make IPE/PPE adjustments based on detection and identification of agents as required.

Sample Management Plan

E-47. The development of a sample management plan is discussed in appendix H.

Sample Collection

E-48. Sample collection TTP are discussed in appendix H.

Exit Procedures/Decontamination

E-49. Prior to exiting the area, the R&S element must communicate ahead to the decontamination station in the warm zone so that the decontamination personnel are prepared to receive them.

E-50. The method of decontamination is determined based on time available, threat level, and the IPE/PPE worn. As a minimum, decontamination of boots/footgear is necessary for all personnel and equipment that have been in the hot zone. It is possible that no contamination was encountered in the hot zone and the R&S element leader can forego conducting decontamination based on the findings of the entry elements and field analysis conducted. Prior to decontamination, a check is conducted of all personnel that were in the hot zone.

E-51. The R&S element is self-sufficient in using technical decontamination. Technical decontamination allows the R&S element to rapidly process through a decontamination station, removing their contaminated IPE/PPE and monitoring devices. All contaminated IPE/PPE, monitoring devices, and individual and collective equipment is packaged for processing off-target at a supported decontamination site. See *MultiService Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Consequence Management Operations* for more information on emergency and technical decontamination procedures.

E-52. If the situation is permissive and the R&S element is supported by a decontamination unit, then a thorough decontamination operation should be undertaken at or near the target. This will limit the possible spread of contamination and negate the need for further decontamination operations.

E-53. If Level A or Level B PPE is worn, then it is necessary to perform technical decontamination. It is similar to a conventional thorough decontamination line, but incorporates the use of water and the doffing procedures necessary when wearing SCBA. See *MultiService Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Consequence Management Operations* for more information on technical decontamination.

PACKAGING/DOCUMENTATION/TRANSPORT

E-54. Sample packaging, documentation, and transport are discussed in appendix H.

REPORTING

E-55. Reporting should normally occur as a two-part process:

- **Initial assessment report.** The first report of the initial findings will occur upon completion of the mission or upon identification of PIR. Reporting of an identified PIR will occur immediately when found.
- **Suspect area survey report.** The final postmission report will be delivered to the higher headquarters, normally within 48 hours unless otherwise specified in the order, SOPs, or command guidance. Report format can be found in appendix H.

DISMOUNTED CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE OPERATIONS

E-56. The CBRN reconnaissance survey techniques that are used for dismounted reconnaissance operations are similar to those used for mounted operations, except for the distances covered and the duration of time spent in an area. Dismounted reconnaissance is configured in a minimum of two-man elements for personnel safety. One person conducts the dismounted reconnaissance, while the other person remains in overwatch as security.

E-57. Dismounted CBRN reconnaissance provides the tactical commander with accurate information pertaining to CBRN activity in the operational environment in order to prepare forces to operate in the CBRN environment or, if possible, avoid contamination. The key tasks for CBRN reconnaissance are detect, locate, identify, quantify, sample collection, survey, mark, and report. (Detailed information on sample collection can be found in appendix H, marking in appendix J, and reporting in appendix I.) The commander considers the factors of METT-TC/METT-T to determine whether to conduct dismounted reconnaissance.

E-58. If a CBRN R&S element is using a Level A or B protective ensemble, a backup R&S element should be on standby. *MultiService Tactics, Techniques, and Procedures for Nuclear, Biological, and Chemical (NBC) Protection* provides information on levels of IPE and PPE. The backup R&S element can assist the primary R&S element if a problem occurs. The backup R&S element, as a minimum, will enter the area of suspected contamination in the same level of protection as the primary element.

E-59. Dismounted CBRN reconnaissance operations may be conducted upwind, downwind, or crosswind of the suspected area of contamination. The survey element remains mounted until reaching a point 100 meters from the limit of the possible hazard (provided by the CBRN control center [CBRNCC]). At that point, members of the survey element dismount, don the appropriate level of IPE/PPE, dosimetry devices, and initiate the predetermined dismounted technique (for example the zigzag, lane, cloverleaf, or grid). Details for these techniques are shown later in this appendix. The mission is terminated after detecting or locating the hazard as planned or upon reaching the expected source of the hazard and getting negative detection results.

E-60. Using an upwind approach, the members of the survey element will reach the expected point of release (source) of the hazard quicker and are not exposed to the hazard until they are close to the release point. They do run the risk of being exposed to greater levels of contamination because the concentration of the CBRN agent or materials will be greater at the release point. This is especially true for radioactive sources.

E-61. Dismounted CBRN reconnaissance operations are similar to mounted operations described in appendix C. However, dismounted operations require more time, CBRN reconnaissance personnel are more exposed to the effects of CBRN hazards, and activities are conducted on foot in lieu of vehicles. The following are CBRN survey procedures:

- Locate the general boundaries of the contaminated area.
- Place warning markers at specified intervals around the contaminated area and at all entry points.
- Determine the intensity of the contamination.
- Report information using CBRN4 report.

E-62. Commanders may use one of three forms of reconnaissance, or a combination of the three. The three forms of CBRN reconnaissance are route reconnaissance, zone reconnaissance, and area reconnaissance.

Route Reconnaissance

E-63. Route reconnaissance is a form of reconnaissance that focuses along a specific line of communications, such as a road, railway, or cross-country mobility corridor. The procedures for CBRN route reconnaissance procedures are—

- Determine the appropriate level of protection.
- Reconnoiter the route and determine locations of contaminated areas along the route.
- Conduct CBRN survey to define the boundaries of the contamination.
- Locate and mark bypass routes if contamination is encountered.
- Evaluate and classify bridges, defiles, overpasses and underpasses, and culverts along the route so that CBRN weapons have not produced collateral damage.
- Locate fords, crossing sites, or bypasses for existing and reinforcing obstacles (including built-up areas) along the route to avoid or bypass CBRN hazard.
- Identify and mark clear bypass routes.
- Report and mark CBRN hazards along the route.

Area Reconnaissance

E-64. A CBRN area reconnaissance is a directed effort to obtain detailed information concerning a specific area. An area reconnaissance is a specialized form of zone reconnaissance that proceeds faster since the effort is focused on a specific piece of terrain. CBRN area reconnaissance procedures are—

- Determine the appropriate level of protection.
- Reconnoiter all terrain within the area for contamination.
- Locate bypass routes around identified contaminated areas.
- Report and mark all chemical, biological, radiological, and nuclear hazards within the area.
- Locate and mark bypass routes if contamination is encountered.
- Request decontamination support if necessary.

ZONE RECONNAISSANCE

E-65. Zone reconnaissance is a form of reconnaissance that involves a directed effort to obtain detailed information on all routes, obstacles, terrain, and adversary forces within a zone defined by boundaries. A zone reconnaissance is a deliberate, time-consuming process that requires a substantial expenditure of resources and is optimum for dismounted reconnaissance. Zone reconnaissance procedures are—

- Determine the appropriate level of protection.
- Locate previously reported chemical, biological, radiological, and nuclear incident areas and determine if there is still a hazard.
- Reconnoiter all terrain within the zone for contamination. Locate possible contamination within the zone.
- Report and mark chemical, biological, radiological, and nuclear hazards within the zone.
- Locate commercial chemical or nuclear facilities, storage areas, and waste sites.
- Check water sources for contamination.
- Mark contaminated areas.
- Request decontamination support.
- Locate routes to bypass contamination.

SUPPORT AREA

E-66. The areas of greatest vulnerability are large fixed sites (for example, ports of debarkation), staging and marshaling areas, hubs, bases, assembly areas, MSRs, and sites involved in early force buildup activities.

- Aerial port of debarkation fixed sites may also be targeted to disrupt or inhibit U.S. military deployments. Because it is unlikely that the operational areas of an aerial port of debarkation will be contaminated at any one time, it is particularly important that the commander know the location of hazard areas, working and parking area requirements, and the availability of runways and taxiways.
- SPODs may also be attractive targets for CBRN attack. CBRN attacks may result in contamination of some operating surfaces, but the size of the contaminated area may be small compared to the size of the port. Conducting area reconnaissance at facilities within the port is important to sustaining throughput operations.

DISMOUNTED CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR LOCATE TECHNIQUES

E-67. To find suspected or actual CBRN hazards, CBRN locate techniques are used. The staff passes intelligence information gathered from the suspected or actual incident to the CBRN R&S element. When conducting dismounted CBRN reconnaissance tasks, the CBRN R&S element assumes the appropriate protective posture according to intelligence information. CBRN dismounted, locate techniques require more time and possible exposure to contamination than mounted operations. CBRN locate techniques require applied judgment based on METT-TC/METT-T. The mission, terrain, and adversary indicate the technique that should be used. Additional considerations for dismounted, CBRN locate techniques include unexpected encounters such as adversary situation, type of agent, and need for decontamination operations. Upon completion of CBRN locate techniques, the CBRN R&S element reports findings and awaits follow-on orders such as conducting survey operations.

E-68. There are four techniques used to locate possible contamination in the AOR. The techniques are zigzag, lane, cloverleaf, and grid.

ZIGZAG

E-69. The zigzag technique is used to locate contaminated areas during route, zone, or area reconnaissance missions. Depending on the terrain, the distances could be larger or smaller. The zigzag technique has a higher probability of detecting contamination because the surface area not traversed is less than that of other search techniques. The following are procedures for the dismounted, zigzag technique (figure E-7) :

- The CBRN R&S element begins its search at the deployment (start) line, maintaining at least 25-meter intervals between personnel.
- The CBRN R&S element moves forward along a line that is oriented 45° from the start line.
- The CBRN R&S element monitors identification equipment for indications of contamination.
- After the CBRN R&S element has moved 100 meters along the first zig, it turns 90° and zags taking readings at each turn and repeating the process until the end.
- Depending on the terrain, the distances could be larger or smaller.
- The CBRN R&S element continues to zigzag until the CBRN R&S element has reached its limit of advance.
- Once the entire mission area has been searched, the CBRN R&S element reports the results.
- If the CBRN R&S element did not search the entire mission area, it begins a new sweep.
- The CBRN R&S element repeats the process until contamination is detected or the entire mission area is searched.
- The CBRN R&S element reports the results normally using CBRN4 report.
- The CBRN R&S element coordinates for decontamination.
- The CBRN R&S element may transition to a CBRN survey if contamination is found.

LANE

E-70. The lane technique is used to locate contaminated areas. It is very similar to the zigzag technique, but is primarily used during route reconnaissance missions. It can also be used for area reconnaissance of long, narrow pieces of terrain (such as defiles). The procedures for the lane technique are—

- The CBRN R&S element begins its search at the line of departure with an interval of less than 50 meters between personnel.
- The CBRN R&S element would follow an azimuth for a designated distance.
- For narrow routes, the CBRN R&S element moves in a staggered column. Each CBRN R&S element moves along a line until it reaches the limit of advance.
- If the CBRN R&S element did not search the entire mission area, it begins a new sweep and repeats the process until contamination is detected or the entire mission area is searched.
- If contamination is found on a route, the CBRN R&S element creates/submits a CBRN4 report and moves on to the next lane.
- Once the entire mission area has been searched, the CBRN R&S element reports the results.
- The CBRN R&S element coordinates for decontamination.
- The CBRN R&S element may transition to a CBRN survey if contamination is found.

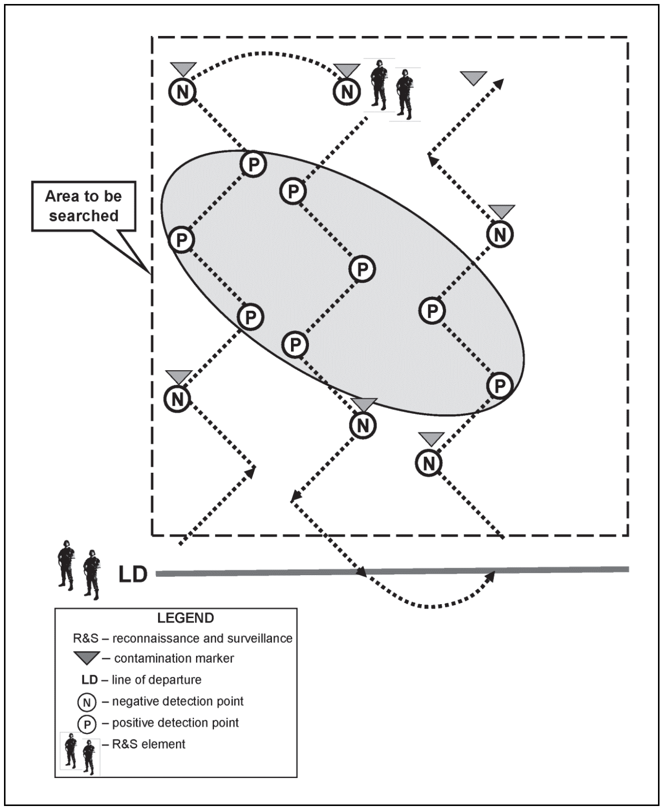


Figure E-7. Dismounted, zigzag technique

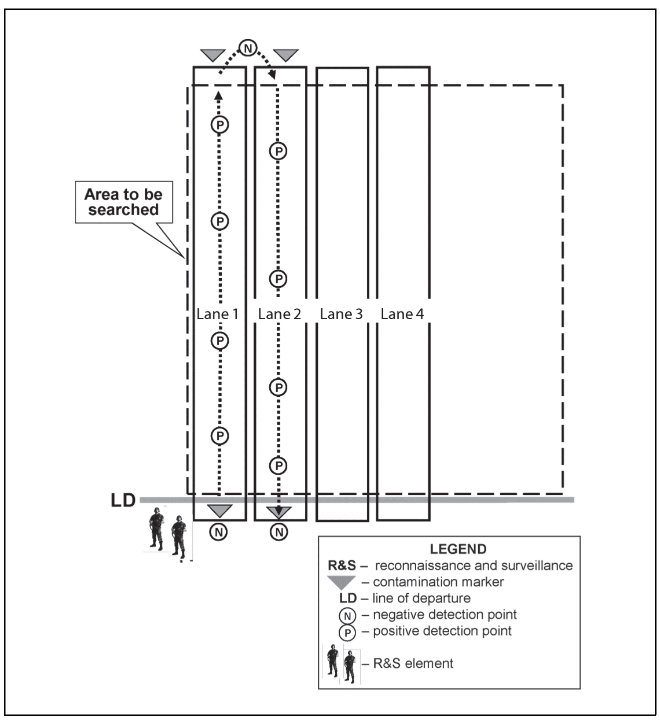


Figure E-8. Dismounted, lane technique

CLOVERLEAF

E-71. The dismounted, cloverleaf technique (figures E-16 and 17) is time-consuming; however, it provides detailed coverage and information about an area. The following are procedures for the dismounted, clover technique:

- The CBRN R&S element begins its cloverleaf at a starting point central to the area to be checked.
- The CBRN R&S element moves in a figure-8 pattern using the start point as the center of the 8. If a second element is used, the second element conducts the same pattern moving 90º direction from the first element. If only one element is conducting the cloverleaf, it completes one figure 8 and then conducts a second figure 8 at a 90º angle from the first figure 8.
- The CBRN R&S element monitors identification equipment for indications of contamination.
- The CBRN R&S element will conduct check at set intervals along its route, or for radiological can conduct continuous monitoring.

Note. Depending on the terrain, the distances could be larger or smaller.

- If the CBRN R&S element did not search the entire mission area, it begins a new cloverleaf within the area not checked.
- The CBRN R&S element repeats the process until contamination is detected or the entire mission area is searched.
- The CBRN R&S element reports the results normally using a CBRN4 report.
- The CBRN R&S element coordinates for decontamination
- The CBRN R&S element may transition to a CBRN survey if contamination is found.

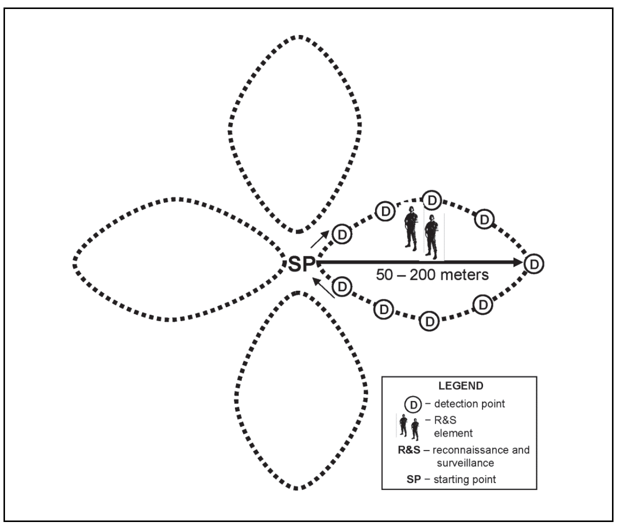


Figure E-9. Dismounted, cloverleaf technique

GRID

E-72. The grid technique is employed by R&S elements conducting dismounted reconnaissance, where accuracy is important. It is employed by superimposing a grid over the R&S element maps, which enables them to rapidly communicate locations for detections, where samples were collected, and the locations of casualties. Number and/or letters are assigned to each detection point and each detection point is associated with a predetermined GPS location. (See figure E-19.)

E-73. The following are procedures for the grid technique:

- The CBRN R&S element establishes the boundaries of the area to be checked.

- The CBRN R&S element preselects points within the area that it will check for contamination.
- Normally the points to be checked are laid out in an evenly spaced grid pattern.
- The CBRN R&S element conducts checks at each point within the grid.
- The CBRN R&S element reports the results normally using a CBRN4 report.
- The CBRN R&S element coordinates for decontamination.
- The CBRN R&S element may transition to a CBRN survey if contamination is found.

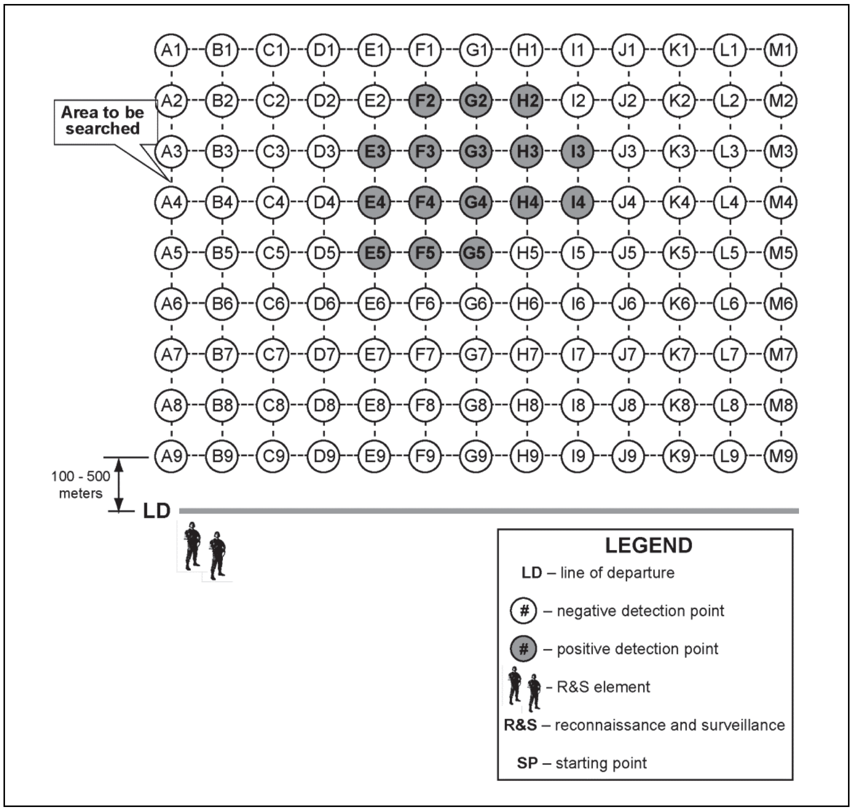


Figure E-10. Dismounted, grid technique

TRIANGULATION

E-74. The triangulation search technique is used to locate radiological sources that have been detected by some form of dosimeter or detector. The triangulation technique's strengths in locating radioactive sources lie with the small number of personnel (three) needed to accomplish the procedure, thereby ensuring personnel exposures remain as low as reasonably achievable, and the ability to rapidly locate the radioactive source even if there are buildings or other shielding materials in the area.

E-75. Shielding effects from buildings may produce confusing dose rate readings. Use the procedures in below when obstacles are encountered along the triangulation legs:

- The element leader takes readings in a semicircular sweep method, at the location of initial hazard recognition, noting the directional heading of maximum exposure.
- From this heading, the two additional personnel are sent out 100 meters in directions of +45° and -45° from the initial heading.
- Personnel perform the sweep method to determine the direction heading of maximum exposure.
- If readings are less than 0.02 centigray per hour, personnel reverse their heading and travel back 60 meters, and perform the sweep method again.
- Once three readings above 0.02 centigray per hour are obtained and plotted, an indication of what area contains the radiological source should be evident.

E-76. The following are procedures for triangulation with obstacles:

- Walk along the obstacle staying 10 meters away at all times, taking readings while facing the obstacle every 5 to 10 meters.
- Upon reaching the end of the obstacle, travel beyond the obstacle 20 meters, assume the direction of the original heading, and take the next set of dose rate readings by using the semicircular sweep method.
- If the largest dose rate reading does not point back toward the obstacle, provide the directional heading towards the largest reading. However, if the largest dose rate reading does point back toward the direction of the obstacle, provide the directional heading associated with the largest reading taken from behind the obstacle.
- In some situations, element members may reach the end of the obstacle and see that all dose rate readings were the same. Under these circumstances, personnel should continue to take readings at 10-meter intervals along the entire obstacle perimeter. If exposure readings in the direction of the obstacle remain constant, the source is located in the obstacle. However, if the dose rate readings do not remain constant, provide the directional heading, facing away from the obstacle, at the location of the largest dose rate reading.

E-77. The projected area of where the radiological source is located is then used as the focal point for a cordon declaration by the incident commander.

Note. If at any time the dose rate is above 1 centigray per hour stop immediately, note the location and direction of the reading, and leave the area. Adjustments to the triangulation legs must be made so that personnel exposure remains as low as reasonably achievable.

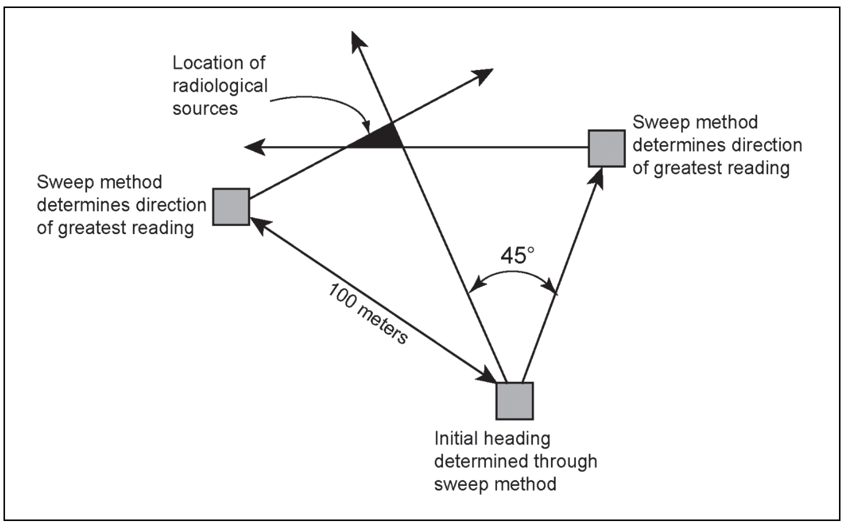


Figure E-11. Triangulation locate technique

E-78. Time challenges may exist when dealing with large sample areas that require the collection of many samples.

DISMOUNTED CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR SURVEY TECHNIQUES

E-79. CBRN surveys define the boundaries of contaminated areas. CBRN survey techniques require applied judgment based on METT-TC/METT-T. The mission, the terrain, and the adversary indicate the technique that should be used. There are four dismounted survey techniques that can be employed when the contamination is located: nearside-farside, box, star, and bounce-and-bypass.

NEARSIDE-FARSIDE

E-80. The nearside-farside dismounted survey technique (figures E-23 and E-24) is used by an R&S element whenever they enter a contaminated area. The nearside-farside survey technique employed by a dismounted element is similar to the technique used by the mounted element, except for the intervals between detection points. The dismounted survey element uses 50- to 100-meter intervals. The following are procedures for the dismounted nearside-farside survey technique:

- Each CBRN R&S element determines if they are in the contaminated area.
- If a CBRN R&S element is in the contaminated area, it moves back along its original path checking for contamination every 50 meters until CBRN contamination is no longer detected.
- Once out of the contaminated area, it emplaces appropriate warning markers.
- Once the initial element has found the nearside boundary of contamination, it moves forward across the contaminated area, testing every 100 meters.
- When contamination is no longer detected, the R&S element moves forward another 100 meters and checks again.
- If no contamination is detected, it places a CBRN warning marker.
- This process is repeated until it is clear of the contamination.
- Each R&S element executes this process to determine the nearside and farside boundaries of the contamination.
- The CBRN R&S element reports the results normally using CBRN4 report.
- The CBRN R&S element coordinates for decontamination.

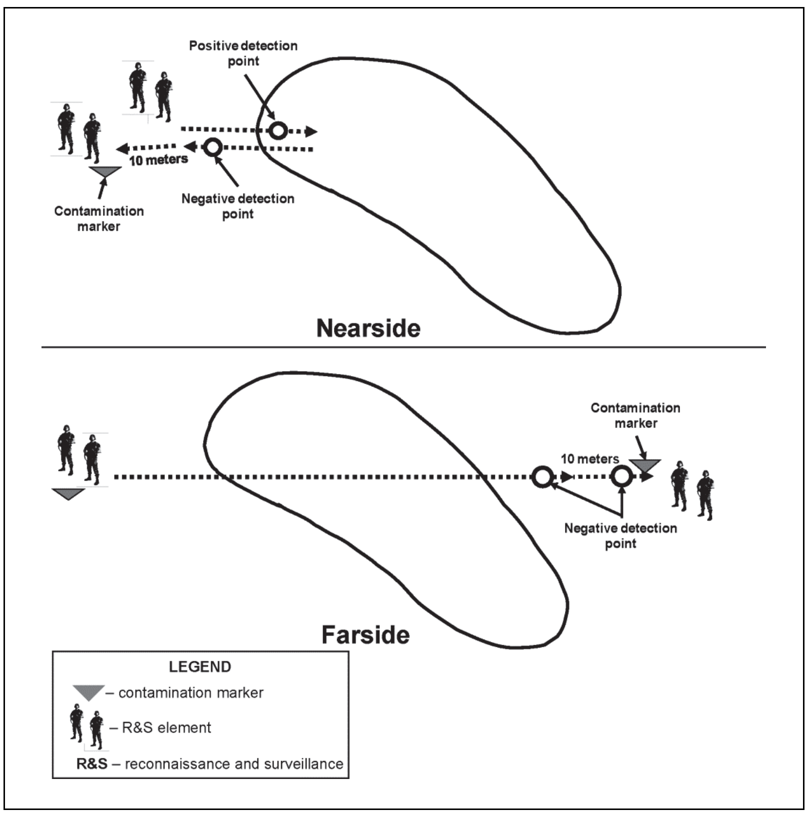


Figure E-12. Dismounted, nearside-farside survey technique

BOUNCE-AND-BYPASS

E-81. The bounce-and-bypass dismounted survey technique (figures E-25 and E-26) is used to locate the general boundaries of a CBRN contaminated area. The following are procedures for the dismounted, bounce-and-pass survey technique:

- The CBRN R&S element stops and checks for contamination in their immediate areas.
- If no contamination is detected, the CBRN R&S element proceeds forward until contamination is detected.
- Once contamination is detected, the CBRN R&S element proceeds out of the contaminated area and places a CBRN marker where no contamination is found.
- The CBRN R&S element proceeds along a general axis moving in the appropriate cardinal direction away from the initial start point at least 100 meters or as prescribed in the operation order.
- Then turn in the same cardinal direction toward the contaminated area until contamination is detected again.
- Once contamination is detected, the CBRN R&S element proceeds out of the contaminated area and places a CBRN marker where no contamination is found.
- This process will continue until no contamination is found.
- The CBRN R&S element reports the results normally using CBRN4 report.
- The CBRN R&S element coordinates for decontamination.

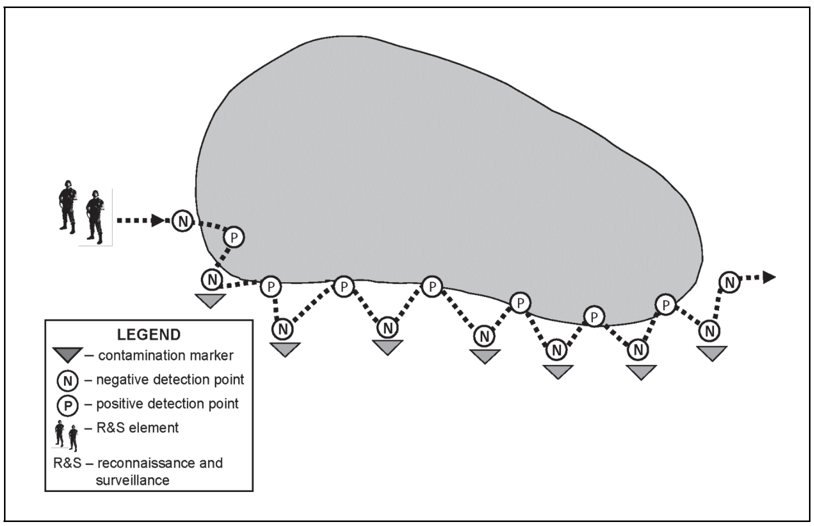


Figure E-13. Dismounted, bounce-and-bypass technique

COURSE LEG

E-82. The course leg technique is used to find the extent and intensity of radiological contamination. The CBRN R&S element moves between two checkpoints; for example, from Point A (top of a hill) to Point B (top of another hill). Readings are taken at given intervals along the route between the two checkpoints. When conducting a dismounted, radiological course leg, the element must be given a turn-back dose and turn-back dose rate. Reporting results of dismounted, course leg techniques may be done in various ways. Normally a survey data sheet can be filled out and turned in to the tasking headquarters at the end of the mission or the data can be sent via a CBRN4 report. The following procedures outline and the course leg technique:

- The CBRN R&S element reads the survey meter and records the dose rate at the start point of the course leg.

- The CBRN R&S element reads the survey meter and records the dose rate at each preselected interval along the course leg. Under no circumstances should the element continue further into a contaminated area if it reaches its turn-back dose or turn-back dose rate.
- The CBRN R&S element reads the survey meter and records the dose rate at the end point of the course leg.
- The CBRN R&S element reports the results normally using CBRN4 report.
- The CBRN R&S element coordinates for decontamination.
- The CBRN R&S element rechecks and zeros the RADIAC meter before each course leg to assure proper operation.

Note. Conducting dismounted, radiological course legs versus mounted or aerial radiological course legs results in higher radiation doses to personnel. Further guidance on radiological aspect of conducting a course leg technique can be found in *MultiService Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Avoidance*.

PRESELECTED DOSE RATE

E-83. The dismounted R&S element looks for a given dose rate or multiple given dose rates designated by the commander. This technique is used for old contamination and neutron-induced radiation. For old contamination that is greater than the time of attack (for example, (H)+48), the CBRN R&S element moves along a route or designated straight line in an area until it finds 1 centigray per hour and/or its designated dose rates. When conducting a dismounted, radiological preselected dose rate technique, the element must be given OEG, which includes a turn-back dose and turn-back dose rate. Reporting results of dismounted, preselected dose rate techniques may be done in various ways. Normally, a survey data sheet can be filled out and turned in to the tasking headquarters at the end of the mission, or the data can be sent via a CBRN4 report. The following procedures outline and illustrate the preselected dose rate technique (see figure E-30):

E-84. The CBRN R&S element departs its start point and constantly monitors the survey meter while moving along its designated route. Under no circumstances should the element continue further into a contaminated area if it reaches its turn-back dose or turn-back dose rate.

- Upon locating a reading of 1 centigray and/or its designated dose rates, the CBRN R&S element records the dose rate and drops a radiological marker if directed.
- The CBRN R&S element records its final reading upon reaching the end point of its route or its highest preselected dose rate.
- The CBRN R&S element reports the results normally using CBRN4 report.
- The CBRN R&S element reports personnel exposure to its command for recording and annotation in their medical records.
- The CBRN R&S element coordinates for decontamination.
- The CBRN R&S element rechecks and zeros the RADIAC meter before each mission to assure proper operation.

Note. Conducting dismounted, radiological preselected dose rate missions versus mounted or aerial radiological preselected dose rate missions, results in higher radiation doses to personnel. Further guidance on radiological aspects of conducting a preselected dose rate technique can be found in *MultiService Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Avoidance*.

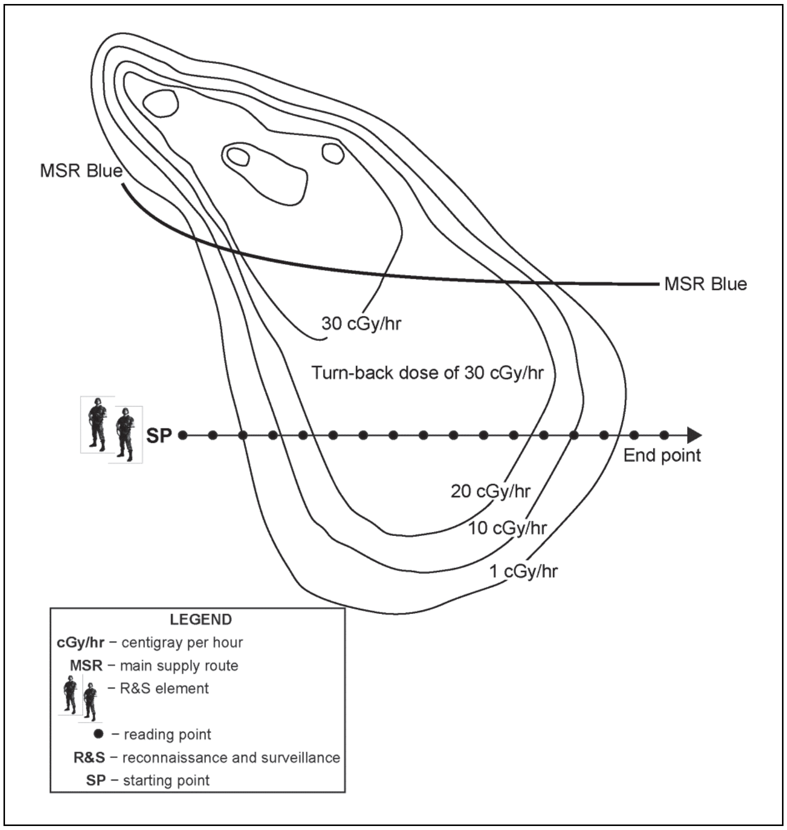


Figure E-14. Dismounted, course leg technique

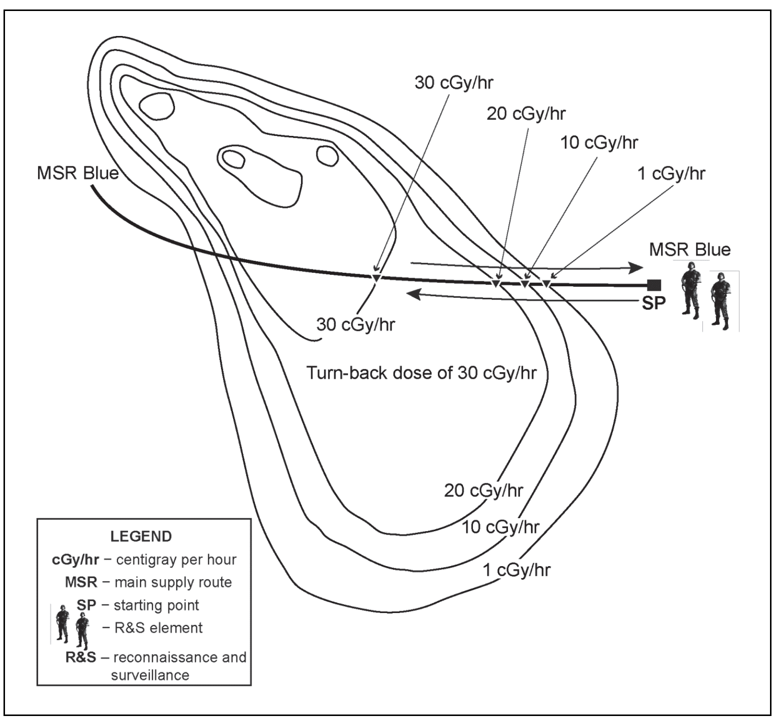


Figure E-15. Sample preselected dose rate technique

BOX

E-85. The box dismounted, survey technique is used to determine the general dimensions (length and width) of a contaminated area. Figure E-31 and figure E-32, page E-30, outline and illustrate the dismounted, box survey technique. The CBRN R&S element may use the decision tree depicted in figure E-33, page E-30, to determine which direction and distance to proceed. The following are dismounted, box survey techniques:

- The CBRN R&S elements stop and check for contamination in their immediate areas.
- The first CBRN R&S element to report contamination becomes the base element.
- If any other CBRN R&S element is located in the contaminated area, they must back out of the contamination.
- All other CBRN R&S elements should orient on the base element.
- At least one CBRN R&S element should be to the left and one CBRN R&S element to the right of the base element.
- When contamination is found, a CBRN4 report is generated and the element turns 180° and returns to a grid intersection.
- A CBRN marker is placed if the grid intersection is far enough away from the contamination. (If not, the element moves out further to place a CBRN marker.)
- The left CBRN R&S element turns 90° to the right and bounds to the next grid intersection to determine the extent of the contamination. (Conversely, the right element turns 90° to the left and bounds to the next grid intersection to determine the extent of the contamination.)
- This process is continued until the presence of or extent of contamination is confirmed and until the CBRN R&S elements meet.
- This process of going straight or turning continues in a boxlike movement until the element has crossed the initial farside line; this is the initial right limit of the contamination.
- The movement of the CBRN R&S element depends on the orientation of the contaminated area.
- Once the CBRN R&S element has reached the initial farside line, the element moves toward the base element while checking for contamination.
- The element to the left of the base CBRN R&S element executes the same movement as the CBRN R&S element to the right, except its first turn is to the left. While this may sound complicated, it is not difficult to execute.
- The reconnaissance CBRN R&S element leader must receive continuous reports from the other elements on their findings—positive or negative.
- From these reports, the CBRN R&S element leader plots the findings to get a general idea of the contamination layout.
- Once the CBRN R&S element leader is satisfied that the limits of the contamination have been determined, the R&S element locates the best route to bypass the contamination.
- Warning markers are erected around the contamination and along any trails leading into the contaminated area so that the bypass route is clearly marked.
- The CBRN R&S element reports the results normally using CBRN4 report.
- The CBRN R&S element coordinates for decontamination.

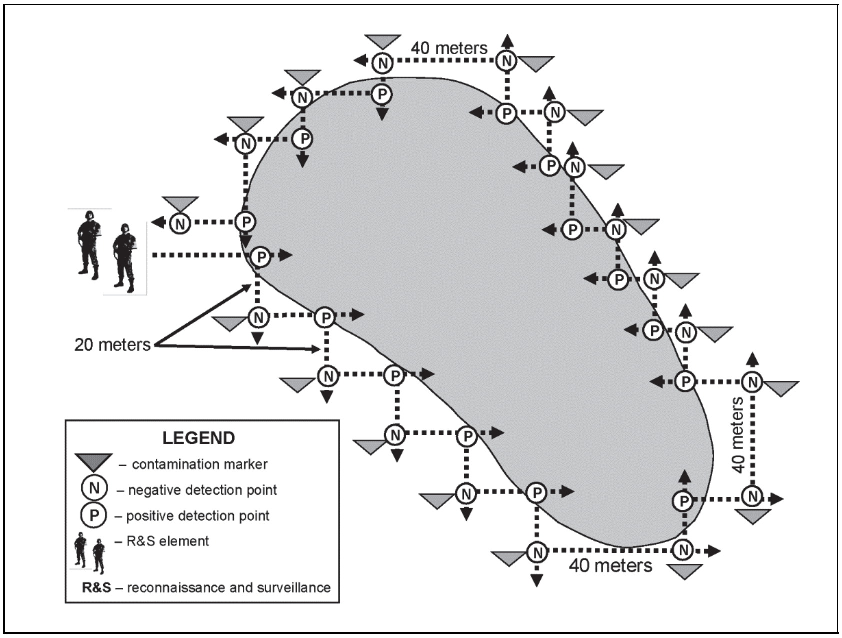


Figure E-16. Dismounted, box survey technique

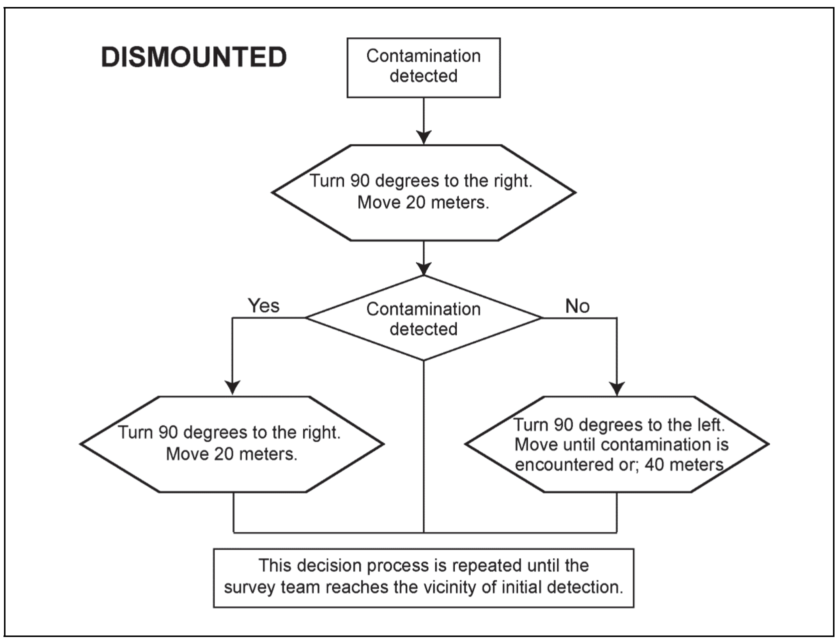


Figure E-17. Dismounted, box survey decision tree

STAR

E-86. The dismounted, star survey technique is a very quick way to determine the rough limits of a contaminated area. The following are dismounted, star survey technique procedures:

- The CBRN R&S element that encounters the contamination moves back from the contaminated area 100 meters from the initial positive reading.
- This point is the base of the star.

- The CBRN R&S element posts a warning marker and proceeds forward to find the farside, detecting every 100 meters until no contamination is detected.
- The CBRN R&S element proceeds another 100 meters, checks again so that no contamination is detected, and posts a warning marker.
- This ends the first leg of the star.
- The element turns about 135° and travels in that direction, detecting every 100 meters.
- If no contamination is detected on this leg, the element does not travel any longer than the length of the initial leg.
- The element repeats this process until it arrives at or near the base of the star.
- This technique can be used by two or more elements to obtain more detecting points, increasing the accuracy of the survey.

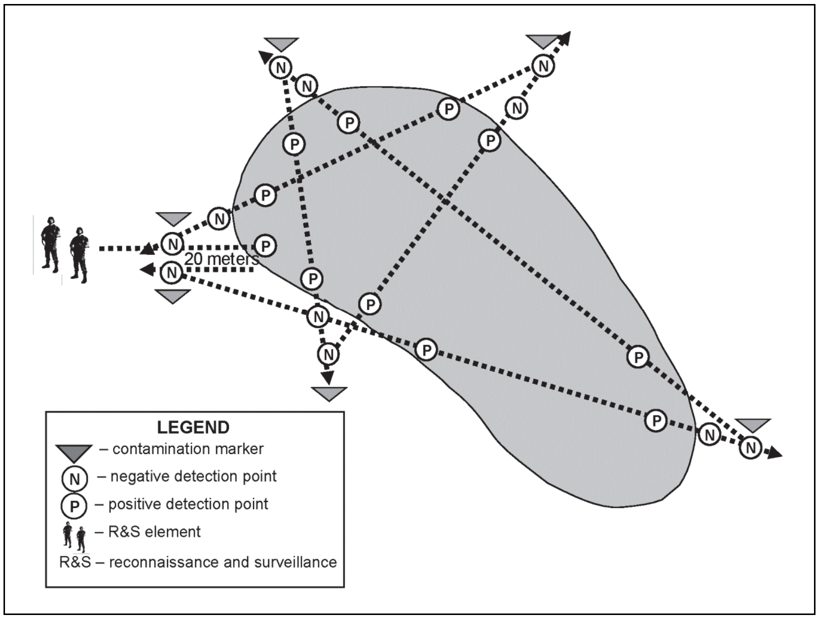


Figure E-18. Dismounted, star survey technique

DISMOUNTED CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR RECONNAISSANCE MOVEMENT TECHNIQUES

E-87. A CBRN R&S element uses standard movement formations and techniques to arrive at its assigned area. These techniques are similar to those described in appendix C for mounted operations except that they are conducted dismounted.

E-88. The CBRN R&S element employs movement techniques for a number of reasons: to minimize exposure, maintain freedom of movement, maximize available tactical options, and react effectively to contact. Effectively employed, dismounted movement techniques allow the R&S element to find and observe threats/hazards without being compromised.

E-89. At the same time, however, dismounted movement techniques alone are not enough to guarantee accomplishment of these tactical goals. The CBRN R&S element must use them in conjunction with other movement- and security-related measures. For example, the CBRN R&S element must make maximum use of all available natural cover and concealment when moving.

E-90. The CBRN R&S element conducting dismounted operations may use vehicles to reach a point near or on the target. When vehicles are involved, the CBRN R&S element must consider the security of the vehicles. That includes the use of additional personnel and the possibility of compromise of the operation from vehicle noise. There are two security formations used when vehicles are not moving—herringbone and coil.

HERRINGBONE

E-91. The herringbone formation (figure E-19) is used to disperse the CBRN R&S element when it is traveling in a column formation. The herringbone formation may be used during air attacks, or when the element must stop during movement, or personnel must dismount to conduct one or more of the CBRN reconnaissance tasks. The herringbone formation allows the CBRN R&S element to move to covered and concealed positions from a road or an open area, and it establishes all-round security without requiring detailed instructions. Vehicles are repositioned as necessary to take advantage of the best cover, concealment, and fields of fire. Crewmembers not involved in CBRN reconnaissance-specific tasks dismount and establish security.

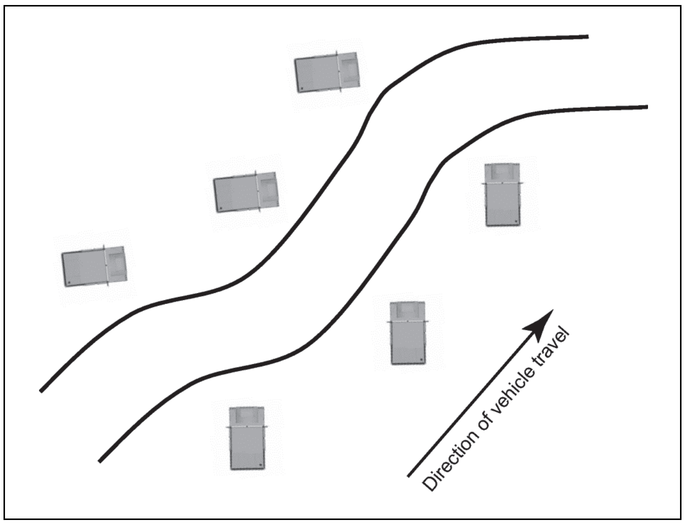


Figure E-19. Herringbone formation at the halt

COIL

E-92. The coil formation (figure E-20) provides 360° security and observation when the CBRN R&S element is stationary. It is useful for tactical refueling and resupply and when issuing element orders. Security, including air guards and dismounted personnel, is posted during the execution of CBRN reconnaissance tasks. The coil formation is used as follows:

- When visibility is limited, the element leader forms the coil. When the coil is complete, all vehicles stop, adjust for cover and concealment, turn 90° outward, and post security.
- During daylight, or when speed is essential, the element leader signals for vehicles to move into position and stop. Other vehicles move directly to their assigned positions (as stated in the element SOP), seek cover and concealment, and post security.

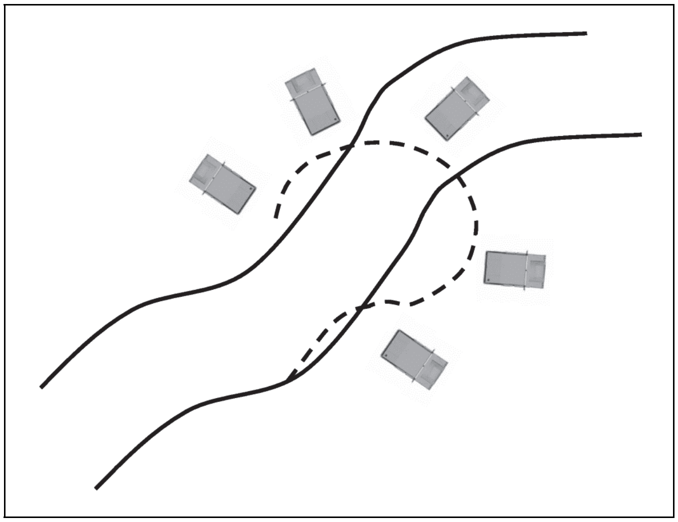


Figure E-20. Coil formation at the halt

E-93. In the conduct of most tactical missions, the CBRN R&S element moves under the mission command/C2 of the element leader.

E-94. The CBRN R&S element may use one of three movement techniques to reach their objective—traveling, traveling overwatch, or bounding overwatch.

TRAVELING

E-95. The traveling technique is employed when speed is necessary and adversary contact is not likely. The CBRN R&S element moves in a column formation, using the appropriate intervals based on visibility, terrain, and weapons ranges. When using vehicles, the CBRN R&S element moves continuously at a maximum safe speed. When the column stops, vehicles move into a herringbone or coil formation and dismount. The CBRN R&S element moves along covered and concealed routes, automatically contracting and expanding based on terrain and visibility. Local security is maintained according to the element SOP. Each vehicle posts an air guard. The CBRN R&S element leader locates where he can best exercise control.

TRAVELING OVERWATCH

E-96. The traveling overwatch technique is employed when adversary contact is likely (possible). The CBRN R&S element moves in a column formation, using the appropriate intervals and designated lead and trail elements. The trail CBRN R&S element moves continuously, following covered and concealed routes. When using vehicles, the lead element is approximately 50 to 100 meters ahead of the trail element, depending on terrain and vegetation. When on foot, the lead CBRN R&S element is approximately 25 to 50 meters ahead of the trail element, depending on terrain and vegetation. The trail CBRN R&S element moves at varying speeds, stopping as required to overwatch the lead element. Visual contact is maintained with the lead CBRN R&S element at all times. The trail CBRN R&S element overwatches at a distance that would allow it to fire or move to support the lead CBRN R&S element if necessary. In wooded areas or restricted terrain, elements reduce the speed and the intervals. In adverse weather conditions, the crew of the lead vehicle dismounts to verify route trafficability and maneuverability, and the trail CBRN R&S element provides overwatch. The CBRN R&S element maintains local security according to the element SOP.

BOUNDING OVERWATCH

D-87. The bounding overwatch technique is employed when adversary contact is expected. The intent of this technique is for the element to deploy prior to contact, giving it the ability to protect the bounding CBRN R&S element by immediately suppressing an adversary force. Considerations when using bounding overwatch include:

- The staggered column formation is the standard movement formation.
- When using the bounding overwatch technique, the overwatch element is assigned sectors to scan. The lead CBRN R&S element bounds forward, following a covered and concealed route.
- The bounding CBRN R&S element should avoid masking the direct fires of the overwatch CBRN R&S element, and it must not move beyond the effective supporting range of the overwatch CBRN R&S element. The bounding CBRN R&S element may be a single element or multiple CBRN R&S elements.
- The overwatching CBRN R&S element covers the progress of the bounding element from covered and concealed positions, offering observation and fields of fire against suspected adversary positions.
- Visual contact is maintained at all times. The length of a bound is based on terrain analysis and the ranges and fields of fire from the overwatching vehicles.
- When cresting a hill, entering an open area, exiting a defile, or moving through restrictive terrain, a crewmember dismounts from the vehicle. He moves forward on foot to a point where he can observe all suspected and likely adversary firing positions.
- The CBRN R&S element maintains local security according to the element SOP.

E-97. Regardless of which technique is used, the leader gives the CBRN R&S element an order explaining what each member of the element will do. This becomes more critical as the likelihood of adversary contact increases. If possible, the CBRN R&S element leader should provide his element with the following information:

- The adversary situation as he knows or suspects it to be.
- The next overwatch position (the objective for the bounding element).
- The route of the bounding element to that position.
- What the overwatch does after the bounding element gets to the next position.

E-98. Selection of a movement technique is based in large on terrain considerations and the likelihood of adversary contact. These techniques provide a standard method of movement, but the CBRN R&S element must use common sense in employing these techniques as they perform their missions and encounter different situations. The following rules apply to military personnel on foot and/or vehicle crews using terrain for protection:

- Do not silhouette themselves against the skyline.
- Cross open areas quickly.
- Do not move directly forward from a concealed firing position.
- Avoid possible kill zones because it is easier to cross difficult terrain than fight the adversary on unfavorable terms.
- Avoid large, open areas, especially when they are dominated by high ground or by terrain that can cover and conceal the adversary.
- Take active countermeasures; such as using smoke, direct, and indirect fire; to suppress or obscure suspected adversary positions.

DISMOUNTED CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR SURVEILLANCE

E-99. Dismounted CBRN surveillance operations are generally conducted in the same manner as mounted operations. Although the term dismounted defines this section, there will be times when the CBRN R&S element uses vehicles to get to or near the location where the dismounted CBRN surveillance operations take place. Consideration must be given to the mode of travel, OP selection, sustainment and relief, security, and follow-on mission of CBRN surveillance operations.

E-100. Generally, a dismounted CBRN surveillance operation requires the CBRN R&S element to travel on foot to conduct operations. This is due to the close proximity of the area, buildings, roads, or personnel that the surveillance operation is targeting and METT-TC/METT-T factors that are favorable for the operation. When the CBRN surveillance operation is located at distances too far to travel on foot, another mode of transportation is used. Based on METT-TC/METT-T factors, the CBRN R&S element may travel by land vehicles, amphibious craft, or aircraft such as helicopters. When traveling by watercraft or airframe, the CBRN R&S element is dropped off at a predesignated location and then travels by foot from the drop-off point to the specified location. In that case, the need to protect and possibly conceal a vehicle is not an issue. However, when the CBRN R&S element is not being dropped off, vehicle safety and concealment must be considered. Additional considerations include—

- Providing additional security for vehicles.
- Taking caution so as to not be heard or possibly seen by the adversary or others who may communicate arrival to the adversary.
- Dismounting at distances that will not alert to the arrival.
- Being compromised by civilians in the mission area.

E-101. CBRN surveillance provides observation of a specific area for indications of a CBRN incident. Based on IPOE/IPB and vulnerability planning, these designated areas are typically NAIs. The commander prioritizes the use of available CBRN R&S elements against designated NAIs; and CBRN R&S elements monitor, watch, and listen to areas for indications of a CBRN incident. Surveillance may be conducted from OPs—positions occupied to observe a designated area. The CBRN R&S element occupying the OP reports any indication of a CBRN incident or adversary activity. Surveillance may also be conducted by routine patrols through the operational area. This type of surveillance is normally conducted in rear areas along MSRs and road networks.

Observation Post Site Selection

E-102. The supported unit leader or the CBRN R&S element leader selects the general location for the OP. The leader considers METT-TC/METT-T factors, the intelligence collection plan, and the ISR plan when determining the general positioning of the OP site.

Attack Indicators

E-103. Hazards can be disseminated by using overt or covert methods. See appendix C for attack indicators.

Location Surveillance

E-104. Reconnaissance is the first step in location selection. Begin with a map reconnaissance. Use the map reconnaissance to determine initial surveillance areas that support the employment tactic; and then select primary, alternate, and supplemental surveillance locations within each surveillance area. Some rules of thumb for the CBRN surveillance include the following:

- Reconnoiter the detection areas and potential locations firsthand if possible.
- Coordinate with the terrain owner before conducting the surveillance operation.
- Ensure that the CBRN R&S element includes the designated serial leaders.
- Select the location that provides the greatest concealment.

DISMOUNTED CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR OBSERVE TECHNIQUES

E-105. The CBRN surveillance task of observing is accomplished by two techniques: critical node and area array.

Critical Node

E-106. In support areas, dismounted CBRN R&S elements may be assigned CBRN surveillance missions to observe designated areas for CBRN incidents. MSRs and areas to be occupied by logistics and mission command/C2 facilities may also be checked for CBRN threats/hazards before their occupation. Figure

D-38 outlines procedures for conducting the critical-node observation technique. The following are critical-node technique procedures:

- Occupy observation points to overwatch the designated area.
- Report all indications of a CBRN incident.
- Employ monitoring capabilities.
- Operate and perform operator's maintenance on CBRN monitoring equipment.
- Conduct CBRN monitoring operations.
- Provide data for the completion of CBRN reports.

E-107. Mounted CBRN R&S elements observe specified areas or NAIs for indications of a CBRN incident. Based on IPOE/IPB and vulnerability planning, the commander prioritizes the use of available collection assets against designated NAIs; and R&S elements employ observation and detection procedures on designated areas for indications of an incident.

E-108. The primary means of surveillance may be from OPs. An OP is a position occupied to observe a designated area. The mounted CBRN R&S element reports any indication of a CBRN incident or adversary activity. Another means of mounted CBRN surveillance is conducting routine patrols through the operational area. This is normally conducted in support areas along MSRs and road networks.

Area Array

E-109. An area array is established in order to maximize the probability of CBRN hazard detection over a large area of interest. The primary objective is to detect a hazard upwind of the operational area of concern and to provide the greatest potential warning to those in the hazard area. The specific architecture of the array is designed by the CBRN staff in close coordination with operations, intelligence and medical staffs. Refer to appendix A for more specific information on surveillance planning considerations and detector employment tactics. The following are procedures for conducting the area array observation technique:

- Consider threat, terrain, weather conditions, performance characteristics, and quantity of CBRN detector assets.
- Determine the appropriate separation distances between CBRN detectors.
- Operate and perform operator's maintenance on CBRN monitoring equipment.
- Report all indications of a CBRN incident.
- Conduct CBRN monitoring operations.

DISMOUNTED CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR MONITOR TECHNIQUES

E-110. The CBRN surveillance task of monitoring is accomplished by two techniques: periodic and continuous.

Periodic

E-111. As the name implies, periodic monitoring is accomplished by employing CBRN detector assets at predetermined intervals of time. Prior to an incident, the time between monitoring is based primarily on the threat assessment. When intelligence estimates deem there is a reduced likelihood of a CBRN incident, the commander is more apt to call for periodic monitoring of the area of concern. In doing so, CBRN resources (equipment and personnel) are conserved and power consumption (fuel and batteries) is reduced.

E-112. Following a CBRN incident, the periodic monitoring technique may be utilized over an extended period to determine whether hazardous effects remain in the area.

Continuous

E-113. Conversely, the continuous monitoring technique is accomplished by employing CBRN detector assets uninterrupted over the duration of the monitoring operations. Similar to periodic monitoring, the threat assessment will be the prime determinant in deciding to apply the continuous monitoring technique.

When an incident is anticipated, continuous monitoring provides the greatest opportunity for warning the area of concern of impending hazardous conditions.

E-114. During and immediately following a CBRN incident, the continuous monitoring technique is employed to note either the dissipation or proliferation of the hazard area and to estimate the duration of CBRN effects.

E-115. Continuous monitoring will place a much heavier burden on personnel (operators and maintainers) and logistics (detectors, batteries, fuel). These factors should be considered and adequately coordinated throughout the staff.

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Appendix F

Aerial Chemical, Biological, Radiological, and Nuclear Reconnaissance

This appendix provides aerial CBRN reconnaissance TTP. The aerial mode of CBRN reconnaissance provides speed and added protection to CBRN R&S elements when conducting their mission. CBRN aerial reconnaissance operations support commanders and their staffs by increasing situational awareness as they plan, coordinate, and execute CBRN R&S missions. Aerial reconnaissance could enhance many missions by improving CBRN detection capabilities, obtaining combat information about adversary and indigenous population activities and resources, and providing meteorological and geographical characteristics of key terrain. Currently, manned aerial systems are limited to radiological sensing. Unmanned systems for CBRN sensing and sample collection are currently not available.

MANNED AERIAL RADIOLOGICAL RECONNAISSANCE

F-1. There is one form used to conduct manned aerial radiological reconnaissance—the route form. There are also two techniques used when conducting an aerial route, they are the course leg and preselected dose rate techniques. The CBRNCC briefs the pilot and the R&S element. All information concerning the mission (survey height, ground speed, routes, course legs, checkpoints) comes from the CBRNCC. The survey team leader and the instrument operator sit beside each other to aid in communications. The survey team leader must have communication with the pilot.

F-2. The aircraft flies to and lands at a specified area. The aircraft must land near the point of interest. The monitor dismounts, proceeds to the selected point, and takes the reading by using normal ground monitoring procedures. When high dose rates do not permit this procedure, aerial dose rates are taken using an air-ground correlation factor. There are two methods for obtaining the air-ground correlation factor—direct determination and use of standardized tables (indirect). Direct determination is the preferred method and is accomplished as follows:

- An aerial dose rate is taken at a given point and height during the survey.
- The aircraft lands and a ground dose rate is obtained at the same area.
- The air-ground correlation factor is obtained by dividing the ground dose rate by the aerial dose rate.
- New data must be obtained when height changes 15 meters or more or when ground foliage or surface conditions vary significantly.

ROUTE

F-3. The aircraft flies between two checkpoints, following the route of a predominant terrain feature (a road, riverbank, railroad track) that connects the two checkpoints. The aircraft only lands to get the air-ground correlation factor data needed by the CBRNCC. The procedures are identical to those for a course leg survey; however, a straight flight direction may or may not be required. The following are aerial route procedures:

- Determine the appropriate level of protection.
- Obtain operational exposure guidance (turn-back dose and turn-back dose rate).
- Reconnoiter the route and determine locations of contaminated areas along the route.
- Report all chemical, biological, radiological, and nuclear (CBRN) threats/hazards along the route.

Course Leg Technique

F-4. The aircraft flies a straight line between two checkpoints; for example, from Point A (top of a hill) to Point B (top of another hill). The aircraft only lands to obtain the air-ground correlation factor data. The following are course leg procedures:

- The pilot maintains (as near as possible) a constant height above ground, a constant ground speed, and a straight flight direction between the start and end checkpoints of each course leg.
- The pilot flies the aircraft on the proper course over the start checkpoint and on a straight path to the end checkpoint. Shortly before reaching the start checkpoint, the pilot alerts the monitor and gives the monitor the height above ground.
- The monitor records the time and height above ground. The monitor then rechecks and zeros the RADIAC meter before each course leg to ensure proper operation.
- The pilot gives the command "MARK" when the aircraft is directly over the start checkpoint. The monitor reads the survey meter, records the dose rate, and begins timing preselected time intervals.
- The monitor reads the survey meter and records the dose rate at each preselected time interval; for example, every ten seconds.
- The pilot alerts the monitor again when the aircraft approaches the end checkpoint. The pilot then gives the command "MARK" when the aircraft is directly over the end checkpoint.
- The monitor reads and records the final dose rate.

Preselected Dose Rate Technique

F-5. The dismounted R&S element looks for a given dose rate or multiple given dose rates designated by the control center team. This technique is used for old contamination and neutron-induced radiation. For old contamination that is greater than the time of attack (for example, (H)+48), the team moves along a route or designated straight line in an area until it finds 1 centigray per hour and/or its designated dose rates. When conducting a dismounted radiological preselected dose rate technique the element must be given a turn-back dose and turn-back dose rate. Reporting results of dismounted preselected dose rate techniques may be done in various ways. Normally, a survey data sheet can be filled out and turned in to the tasking headquarters at the end of the mission or the data can be sent via a CBRN4 report. The following are preselected dose rate technique procedures:

- The pilot maintains (as near as possible) a constant height above ground, a constant ground speed, and a straight flight direction between the start and end checkpoints of each route.
- The pilot flies the aircraft on the proper route over the start checkpoint and on a path to the end checkpoint. Shortly before reaching the start checkpoint, the pilot alerts the monitor and gives the monitor the height above ground.
- The monitor records the time and height above ground. The monitor then rechecks and zeros the RADIAC meter before each route to ensure proper operation.
- The monitor constantly monitors the survey meter while moving along its designated route. Under no circumstances should the element continue further into a contaminated area if it reaches its turn-back dose or turn-back dose rate.
- Upon locating a reading of 1 centigray and/or its designated dose rates the monitor records the dose rate and area.
- The pilot alerts the monitor again when the aircraft approaches the end checkpoint. The pilot then gives the command "MARK" when the aircraft is directly over the end checkpoint.
- The monitor reads and records the final dose rate.
- The CBRN reconnaissance and surveillance (R&S) element reports the results normally using CBRN4 report.
- The CBRN R&S element coordinates for decontamination if required.
- The CBRN R&S element rechecks and zeros the RADIAC meter before each mission to assure proper operation.

> *Note*. Conducting dismounted radiological preselected dose rate missions versus mounted or aerial radiological preselected dose rate mission's results in higher radiation dosages to personnel. Further guidance on radiological aspects of conducting a preselected dose rate technique can be found in *MultiService Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Avoidance*.

F-6. The advantages and disadvantages of aerial reconnaissance over ground reconnaissance for detecting radiological threats/hazards are depicted in figure F-4. The following are aerial radiological survey advantages:

- A large area can be surveyed quickly.
- Speed and flexibility enable surveys over large unoccupied areas, adversary occupied areas, and areas not easily accessible to ground troops.
- Enables surveys of areas where dose rates exceed the commander's operational exposure guide and are dangerous to ground survey parties.
- Exposes personnel to lower dose rates because of the distance the aircraft flies above the ground.
- Requires less equipment and personnel.
- A helicopter and a survey team can cover more terrain than ten trucks with ground survey teams.

F-7. The following are aerial radiological survey disadvantages:

- Dose rate readings are not as accurate as those obtained by ground surveys.
- Weather conditions, such as high winds and extreme temperatures, impact flight operations.
- Dose rates for specific points on the ground are not provided by aerial surveys.
- Resources must be coordinated between pilots and chemical, biological, radiological, and nuclear survey team members.
- May impact external operations (for example, artillery missions).
- Requires availability of aviation assets to conduct operations.
- Increases vulnerability to adversary fires.
- Terrain restrictions may impede landing to take ground readings to calculate the air-ground correlation factor.

F-8. Once collected, aerial survey data must be processed in real time, to include data validation, spectral analysis, and mapping, so that results can be obtained within the first few hours or sooner after landing. This is necessary due to the time constraints for effective response in the early stages of an incident or accident. Planning to collect and record aerial survey data includes defining survey parameters, such as the following:

- Sample time.
- Ground clearance.
- Speed.
- Line spacing on a grid map.

RECORD AND REPORT MANNED AERIAL RECONNAISSANCE MISSIONS

F-9. The CBRNCC relies on reports to construct and update contamination overlays including the COP. The CBRN R&S element must accurately record aerial radiological data as it may be used as evidence of violations of treaties and agreements. Examples of nuclear data sheets can be found in *Multiservice Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Avoidance*.

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Appendix G

Standoff and Remote Chemical, Biological, Radiological, and Nuclear Reconnaissance and Surveillance

This appendix provides standoff and remote CBRN R&S TTP. Standoff and remote CBRN R&S provides early warning and added protection to CBRN R&S elements when conducting their mission. This appendix will discuss the employment, functions, and capabilities of standoff and remote detectors for conducting CBRN R&S, including active and passive CBRN detection technologies and other organic battlefield sensor systems, such as counter-battery radar and missile defense systems. Organic CBRN R&S elements may use equipment that is capable of operating in a standoff and/or remote mode through optical detection methods and advanced algorithms detection technology. Standoff chemical detectors provide near-real-time stationary and on-the-move detection of chemical hazards. Chemical and biological standoff and remote R&S technology provides detection capabilities to warn commanders of an approaching chemical or biological aerosol or vapor cloud in sufficient time to implement protective measures before the actual contamination arrives. Currently, fielded CBRN standoff and remote R&S technologies are predominantly passive systems that detect the presence of chemical and biological hazards by completing a spectral analysis through direct reading of the environment or analysis of a signal (for example, laser induced fluorescence) returning to its source.

CONSIDERATIONS FOR CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR STANDOFF AND REMOTE DETECTION CAPABILITIES

G-1. CBRN R&S elements can use remote or standoff capabilities to detect the presence of chemical or biological aerosol or vapor clouds. The terrain and the adversary dictate which method to use and the level of detail possible. More than one method may be executed during a single mission. The standoff or remote detection equipment varies based on the situation and the threat. Equipment and system operating instructions are found in applicable operator and crew Service and technical publications.

G-2. Chemical and biological standoff and remote R&S equipment may be operated from a dismounted platform or be integrated into mobile reconnaissance platforms that transmit the results to local and remote personnel via electronic information systems.

G-3. Chemical and biological standoff and remote R&S equipment may also be positioned in a covered and concealed location with maximum line of sight (LOS) of designated key terrain (for example, NAI, TAI, or maneuver decision point).

G-4. Land environment observation is the ability to see the adversary's use of CBRN agents via CBRN reconnaissance detection methods, such as OPs or standoff detection devices. However, several factors can hinder observation, including vegetation, buildings, relief features (hills, defiles), distance, sensor capabilities, employment mode (scanning versus staring, stationary versus moving), scope/size of the hazard, precipitation, temperature, humidity and cloud cover. The analysis of each limiting factor can be combined into a single product, usually in the form of an overlay that indicates the LOS.

G-5. The operational air environment is the operating medium for fixed- and rotary-wing aircraft, air defense systems, UAS, cruise missiles, and some theater ballistic missiles. Consider the following:

- **Airfields and support infrastructures.** Identify and analyze CBRN reconnaissance requirements for support of air base operations.
- **Avenues of approach.** Identify air avenues of approach for standoff CBRN monitoring and survey.
- **CBRN collateral effects.** Atmospheric stability could play a key factor in analyzing when an adversary may use CBRN weapons. Production and storage facilities for CBRN weapons present special problems. For each known CBRN facility location, analyze the surrounding terrain and the forecasted weather conditions and patterns to aid in modeling postattack dispersion of contamination. (See *MultiService Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Avoidance.*) A more accurate determination of the hazard area can be made using a hazard prediction model and real-time weather data.
- **Standoff detection.** Identify standoff detection capabilities, and use IPOE/IPB to determine how their use can support mission requirements.

G-6. CBRN R&S elements equipped with standoff LOS chemical detection can detect between the detector and the target area at ranges that vary based on environmental conditions and capabilities available to the force. They can provide a stationary capability to support standoff monitoring of NAIs specified in ISR plans. Standoff detection can be conducted as follows (figure G-1 provides a graphical representation of each):

- **Upwind surveillance.** CBRN R&S elements use this technique to reduce the likelihood of exposure to a chemical agent when conducting chemical surveillance. CBRN R&S element efforts remain focused by IPOE/IPB and the commander's PIR and IR.
- **Downwind surveillance.** This technique provides early warning to R&S elements who may be exposed to chemical agent hazards. The application of this technique must weigh the potential threat against the risk. The IPOE/IPB, risk assessment, and vulnerability analysis must consider the cost factor and the likelihood and impact of exposure of the R&S vehicle, crew, or element.
- **Crosswind surveillance.** When CBRN R&S elements conduct crosswind surveillance, they are positioned to observe the NAI unaffected by head or tail winds. This technique is recommended when contamination avoidance is foremost and observation and sensing can be achieved using standoff sensors and dismounts.

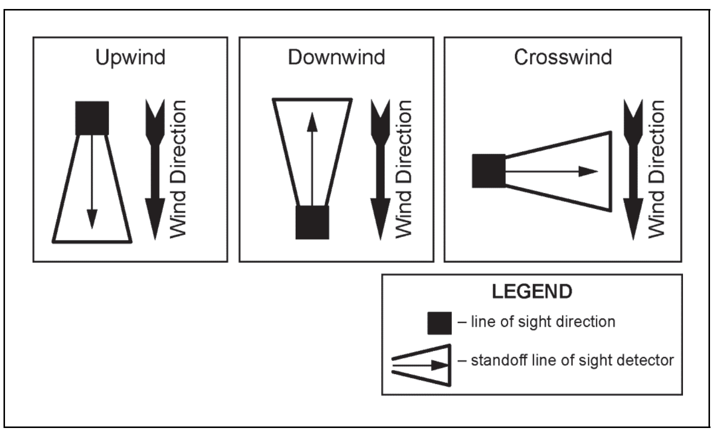

Figure G-1. Standoff line-of-sight wind positioning

STANDOFF DETECTION CAPABILITIES

G-7. Standoff detection is conducted to provide early warning of a CBRN hazard. It supports the CBRN *Sense* operational element that provides the commander information on the threats and hazards in the AOR. Additionally, it serves as a passive defense measure for military personnel to avoid contamination while implementing protection measures and to mitigate or neutralize the effects of a chemical or biological hazard. Standoff technology detects the presence of a chemical or biological agent cloud from a distance that does not require military personnel to enter into the contaminated area. Standoff detectors are capable of applying technologies (for example, laser technology or electromagnetic spectrum) that will measure the change in air and/or area conditions and convert information that is computed to distinguish a chemical or biological agent.

G-8. Standoff detectors are passive defense measures to detect the presence of a chemical or biological hazard. CBRN passive defense includes passive measures taken to minimize or negate the vulnerability to and effects of CBRN attacks. Currently, standoff detection capabilities focus on the chemical and biological aspects; however, new and emerging technologies will present a radiological standoff capability.

G-9. In contrast to point detection, standoff detection provides greater warning time prior to the arrival or passing of a chemical or biological agent. On the other hand, point detection capability only detects the presence of the agent once the agent is upon the detector. Standoff detection is arrayed in many configurations to fit the operational commander's needs. Standoff detection can be—

- Used in support of CBRN reconnaissance operations to detect and locate chemical and biological hazards.
- Used in support of CBRN surveillance operations to observe, monitor, and detect chemical and biological hazards.
- Mounted on vehicles, watercraft, and aircraft for mobile operations in multiple environments.
- Dismounted (generally on tripods) for stationary and fixed-site operations.
- Employed for long-range and short-range detection (depending on the technology available).
- Employed as a remote capability (see remote detection capabilities section).

G-10. Standoff chemical detectors detect and classify the presence of some CW vapors under limited conditions. Standoff chemical detectors—

- Detect chemical agent vapors and can be programmed to detect a wide variety of other chemical hazards, including some TICs.
- Detect the presence of chemical agents by completing a spectral analysis of target chemicals.

G-11. Standoff chemical detectors allow commanders to monitor the AOR for chemical hazards. During periods of increased tension, detectors will be deployed at fixed sites, as mobile detection systems on and around fixed sites (for example, main and collocated operating bases), or in support of maneuver units. Standoff chemical detectors must be positioned to maximize detection in designated areas, and they can be used in an overlapping field of view to provide triangulation and tracking of a cloud. Standoff chemical detectors—

- Monitor avenues of approach and egress routes.
- Search areas between friendly and adversary forces.
- Monitor bridges, road junctions, and other point targets.
- Monitor barriers (minefields, obstacles, chokepoints).
- Cue and vector the CBRN R&S element to or around suspected hazard areas.
- Provide advance detection and warning (that is, area surveillance or unit defense) of hazards to units located adjacent to favorable terrain (that is, having adequate LOS).

G-12. Standoff chemical detectors can be operated in two ways—vehicle-mounted and tripod-mounted. In the vehicle-mounted configuration, the detector is integrated into a mobile R&S platform. Military vehicles equipped with a standoff chemical detector should be positioned with maximum LOS to designated key terrain or routes. The tripod-mounted configuration is addressed in the remote detection capabilities section.

G-13. Where possible, standoff chemical detectors will be employed in pairs (two R&S elements) so that one can use the detector in an overwatch position while the other is moving. The speed of the vehicle will impact the likelihood of detection before coming into contact with contamination. The sensors have a set time it takes to detect. Detection time and speed should be taken into consideration when operating while moving. The detector can be used when the CBRN R&S vehicle is moving. If the standoff chemical detector indicates the presence of vapor hazard, the R&S element uses remaining onboard detectors to determine the extent and type of contamination present.

- Standoff chemical detectors are used on mobile R&S platforms to conduct reconnaissance in the following roles:
  - Identifying potential routes that contain a vapor hazard.
  - Providing overwatch for vapor hazards while other mobile R&S platforms search for liquid hazards.
  - Searching an area for potential unit occupation (for example, assembly area) to determine the presence of vapor hazards.
  - Performing a secondary role to provide warning of off-target vapor attacks at fixed sites.
- In determining the exact location of vapor hazards, there are different types of chemical agents that produce varying amounts of vapor, depending on agent characteristics (see multi-Service publication*, Potential Military Chemical/Biological Agents and Compounds*) and weather conditions. These include G series nerve agents, nerve agent (O-Ethyl S-Diisopropylaminomethyl (VX), and HD. Additionally, standoff chemical detection provides only the direction of the hazard, not distance information. To determine the actual location of a hazard, the unit may use one of the following techniques:
  - **Single system**. A single R&S platform (figure G-2) can stop for one and one-half minutes to take information from multiple detection locations as the vehicle moves along a predetermined route and perform the map resections on all detections. This method can be effective when the wind speed is less than 10 kilometers per hour for a point release.

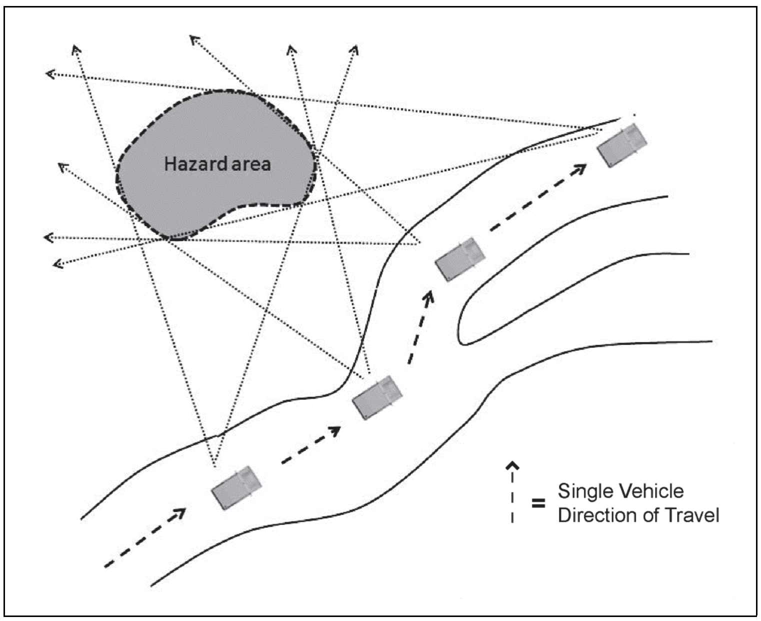

Figure G-2. Single-system detection technique

  - **Multiple systems.** Information from multiple reconnaissance systems (figure G-3) can be combined. Using the direction of the left and right limits, a resection is performed on a map indicating the location of the hazard. This is the preferred method, especially when wind speeds are in excess of 10 kilometers per hour, which creates a moving hazard. This method effectively locates point releases, such as a surface-to-surface missile system impact or a limited artillery strike, but is less effective against a line release.

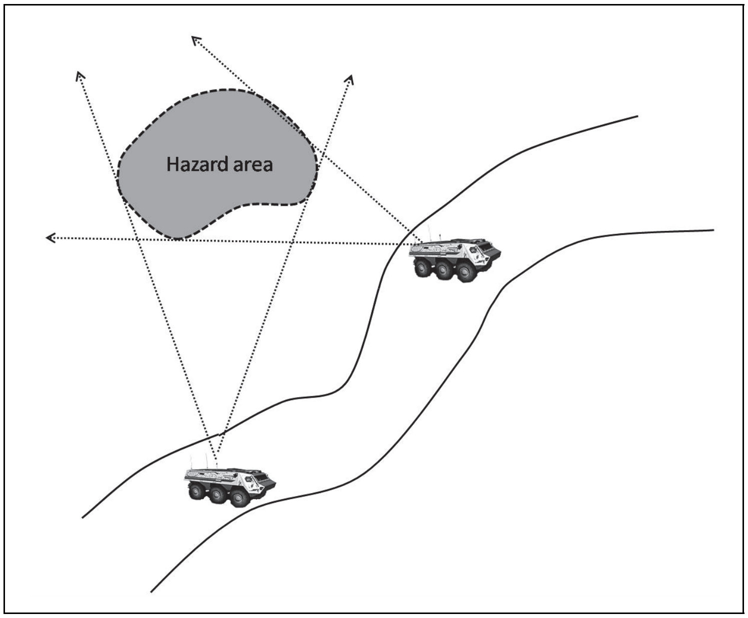

Figure G-3. Multiple-system detection technique

- **Cueing and vectoring.** A reconnaissance system can follow the direction provided by the detector, vectoring in on the location. Other onboard sensors will alarm when contact with the hazard occurs. This is the least preferred method since it is the most time-consuming and provides very little useful information. It provides leading-edge information for one point only and may not be a true representation of the larger picture. Cloud locations can quickly change, and the detector operator may have difficulty detecting movement when he is in contact with the cloud. Cueing and vectoring may be used to locate off-gassing from ground contamination, allowing a reconnaissance platform to begin a survey and determine the limits of the ground contamination.

G-14. When conducting fixed-site tactical employment, consider the following:

- The tripod-mounted standoff chemical detector can be employed as a networked or stand-alone detector to detect a chemical hazard. Employment of the detector should ensure good visibility of upwind areas of operating forces to detect attacks and allow the commander sufficient time to take immediate action.
- Standoff chemical detectors may be employed at airfields, forward facilities, logistics bases, support area command posts (CPs) and headquarters (fixed sites), and port facilities. They may also be used to detect chemical agents and provide early warning around MSRs and other lines of communication.
- The distance between standoff detectors is based on the terrain and the threat. The distance between the fixed site and the standoff detector is based on the terrain, the size of the area to be covered, the radio transmission range, the desired warning time, and METT-TC/METT-T.
- Fixed-site installation of detectors should exploit available terrain and infrastructure to the maximum extent possible. Buildings and other high ground should be exploited to improve visibility and limit uncovered areas hidden behind other structures. Power converters may be used to capitalize on the electrical or generator power available.
- At least three standoff detector systems are required to conduct a reliable map resection and provide the hazard location (figure G-4, page G-6). If only two systems are used or if all three systems are placed in a straight line, the cloud location cannot be determined in many situations. Information provided by a standoff chemical detector is used by the CBRNCC or staff to help determine the status of the installation before, during, and after an attack.

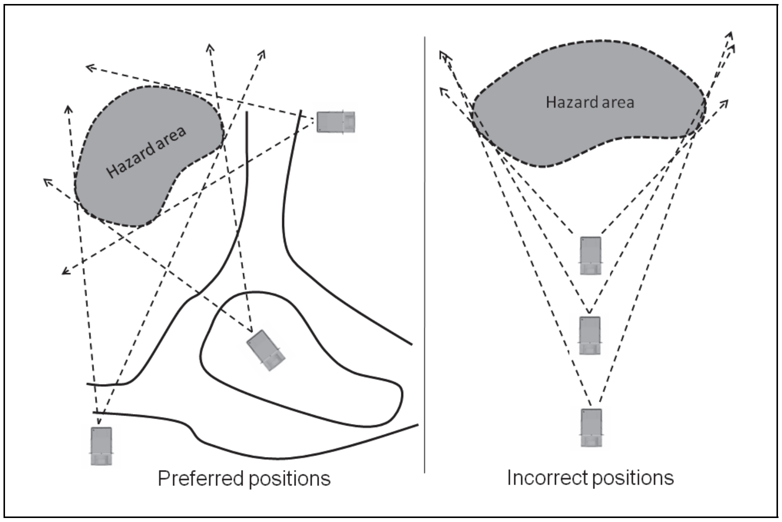

Figure G-4. Position of detectors for map resection

G-15. Standoff chemical detectors constraints include—they cannot provide the specific location, they cannot track moving plumes, or they cannot determine the distance to the leading or trailing edge of the detected plume. To maximize effectiveness and provide this information, triangulation with two or more detectors can be used. To perform triangulation, the fields of the detectors must cross or overlap. The basic detection grid could require four detectors to provide coverage for a small installation. A large installation would require at least six to provide coverage. Other constraints are—

- **Networking for remote operation.** A detector can be networked to provide remote operation. Multiple alerts and information can be displayed on a single screen, allowing the operator to easily triangulate the estimated hazard location. This can only be done when a sensor-integrated communications network exists.
- **Locating the hazard.** A detector reports the direction of a hazard based on the relative bearing from the scanner position. It reports the right and left limits, elevation, and declination of a hazard, but does not provide the distance from the scanner or the depth of the cloud.
- **Tracking the hazard.** A detector reports the movement of a hazard as scans are updated in the search mode. Each detection and subsequent alert is treated as a separate event. Tracking the cloud is only provided when triangulation is available. Additionally, the detector may not detect low-level emissions, such as the levels associated with leaking containers and the off-gassing, from previously deposited/undetected hazards.
- **Detecting hazard plumes.** A detector is designed to detect plumes containing selected chemical agents in vapor form. The operator must be aware of how the weather impacts the system. For example, a chemical agent that is cold or frozen may not produce enough vapors to be detected, rain may interfere with detection, and detection of some agents may only occur within 500 meters.

REMOTE DETECTION CAPABILITIES

G-16. Remote detection systems are usually operated from a distant location through a communication link to a CBRN detector or monitor. The tripod-mounted variant is intended to operate in the operational field environment at static, designated locations and fixed-site locations near or around airbases and ports. These devices are normally designed to be recoverable. Emerging technologies allow remote CBRN detectors and monitors to be remotely operated on mobile platforms such as UAS, UGVs, and robots. With integration into a mobile R&S platform, detectors can also be positioned in a covered and concealed location with maximum LOS to designated key terrain.

G-17. Remote detection is the capability to detect CBRN hazards away from the operational area. Remote detection provides advance warning before the arrival of the CBRN agent to allow time for contamination avoidance and the implementation of protective measures. The term *remote* implies a detector that transmits a detection indication back to a remote location. The term *standoff detector* is used to specify a detector that can detect CBRN hazards at some distance away from the detector itself.

G-18. Some remote detection systems are capable of standoff operations, with the remote being fed by tethered line or relay technology. Most remote detection systems are also considered point detection systems that are used for CBRN R&S operations. Information on remote detectors are as follows:

- Remote detectors must be positioned so that they have an unobstructed field of view. This may require elevating the detector scanner or sensor electronics module to a height that provides a clear view of the horizon.
- As the individual fields of regard bisect, the detection event data from individual systems can be analyzed to provide triangulation.
- Triangulation occurs when the fields of regard of two or more scanners bisect or overlap.
- Triangulation is not performed by the system software or computer interface; it must be performed manually by plotting the detection information from each detector on an installation or area map.
- The process of establishing a triangulated pattern is accomplished by separating two or more detectors by approximately 1,000 meters and focusing the field of regard so that they cross.

G-19. Detection for warning provides warning in sufficient time to implement protective, preventive, and treatment measures before exposure to agent contamination occurs. Remote sensors can be used to mitigate the limitations (or absence) of standoff capabilities. When there are insufficient automatic standoffs or remote detectors for chemical and biological agents, it is necessary to rely on available attack indicators and PVNTMED sample collection and analysis.

G-20. Warning of an upwind attack may come from a force's own upwind detectors or from other assets monitoring the upwind area—assuming that forces have the necessary detectors, have observed adversary activities indicative of an attack. Lacking the necessary point or standoff detectors, commanders must decide when the possibility of attack warrants an increased protective posture based on intelligence indications.

G-21. Point surveillance is conducted for a specific period of time and oriented or focused on key terrain located on or off the installation or base property. For example, the detector would be focused into the wind or toward an area of concern. Point surveillance activities may be dismounted, fixed, tripod-mounted, shipboard-mounted, or placed on mobile platforms. The technology used for point surveillance requires the agent or hazard to be directly in contact with the detector and equipment decontamination must be considered. Point surveillance could require the detector to be within the hazard area to obtain readings. The reading may be routed to another output source remotely for analysis of the initial reading. Point detectors such as dry filter units that are not capable of being remotely configured may require personnel to remove, package, and transport filters from the detector location to the laboratory for further analysis. A positive reading drives initiation of the CBRNWRS. See *MultiService Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Avoidance* for additional information.

G-22. Area surveillance provides warning to friendly units, allowing them to avoid contaminated areas before they pose a hazard to resources. It may be conducted while positioned around the perimeter of a fixed-site, such as an airbase.

G-23. Fixed-site employment considers the installation size as only one factor in determining the required number of detectors. The airflow is another factor that could affect the number of detectors required. Tall or large structures (dormitories, hangars, fuel tanks) can obstruct airflow. Terrain features (mountains, hills, valleys) may also obstruct or affect how the prevailing winds flow throughout the fixed site. Simulation and modeling capabilities aid in and maximize the positioning of detectors throughout the perimeter. Also, threat plays a major role in detector placement. For instance, if there is a threat of a line release upwind, then the sensors may be placed in the upwind side of an installation in a picket line. If the threat is from artillery, then the detectors could be placed in a box technique to ensure uniform coverage across the entire installation. These factors must be considered when emplacing the detector so that blind areas are minimized and the overlapping of detectors is maximized to ensure adequate coverage of the fixed site through point or area surveillance.

G-24. Vehicle-mounted employment can be used in and around fixed sites, and temporary perimeters. The advantages of vehicle-mounted systems are that they can be easily repositioned as needed to adjust to changing environmental conditions and threat. A single system provides a circular ring of coverage around an employed location. In this situation, the system should be located as close as possible to the center of the location with an unobstructed field of regard. If there is a high probability that an attack will occur because of an upwind release of a CBRN agent, the system could be placed on the upwind edge of the target to provide early warning. Multiple systems are positioned strategically around the location as close to the perimeter as possible. For example, three systems could be placed upwind of a base airfield, and a fourth system could be positioned strategically on the base. Four systems provide a sensor perimeter (scanning diameter) for each system and provide an outer perimeter (overall diameter) for the combined field of regard.

G-25. A tripod-mounted system can be used in and around fixed-site installations to optimize the sensor field of view and to overcome obstructions from buildings and equipment. Consider using the roofs of existing buildings or structures to elevate the system. Key definitions that must be understood for fixed-site elevation include—

- **Sensor height.** Sensor height is the elevation at which the sensor is placed on the ground, building, or equipment to provide an unimpeded flow of air.
- **Ground intersect.** Ground intersect is the distance from the system that the lower tangent of 10° will intersect the ground. The ground intersect is representative of the distance from the detector that will not be viewable in the field of regard. Always consider the ground intersect when elevating the system.

G-26. Shipboard operations provide a capability to alert, collect, and identify chemical, radiological, and biological agents to support maritime operations. Biological detection technology continuously monitors the air for a significant rise in particulate concentrations and/or biological mass. If a significant rise over the background is detected, the instruments will automatically collect an aerosol sample and alert the ship damage control central of the need to collect the sample and screen it using a handheld assay for a possible presumptive identification.

G-27. The maritime biological detection technology detects and identifies biological agents. It contains or connects to navigation, meteorological, and communications equipment that is used to identify the location and sense the conditions under which the agent was detected. The maritime biological detection technology has the ability to detect and identify many agents (bacteria, viruses, toxins) during a mission. Biological agent identification is limited by the available agent reactive assay strips housed within the identifier, the ability to collect enough material to reach the identification thresholds of the assay strips, and reagent interferents. It provides the ability to collect and save biological agent samples for later laboratory analysis.

Appendix H
Sample Collection and Processing

This appendix provides information on sample collection types, media, and techniques for CBRN environmental samples in liquid, solid, or gas form. It also provides the vital requirements to package these samples properly for shipment to a support laboratory. The sample collections plans are discussed at length in this appendix, including leadership and R&S element responsibilities. The construct of the R&S elements and their equipment are described in detail. This appendix provides information on sample collection procedures for CBRN environmental samples in liquid, solid, or gas form and the associated requirements to package the sample for shipment to a supporting laboratory for theater validation. CBRN sample collection is a key step in determining and documenting the presence of CBRN threats/hazards. It is applicable to peacetime and wartime response operations to a suspected CBRN incident. CBRN sample collection is the process or technique of selecting, packaging, and documenting the collection of CBRN agents or materials. CBRN sample collection supports operational intelligence requirements, and the results are used to confirm or deny that an incident or an outbreak has occurred. The goal of CBRN sample collection is to collect a series of samples of suspected CBRN agents or materials that represent the original source, thus permitting CBRN incident analysis. Information collected while conducting CBRN sample collection is used to support protection, prevention, and treatment decisions. CBRN sample collection, in support of military operations, is primarily for tactical use but may be used as evidence in a criminal investigation if personnel are trained and the proper procedures are followed. Understanding proper CBRN sample collection, documentation, and tracking procedures helps ensure the strict preservation of the sample collected. Specific sample collection procedures vary depending on the local SOP/special operations group and the supporting laboratory. If operations allow, sample collection and decontamination waste should be collected, containerized, marked, and transferred to the decontamination or support element for proper disposal. Additionally, CBRN R&S personnel should make every attempt to coordinate with the appropriate laboratory prior to initiating sample collection operations to discover specific requirements for sample collection (minimum quantity, container type, reporting requirements).

SAMPLE COLLECTION PLAN

H-1. Appendix B described CBRN planning considerations and appendix E discussed dismounted reconnaissance planning. The sample collection plan discussed in this appendix focuses on the sample collection plan developed immediately prior to actual sample collection operations at a specific area. The plan is normally finalized by the R&S element leader after the execution of an initial area survey.

H-2. Because CBRN sample collection operations are unique, each sample collection operation requires a specific plan. Each CBRN sample collection plan must consider the expected results of the sample collection operation. The sample collection plan defines the—

- Purpose and scope of the operation, including the objectives, limitations, and pertinent background information.
- Priority of sample collection.

- PIR and reporting.
- Medium, such as groundwater, surface water, soil, sediment, and waste.
- Sample collection parameters, such as the expected contamination or type of contaminant.
- Sample collection scheme, consisting of the sample type, strategy, and number.
- Technique to be used in the sample collection process.
- Amount of time the sample collection mission will last.
- Waste disposal plan, including if and how waste produced when collecting samples should be handled. For instance, waste could be left in the area or be collected, containerized, marked, and transferred to the decontamination or support element for proper disposal.

SAMPLE COLLECTION RECONNAISSANCE AND SURVEILLANCE ELEMENT ORGANIZATION

H-3. Sample collection R&S elements may be structured as either of two basic organizations. It is the responsibility of the persons involved in sample collection so that works are aseptic. The two R&S elements are—

- **Two-person sample collection R&S element**. A two-person sample collection R&S element is the minimum size that can be used. It places a large load on the "clean person" to document and supply the "dirty person" with the sample collection equipment needed, when needed. Using two people takes more time than when using three and must be conducted slowly and methodically to ensure sample integrity, safety, and proper documentation.
- **Three-person sample collection R&S element**. Using three people as a sample collection R&S element is the optimum organization. It allows for initial QA/quality control (QC) and efficient documentation of the sample collection operations that occur.

TWO-PERSON SAMPLE COLLECTION RECONNAISSANCE AND SURVEILLANCE RESPONSIBILITIES

H-4. The following procedures are provided for two-person sample collection R&S elements:

- The sample collector (sampler or "dirty person")—
  - Exercises overall control of sample collection.
  - Assists clean person with setup. Dirty person is considered clean unless they have touched anything at the target. Dirty person may continue to assist clean person until they take their first sample.
  - Identifies what will be needed to successfully collect samples. Informs the clean person of exactly what is needed and collects the sample using appropriate procedures.
  - Uses laboratory tape to ensure that the sample collection container cap will not come off. After the sample containers are decontaminated, he will receive laboratory tape from clean person and wrap the laboratory tape around the cap of the container, ensuring that the laboratory tape covers the top of the container and the cap. Wrap in a clockwise direction, gently stretching the laboratory tape for a tight seal. The clockwise direction will tighten screw top caps more firmly.
  - Places sample into an overpack held by the clean person. Be sure not to touch the outside of the overpack or the clean person.
  - **Never** holds or moves a sample over the clean tarp. Dirty person will **never** transfer a sample from sample collection utensil to initial package over the clean tarp. Takes samples as close to the original spot as possible to reduce spread of contamination.
  - Removes the outer layer gloves, using proper glove removal technique, and secures a clean pair from the clean person. Dirty personnel may wear several layers of gloves to save time, by just peeling a layer off, but personnel's dexterity suffers with multiple layers. Glove removal will be done **after** each sample is taken, and **before** taking the next sample. All used gloves and used sample collection equipment will be discarded. Another technique that can be used when a limited supply of gloves exists is to decontaminate gloves and hands

after each iteration of sample collection. Caution must be used when reusing decontaminated gloves as they may have become damaged or worn through physical use or interaction with the chemical being sampled.

- The assistant sample collector (assistant sampler or clean person)—
  - Prepares the equipment that is needed to collect samples.
  - Hands all sample collection tools to the dirty person, ensuring not to touch any portion of the tools that will actually come in contact with the sample. Never touches the dirty person while handing equipment to them. Never takes any equipment back from the dirty person. This keeps the clean person as clean as possible. If clean person comes into contact with dirty person or a suspected dirty surface, the clean person will change gloves using proper glove removal technique.
  - Maintains the sample log notebook.
  - Documents the collection effort with still and video recordings.
  - Is responsible for QA/QC.
  - Ensures that biological sample collection efforts adhere to standards for aseptic techniques.

THREE-PERSON SAMPLE COLLECTION RECONNAISSANCE AND SURVIELLANCE ELEMENT RESPONSIBILITIES

H-5. The following procedures are provided for three-person sample collection R&S elements:

- The R&S element leader (recorder)—
  - Exercises overall control of sample collection.
  - Maintains control of the sample collection kit.
  - Completes sample log notebook.
  - Assists the assistant sample collector.
  - Maintains the sample log notebook.
  - Documents the collection effort with still photography and video recordings.
  - Is responsible for QA/QC.
- The sample collector (sampler or dirty person)—
  - Assists clean person with setup. Dirty person is considered clean unless they have touched anything at the target. Dirty person may continue to assist clean person until the first sample is taken.
  - Identifies what will be needed to successfully collect samples. Informs clean person exactly what is needed to collect the sample using appropriate procedures.
  - Uses laboratory tape so that sample container caps will not come off. After the sample containers are decontaminated, he will receive laboratory tape from clean person and wrap the laboratory tape around the cap of the container, ensuring the laboratory tape covers the top of the container and the cap. Wrap in a clockwise direction, gently stretching the laboratory tape for a tight seal. The clockwise direction will tighten screw top caps more firmly.
  - Places sample into an overpack held by the clean person. Be sure not to touch the outside of the overpack or the clean person.
  - **Never** holds or moves a sample over the clean tarp. Dirty person will **never** transfer a sample from sample collection utensil to initial package over the clean tarp. Takes samples as close to the original spot as possible to reduce spread of contamination.
  - Removes the outer layer gloves, using proper glove removal technique, and secures a clean pair from the clean person. Dirty personnel may wear several layers of gloves to save time, by peeling a layer off, but personnel's dexterity suffers with multiple layers. Glove removal will be done **after** each sample is taken, and **before** taking the next sample. Used gloves and used sample collection equipment will be discarded. Another technique that can be used when a limited supply of gloves exists, is to decontaminate gloves and hands after each sample collection iteration. Caution must be used when reusing decontaminated gloves as

they may have become damaged or worn through physical use or interaction with the chemical being sampled.

- Assistant sample collector (assistant sampler or "clean person")—
  - Prepares the equipment needed to collect samples.
  - Hands sample collection tools to the dirty person, ensuring not to touch any portion of the tools that will actually come in contact with the sample. Never touches the dirty person while handing equipment to them. Never takes any equipment back from the dirty person. This keeps the clean person as clean as possible. If the clean person comes into contact with dirty person or a suspected dirty surface, the clean person will change gloves using proper glove removal technique.

SAMPLE COLLECTION TYPES AND COLLECTION CONSIDERATIONS

H-6. The type of CBRN sample collection may vary based on the nature, source, type, and method of dissemination and location of the area. Normally, the best area for CBRN sample collection is where casualties have occurred, plants are wilted or discolored, or there are dead animals (fish or birds). This is not always the case when dealing with biological agents due to an incubation time period. Other considerations include the following:

- **Environment**. Environmental samples (air, water, soil) are removed from common, natural materials, such as air, water, soil, or vegetation. Solid samples (powders, paints, metals) may be useful if collected at an incident scene, impact area, blast zone, operating facilities, and areas where runoff may collect. The following environmental factors should be considered:
  - Fabrics such as clothing and upholstery may be another source for sample collection. Using a scalpel, personnel should cut a piece no more than 3 1/2 by 3 1/2 inches. For carpeting, the sample should be no more than 1 1/2 by 1 1/2 inches. Attention should be paid when securing this type of sample. If a fabric, upholstery, or carpet is stained or contaminated, limit the sample size to that required for follow-on analysis.
  - Stones should be no more than 1/4 to 1/2 inch. These samples should be placed in a plastic freezer bag. The volume of stones should be approximately 200 to 300 milliliters.
  - Samples from walls, vehicles, or other types of immovable objects should be taken by scraping the contaminated surface and collecting the scrapings into a sample container.
  - Soil samples should be taken over a surface area 3 1/2 by 3 1/2 inches to a depth of no more than 1/2 inch (true required depth depends on absorption of substance into soil). Samples should be taken as close to the center of contamination as possible. Samples may be taken near bodies of fallen victims. Environmental samples that consist of plants, seeds, and any debris should be collected in separate containers.
  - Vegetables, leaves, grasses, and grain matter should never be touched. These require using scissors and tweezers, forceps, or hemostat. Particular attention should be paid to the discoloration or withering of the matter.
  - Snow samples should be collected from the layer of suspected exposure to chemical or biological agents. Should new snow have fallen, coordination with the weather officer should be conducted to determine how much new fallen snow has occurred. This will aid the R&S element in determining how much snow should be removed before coming into contact with possible contamination.
  - Aerosols may leave little residue. Water, vegetation, PPE (especially filters), and dosimetry devices downwind from the sample collection area may provide useful samples.
- **Equipment**. Sample collection R&S element should have enough sample collection equipment and consumables to take a minimum of ten samples of the necessary types (vapor, soil, vegetation, snow, or water). Also, sample collection R&S elements should be equipped with digital photography capability. Digital photographs of the suspect agent or scene are critical and may be sent electronically.

- **Background.** The background sample is collected away from the hazard area in an area that is known to be uncontaminated. It is used as a comparison sample so that a compound is not naturally found in the area. Evacuated samples will include CBRN samples, and routine background samples when directed by higher headquarters. The background samples will be analyzed at the supporting laboratory along with the actual suspected samples. The following factors should on background should be considered:
  - The sample collection R&S element collects at least two samples of soil, water, air, or vegetation from areas that are approximately 500 meters upwind of an alleged incident area to ensure no downwind hazards have contaminated the source or area where the background sample is taken. Clearly mark background and contaminated samples.
  - Background samples must closely resemble or be similar to those presumed to be contaminated and collected at an incident area. For example, if a CBRN R&S element collects leaves from a tree in an incident area, the R&S element should collect sample leaves from a tree of the same type outside the contaminated area. Background information for each collected CBRN sample must be detailed and clearly stated.

H-7. CBRN samples fall into one of the three priority categories depicted in table H-1, page H-7, based on where samples are collected. The following are categories for sample collection priority:

- **Priority I.** These samples are of bulk agent (contents of drums, barrels, final laboratory products) and delivery systems.
- **Priority II.** The environmental samples (soil, liquid, vegetation, and air) are from areas where alleged chemical, biological, and radiological incidents have occurred.
- **Priority III.** This category is the acquisition of chemical, biological, and radiological defensive materials, such as antidote kits, decontamination equipment, detection gear, and protective equipment.

SAMPLE MEDIA

H-8. The sample media is the physical state of the sample being collected and supports the quality of the collection. The following are general classifications of samples:

- **Air sample**. Air sample collection is typically conducted to determine the presence of contamination. Air sample collection is also conducted to determine the background for comparison purposes. Considerations are—
  - The concentration of contaminants at a sample area depends upon the flow rate of the contaminant into the environment, the wind speed, and the physical state of the contaminant, the terrain contours, and temperature as a variable.
  - Natural and man-made terrain features such as hills, valleys, and rows of buildings, sometimes aid the CBRN R&S element by channeling emissions.
  - When associated with a particular facility, the downwind side from the release point is a suitable place to collect a sample.
- **Water sample.** In the event of a CBRN incident, water sample collection may be necessary so that water supply sources have not become contaminated. Take a minimum of four samples; three samples of the suspected contamination and one control sample from a nearby unaffected (uncontaminated) area for reference. The additional samples allow for greater analysis of the contamination.
  - Collect samples at various depths to obtain the most complete assessment of the contamination. The upper layers of water may have lesser amounts of contaminants, due to higher temperatures that promote evaporation and decomposition.
  - At a minimum, collect samples from the water's surface and near the bottom of the water source. If an oil film, globules of organic materials, or a powder-like material is visible on the water's surface, ensure this material is sampled.
- **Soil sample**. Soil samples are used to determine the nature and extent of contamination and to identify hazardous substance source areas. Personnel should consider collecting duplicate samples, especially for evidentiary purposes. The duplicate sample is one that has been collected

at the same area and time as the original and that may be analyzed by another accepted analytical technique or qualified laboratory in order to compare results. Duplicate samples should be stored in the event that one sample is destroyed during analytical testing in the laboratory or in transit.

- **Bulk sample**. Bulk samples are classified as solids, liquids, and powders taken from containers, tubs, and drums. Bulk samples are not to be confused with water or soil samples. For example, liquid samples contain a higher concentration of some other substance or product such as petroleum and solvents. Examples of solids samples are stones, fixed structures (for example, buildings and paved surfaces), pastes, metals, carpets, or gels. However, most laboratories cannot process certain forms of bulk samples. The receiving laboratory should be contacted before bulk samples are collected to determine whether such samples will be accepted, the recommended collection method, and the quantity needed. Considerations for bulk sample collection are—
  - When collecting substances and transferring to sample container caution should be used (for example, the powder or liquid substance may react to the sample container).
  - Bulk sample collection will be completed at the discretion of the commander. It should be noted however, that this approach does not require that a sample drum should be collected and packaged for transport.
  - If large amounts are transported to the laboratory for further analysis, additional coordination will be required for the disposal of the unused portion.
- **Surface sample.** The surface sample is primarily associated with contact hazards and consists of metals, dust particles, and/or unseen materials that collect on surfaces. These surfaces may include floors, windowsills, or automobiles. Due to the physical state of the surface, the sample collection R&S element must be properly equipped should they encounter the following types of surfaces:
  - Hard and smooth nonporous surfaces (the ideal surface).
  - Soft rough porous substrates.
  - Fragile substrates (a surface on which an organism grows or is attached).
  - Oily and/or grossly contaminated surfaces.
  - Dermal (pertaining to the skin) sample collection.

SAMPLE COLLECTION MEDIA TECHNIQUES AND GUIDELINES

H-9. Air/vapor is a good sample matrix since it is a well-mixed medium. Air/vapor from a sample area contains a variable concentration of contaminants. The concentration of contaminants depends on the flow rate of the contaminant into the environment, the wind speed, the physical state of the contaminant, the terrain contours, and temperature as a variable. (See table H-1.)

Table H-1. Chemical, biological, and radiological air/vapor sample collection information

Air/vapor sample collection for chemical, biological, and radiological agents	
When to sample	Perform sample collection as soon as possible after alleged use of a chemical, biological, and radiological agent.
Where to sample	The optimum place to obtain samples is as close to the emission source as possible. The farther away from the point of release, the more diluted the sample becomes from mixing with water, air, or environmental pollutants. Natural and man-made terrain features, such as hills, rows of buildings, and valleys, sometimes aid the R&S element by channeling emissions. When these features are close to a particular facility, use the downwind side (if possible), as emissions remain concentrated due to the channeling affect. The sample collection R&S element determines the downwind area and collects environmental samples from that area.
	For collection in a possibly contaminated area, use a chemical agent detector kit to determine if a vapor hazard exists. Collect an air sample for laboratory analysis when a vapor, aerosol, or airborne particle hazard is unknown or suspected. Air samplers enable the R&S element to obtain vapor, aerosol, or airborne particle samples. Explosive ordnance disposal personnel must render munitions safe prior to taking any type of sample from munition surfaces.
How to sample	Contaminants are sampled for later identification by using devices that draw air through filter material. Sample collection personnel should not use cologne, perfume, insect repellent, medical creams, or strong soaps while taking an air sample. These fragrances mimic volatile organic compounds that can be absorbed on the filter and skew analytical results. Smoke products can also interfere with air sample collection; therefore, avoid cigarette, vehicle exhaust, and campfire smoke. Shipboard sample collection operations must consider the products (for example, fuels, solvents, and gases) that are present and can cause false readings. Another method for collecting air samples is with devices such as automatic air samplers. Employ device for three to four minutes, when possible. Upon completion of sample collection, place the tube in a sealable bag and seal the bag with pressure-sensitive tape. Place the bag into a second bag, and use any type of tape to secure it. Decontaminate each layer of packaging with a 5 percent chlorine solution. Whatever is used (for example, sodium hypochlorite or calcium hypochlorite) the strength should be measured to create 5 percent chlorine solution. (See *Multiservice Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Decontamination,* or *Naval Ships' Technical Manual,* Chapter 470 – Shipboard BW/CW Defense and Countermeasures for directions on how to mix a 5% chlorine solution.) When possible, record the ambient temperature, barometric pressure, wind direction, and wind velocity when air sample collection is begun and when the sample collection ends.

H-10. The collection of water (table H-2, page H-8, and table H-3, page H-9) involves the collection of a sufficient number of samples to properly analyze the source with regard to contaminants. Water samples are collected by PVNTMED personnel/bioenvironmental engineers for identification or verification of biological contamination. At least four samples should be taken—three samples of the suspected contamination and one control sample—from a nearby, uncontaminated area for reference.

Table H-2. Water sample collection information (chemical/biological)

Water sample collection for chemical/biological agents	
When to sample	Water from a facility should be sampled when intelligence or local reports suggest that possible chemical or biological production or storage occurs at the facility or a chemical-biological incident has occurred there.

	Collect water samples from allegedly contaminated areas just after the start of a rainstorm when runoff is beginning. Natural surface drainage will concentrate any remnants of toxic compounds in depressions, streams, or ditches.
	Because of their large surface area and the potential for collecting runoff from an incident area, ponds, streams, reservoirs, or puddles in the immediate area of a suspected incident are potential sources of useful samples.
Where to sample	Water discharge pipes from suspected facilities should be sampled directly. Drainage areas are ideal sample collection areas since contamination and dilution from other sources is minimized. Samples should be collected as close to the potential contamination area as possible since mixing may not have occurred. Multiple samples should be taken, one from the water surface and several from different depths. At a minimum, samples should be collected from the water surface and at the bottom of the water column in slow moving areas. Preferably, the R&S element should sample various parts of a stream to capture different water velocities, water body depth, and other variables. Avoid extremely turbulent and rapidly moving areas as this may affect contaminant concentration and detection. If an oil stain-like fan, globules of organic materials, or an unnatural-looking powder is visible on surface water, take surface samples. Most chemicals of interest are denser than water and usually sink to lower levels. However, high water temperatures promote decomposition and may cause the upper layers of water to harbor contaminants (blister agent [mustard] may float on the surface of water due to surface tension, even though it is heavier than water). The R&S element may also collect samples from stagnant pools of water if the pools of water are part of chemical waste areas (a landfill, a chemical disposal area). Chemicals may percolate into stagnant pools or dumps close to the area.
How to sample	The samples can be taken with a 50 to 100 milliliter pipette (or syringe) from the source surface. Use one pipette per sample, transfer the contents into a separate clean sample bottle (retaining any material suspended in the water), and close the bottle (airtight). A sample size of at least 50 milliliter is needed. If the sample container is not prepreserved, collect the sample by immersing a capped container or a container with a stopper to the desired depth, removing the cap or stopper, letting the container fill, and recapping the container. An alternate method for deep-water sample collection is to use a plastic, pump-operated siphon to pump water from a specific depth. Besides water samples, surface scum and bottom sediment can also be sampled and forwarded for analysis. If there is a belief that the adversary has used chemical agents during an incident, use a chemical-agent water test kit for sample collection. This kit will provide gross-level detection of chemical agents but is not an alternative to collecting samples for laboratory analysis.

Table H-3. Water sample collection information (radiological)

Water sample collection for radiological agents	
When to sample	Intelligence assets will provide information on the presence of indicators that may show the need for sample collection (such as higher than normal amounts of security, increased flow of smoke from a facility chimney, or water from water discharge pipes). The best time to collect water samples from an allegedly contaminated area is just after the start of a rainstorm when runoff is beginning. Natural surface drainage will concentrate any remnants of radionuclides in depressions, streams, or ditches.
Where to sample	The R&S element should sample various parts of a stream to capture different water velocities, water body depth, and other variables. Avoid extremely turbulent and rapidly moving areas as this may affect contaminant concentration and detection. The R&S element may also collect samples from stagnant pools of water, if the pools of water are part of chemical waste areas, such as a landfill or a chemical disposal area. Contaminants may percolate into stagnant pools or dumps close to the area.
How to sample	If the collector believes that radiological particles are present, he should use currently fielded RADIAC equipment to confirm contamination. If deemed safe enough to collect samples, then use one of the following methods to collect samples: • The samples can be taken with a pipette (or syringe) from the source surface. Use one pipette per sample, transfer the contents into a separate clean sample bottle (retaining any material suspended in the water), and close the bottle (airtight). A sample size of at least 50 milliliters is needed. • If the sample container is not preserved, collect the sample by immersing a capped container or a container with a stopper to the desired depth, removing the cap or stopper, letting the container fill, and then recapping the container. • An alternate method for deep-water sample collection is to use a plastic, pump-operated siphon to pump water from a specific depth. • Besides water samples, surface scum and bottom sediment can also be sampled and forwarded for analysis.

H-11. When uncapping the bottle or container, hold the bottle or container near the bottom and the cap near the top edge. Do not allow anything to touch the inside of the cap. Do not set the cap down. Do not rinse the bottle or cap. If the bottle becomes contaminated (for example, if the threads are touched or hit on the stream bottom), discard it.

- **Step 1**. Hold the bottle near its base and plunge it below the water surface with the opening pointing downward. Collect the sample from the desired depth (see figure H-1, page H-10).
- **Step 2**. Turn the bottle underwater into the current, and ensure that is it turned away. In slow-moving streams, push the bottle underneath the surface, and ensure that it is pointed away and in an upstream direction.
- **Step 3**. Remove the bottle from the water when it is filled to the shoulder. Two-thirds of the way full is also acceptable.

Note. Do not discard the sample if the sample collection container contains a preservative. If a preservative is present, the sampler must choose a sample collection method that conserves the preservative. If the water level in the bottle is over full (there is no air pocket), quickly flick the bottle until the sample level falls enough to create headspace. If more than a few seconds pass, cap and shake the bottle before flicking.

- **Step 4.** Recap the bottle carefully without touching the sample inside.

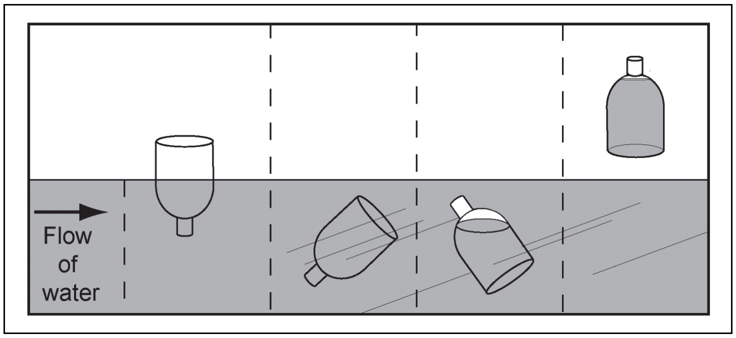

Figure H-1. Water collection technique

H-12. Soil is a good medium to sample (table H-4 and table H-5) for toxic organic compounds. Soil may contain large amounts of compounds of interest. For best results, it is essential that the collector from the R&S element sample at the precise area of compound deposition. Soil is a good medium to collect radiological particles (dust or pellets). It is essential that the sample collector monitor the sample before collecting it to ensure that the sample is contaminated with low enough levels of radiation to be safe for transport and will not exceed his OEG.

Table H-4. Soil sample collection information (chemical/biological)

Soil sample collection for chemical or biological agents	
When to sample	The R&S element should sample as soon as possible after the alleged chemical or biological incident.
Where to sample	Contamination may be recognized by discoloration or apparent deposition of material on the soil's surface. If discoloration or deposition of material is evident, use a garden trowel or wooden tongue depressor to scrape up the soil. Collect only discolored soil or deposited materials, if possible. Multiple samples should be taken at different depths.
How to sample	Avoid direct contact with the sample by wearing the appropriate protective equipment. The R&S element may take soil samples using a knife, spoon, spatula, or similar item by scraping into a collection container the top 2 to 5 centimeters of soil from areas that appear to be contaminated. If the R&S element samples chunks or clods of earth, select those that are no larger than 10 x 5 x 1 centimeters. Collect a control sample from a sample control point of the same soil type or texture from a nearby, uncontaminated area. Normally 500 meters from actual sample point. Use a glass bottle, container, or nonstick container as a container when available. Plastic bags may also be used. When using glass bottles, containers, or nonstick plastic containers, seal the cap with pressure-sensitive tape and mark for identification. Place the soil sample in one bag, push excess air out, and seal by folding over open end two to three times and wrapping with any tape when using plastic bags. Insert the first bag into a second bag, seal, tape, and mark for identification. If possible, place samples in a shielded container. It is important to seal well so volatiles do not escape.

Table H-4. Soil sample collection information (chemical/biological) (continued)

Soil sample collection for chemical or biological agents (continued)	
How to sample (continued)	Also, place a tamper-resistant seal across storage bags. Ensure that each layer of packaging is decontaminated using a 5 percent chlorine solution. Whatever is used (for example, sodium hypochlorite or calcium hypochlorite), the strength should be measured to create a 5 percent chlorine solution. See *Multiservice Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Decontamination*. Place the soil sample in one bag, push excess air out, and seal by folding over open end two to three times and wrapping with any tape when using plastic bags. Insert the first bag into a second bag, seal, tape, and mark for identification. If possible, place samples in a shielded container.

Table H-5. Soil sample collection information (radiological)

Soil sample collection for radiological materials	
When to sample	Sample as soon as possible after the alleged radiological incident or report of activity.
Where to sample	Collect radiological agent samples from any place where RADIAC equipment indicates contamination (hot). If radiological deposits or material are evident, use a garden trowel or the scoop provided in the soil sample collection kit to scrape up the soil. Collect only contaminated (hot) soil, if possible.
How to sample	Avoid direct contact with the sample. Adequate respiratory protection is especially important whenever dry radioactive material samples are collected due to the risk of inhaling resuspended radioactive material. Collect soil samples by scraping the material into a collection container from contaminated areas. Collect a background (uncontaminated) sample of soil of the same type or texture from a sample control point normally 500 meters from the sample collection area. Scrape the soil into a collection container using a knife, spoon, spatula, or similar item. When using glass bottles or containers, seal the cap with pressure-sensitive tape and mark for identification. Place sample in one bag, push excess air out, and seal by folding over open end two to three times and wrapping with any tape when using plastic bags. Insert first bag into a second bag, seal, tape, and mark for identification. If possible, place samples in a shielded container. Place a tamper-resistant seal across storage bags.

H-13. Although not categorized as media, vegetation provides an excellent means for collecting CBRN samples. Collect samples of vegetation that are not consistent with healthy plants or plant material that is in the process of natural decay. (See tables H-6 and table H-7, page H-12)

Table H-6. Vegetation sample collection information (chemical/biological)

Vegetation sample collection for chemical or biological agents	
When to sample	The R&S element should sample as soon as possible after the alleged chemical or biological incident.
Where to sample	When the center of the incident in an area has been determined, collect vegetation from that area and approximately 100 meters upwind of the area. Also, take samples at several 100-meter increments downwind of the area. If the R&S element can discern a contamination pattern in the area, this should be reported.

Table H-6. Vegetation sample collection information (chemical/biological) (continued)

Vegetation sample collection for chemical or biological agents	
How to sample	Make a visual survey of the area and don protective equipment before collecting contaminated vegetation. Enter the area from an upwind direction. Select leaves that have wilted or appear to have been chemically burned. Collect vegetation that has liquid or solid substances deposited on its surfaces. This may appear as a shiny or moist area. Collect vegetation at several places within the suspected contaminated area. Horizontal surfaces are the preferred sample collection areas. Use a cutting tool or any sharp object and cut several contaminated leaves or a handful of grass whenever possible. Do not crush the sample. Place the vegetation sample into a zipper lock bag. Squeeze excess air out of the bag and seal. Fold opened end of the bag two to three times and wrap with tape. The minimum size sample of value is three leaves or three handfuls of grass. One leaf would be of little value, but should be collected. Tree bark is an acceptable sample but not preferred. Mark the bag for identification. Take a control sample of similar material from an unaffected area. Seal, tape, and mark the control sample. Ensure that each layer of packaging is decontaminated using a 5% chlorine solution.

Table H-7. Vegetation sample collection information (radiological)

Vegetation sample collection for radiological agents	
When to sample	Collect vegetation samples as soon as possible after the alleged radiological incident or report of activity.
Where to sample	When the center of the incident in an area has been determined, collect vegetation from that area and approximately 100 meters upwind of the area. If the collector can discern a contamination pattern in the area, it should be reported.
How to sample	Make a visual survey of the area and don protective equipment before collecting vegetation. Enter the area from an upwind direction.
	Collect vegetation samples that the RADIAC shows as contaminated (hot). Collect vegetation at several places within the suspected contaminated area.
	Use a cutting tool or any sharp object and cut contaminated leaves or grass whenever possible.
	Place at least three liters of densely packed sample in plastic bags or in a 1-gallon wide-mouth plastic container.
	Double-pack the plastic bag or place the 1-gallon wide-mouthed plastic container in a plastic bag.
	Mark the bag for identification.
	Collect a control sample of similar material from an unaffected area at a sample control point normally 500 meters away from the sample collection area.
	Seal, tape, and mark the control samples.
	Note. The minimum quantity of a vegetation sample necessary for analysis is at least three liters per sample.

H-14. A bulk sample is a quantity of material, sufficient to run laboratory analysis to determine the composition. The volume or quantity needed is dependent on the type of material and the type of analysis required. A bulk sample consists of suspicious powders, liquids, and solids. Bulk samples of building materials such as sections of carpet, office equipment, and supplies can also be taken. The receiving laboratory's capabilities to process bulk samples should be considered. The commander's staff must coordinate with the receiving laboratory as to the bulk sample size, quantity, and type that can be processed and accepted. Other considerations include the hazard severity of the sample, the sample collection expertise, and transport requirements. Factors include—

- **Sample size**. Sealing and packaging large samples may become difficult.
- **Sample quantity**. Collecting too much or too large of a sample may exceed the limit for laboratory personnel to process and their ability to properly dispose of unused contaminated portion of sample.
- **Sample safety**. Opening some containers may cause more harm when exposed to other elements in the immediate environment.
- **Sample collection expertise**. Collecting suspicious material may require higher levels of expertise and capacity to collect, contain, and limit further damage, harm, or contamination.
- **Sample transport**. Establishing and maintaining chain of custody of bulk materials when sample is transported by other means than the R&S element.

SAMPLE COLLECTION TECHNIQUES AND PROCEDURES

H-15. Sample collection techniques are the methods in which the sample is removed from its original area and transferred to the sample container. The techniques are discrete, composite, grab, and surface. These techniques are associated with the physical state of the sample media.

- **Discrete technique**. The discrete technique is used when the sample media is soil. A discrete sample is collected from a single point to obtain a sample that accurately portrays the soil conditions at a specific area. Discrete samples are routinely collected to accurately portray the soil conditions at an area where a chemical spill has occurred and the spill is isolated to a very small area.
- **Composite technique**. The composite technique is a mixture of multiple samples collected from a defined area. The samples that make up the composite sample are called aliquots (an exact fraction of the whole). Composite samples are collected to accurately portray contaminants in soil in an area that may or may not be contaminated. Multiple aliquots are collected from the sample collection area identified from the sample plan, homogenized in a large mixing bowl, and treated as one soil sample. Composite sample collection produces an average value of an area when analyzed. Composite sample collection is commonly employed when analyzing environmental areas for pollutants or screening large numbers of samples, such as soil and bulk sample collection at multiple places within a specified area. This technique may be used when sample collection occurs at the point of a chemical-biological incident to increase the probability of obtaining a positive sample. A disadvantage to this approach is the risk of dilution of the chemical-biological agent to a concentration that is below the detection limit of analytical platforms.
- **Grab technique**. The grab technique is the basic and preferred collection technique in sample collection operations. Grab sample collection is defined as a single sample that is removed at a single point in time from one area. This can be contrasted with composite sample collection in which samples are taken at multiple areas at one time or over the course of time when combined. Multiple grab samples carry an analytical cost burden. Furthermore, the probability that the samples will be required as evidence in legal proceedings substantiates this approach as the preferred technique.
- **Surface technique**. The surface technique is the process of wiping surfaces that contain suspected contaminants with approved material (swabs, cloths, tape, and vacuums).

H-16. Once the CBRN sample collection type has been determined, the number of CBRN samples that must be taken and the number of available personnel to support the sample collection operation are determined.

H-17. The number of samples that must be taken and personnel available to support the sample collection operation are key factors in determining the technique to be used. Time constraints on the completion of objectives must also be adhered to. Three basic strategies for sample collection at a given target area are:

- **Random**. Random, nonsystematic sample collection of the target or a portion of the target may be used when the specific area of concentration is unknown or when a suspicion drives area selection.
- **Systematic.** Systematic (or grid) sample collection is an objective strategy where samples are taken at predetermined intervals. Regular patterns of samples can rely on a grid structure or other type of regulated pattern that is superimposed on the target area. In some cases, the grid can literally be demarcated with string or stakes.
- **Judgmental**. Judgmental (or selective) sample collection is a subjective strategy where areas are selected based on the assessment or determination of the sample collection R&S element. Often, judgmental sample collection is employed to take a series of grab samples from the areas considered to be the most likely areas of contamination.

SURFACE SAMPLE COLLECTION

H-18. Surface sample collection technique is the process of wiping surfaces with approved material that will capture the suspected contamination. The surface technique of sample collection varies with the agent and purpose of the sample. It is recommended that the analytical laboratory processing the samples be consulted when selecting a sample procedure for a specific chemical or contaminant. Surface sample collection techniques also involve properly using the appropriate wiping materials of a particular surface such as a filter or cloth, which is then submitted to a laboratory for analysis. Typical materials used in surface sample collection include :

- **Glass fiber filters.** Gas fiber filters are recommended for chemicals that are analyzed by using gas chromatography or high-performance liquid chromatography. Also used for radiological wipes (for carbon-14 and tritium) being analyzed with a liquid scintillation counter.
- **Cloth sample collection smears (1 3/4 inch).** Cloth sample collection smears (1 3/4 inch) are used for surface wipe sample collection for radiological material.
- **Paper filters.** Paper filters are generally used for collection of metals. Mixed cellulose ester filter discs or smear tabs or their equivalent, are most often recommended.
- **Polyvinyl chloride filters.** Polyvinyl chloride is available for substances unstable on paper-type filters.
- **Gauze squares**. Gauze squares may be used for organic substances. More durable than filter media, especially when wiping rough surfaces.
- **Charcoal-impregnated pads.** Charcoal-impregnated pads may be used for collection of volatile solvents from surfaces. Work by trapping solvent on activated charcoal.

GENERAL PROCEDURES FOR COLLECTING CHEMICAL AND RADIOLOGICAL SURFACE SAMPLES

H-19. Preloading a group of vials or other containers with appropriate filters is a convenient method to carry the sample media to the work area. (The smear tabs, if present, are inserted with the tab end out.) Clean gloves should be worn when handling the filters. The gloves should not be powdered. The following are general procedures for taking surface samples:

- If multiple samples are to be taken at the area, prepare a rough sketch of the area to be swipe sampled.
- A new set of clean, impervious gloves should be used for each sample to avoid contamination of the filter by previous samples (and the possibility of false positives) and to prevent contact with the substance.
- Withdraw the filter from the vial or container with your fingers or clean tweezers. If a damp surface sample is desired, moisten the filter with the recommended agent (distilled water or other solvent).
- Depending on the purpose of the sample, it may be useful to determine the concentration of contamination using a direct reading instrument such as a radiation detector (for example, in counts per minute or disintegration per minute of agent per area). For these samples, it is necessary to record the area of the surface wiped (for example, 100 square centimeters). This

would normally not be necessary for samples taken to simply show the presence of the contaminant.

GENERAL PROCEDURES FOR WIPING

H-20. Two techniques are commonly used for wiping—S-pattern and decreasing concentric squares. For each technique, firm pressure should be applied when wiping.

- **S-pattern**. Place filter flat at one end of the sample and wipe in an S-pattern over the entire surface. Without allowing the filter to come in contact with any other surface, fold the filter in half with the exposed side in. If possible, for chemical/radiological sample collection use the same filter to rewipe the area at 90° from the first wipe, again using the S-pattern, and then fold it inward again; see figure H-2. Place the filter in a sample vial or container, cap, and place identifying data on the container. Place the same identifying data on the area sketch and sample collection form. Include notes with the sketch and sample collection form giving any further description of the sample, for example, tabletop or baseboard.

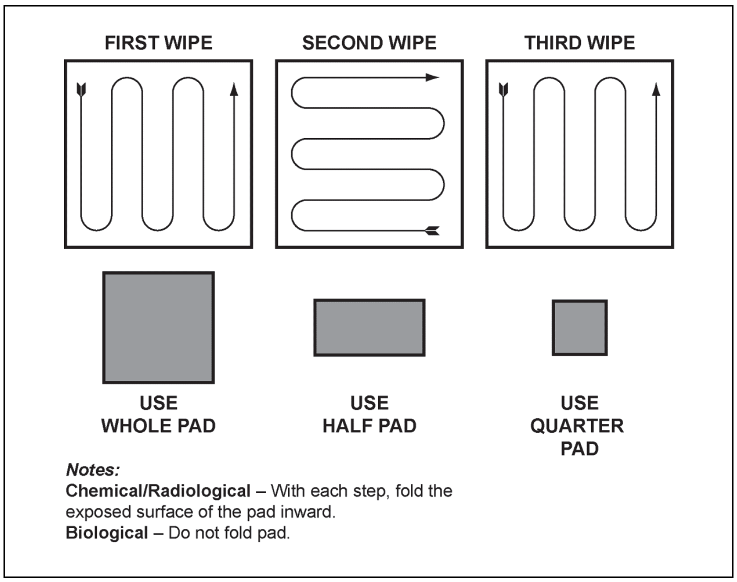

Figure H-2. S-pattern surface technique

- **Decreasing concentric squares**. Start at the outside edge and progress toward the center of the surface area by wiping in concentric squares of decreasing size. Without allowing the filter to come in contact with any other surface, fold the filter with the exposed side inward. If possible, for chemical/radiological sample collection use the same filter to repeat sample collection of the same area, and then fold it inward again, see figure H-3, page H-16. Place the filter in a sample vial or container, cap and place identifying data on the container. Place the same identifying data on the area sketch and sample collection form. Include notes with the sketch and sample collection form giving any further description of the sample, for example, tabletop or baseboard.

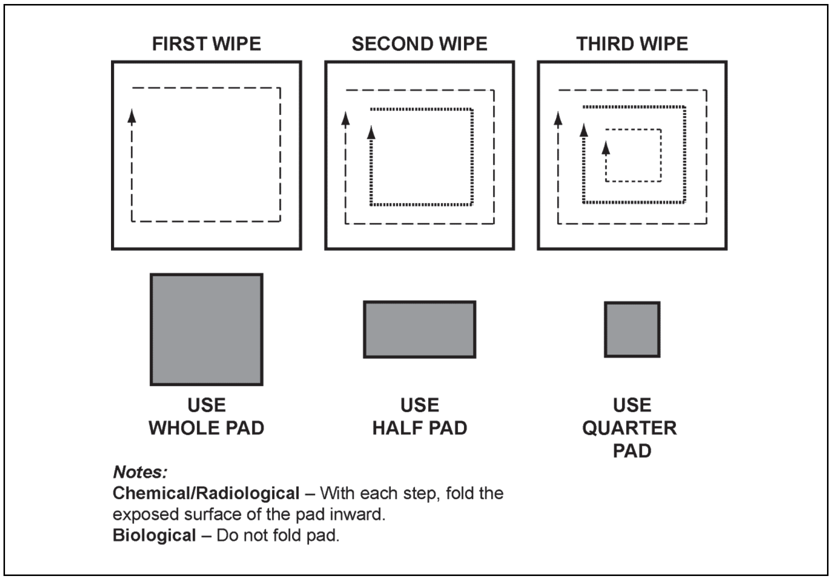

Figure H-3. Decrease concentric squares surface technique

GENERAL SAMPLE SUBMISSION PROCEDURES

H-21. The general sample submission procedure are as follows:

- Submit control standards and samples (for example, field blanks, background samples, spike samples, split samples, duplicates, laboratory blanks) as required by the sample collection plan or analytical laboratory's protocol.
- Obtain information for the analytical laboratory about adding solvent to the container containing the swipe sample. Samples for some substances should have solvent added to the vial or other container as soon as the swipe sample is placed inside the container.
- Submit the samples to the analytical laboratory with appropriate documentation, which includes a chain-of-custody form. (Sample shipment procedures are not covered under this reference document.)

SURFACE SAMPLES FOR RADIOACTIVE CONTAMINATION

H-22. Monitoring for removable radioactive contamination should be conducted using conventional large-area wiping for qualitative analyses using a filter paper or equivalent over 100 square centimeters of the surface. Large-area sample collection is performed by wiping cheesecloth, muslin, or an oil-impregnated dust cloth over the surface. If tritium contamination is likely, collection should be done using wet glass fiber filters meant to be analyzed with a liquid scintillation counter. Under certain conditions, radioactive (tritium) contamination may penetrate the contaminated surface and then return to the surface over an extended period of time. The following are procedures for surface sample collection for radioactive contamination:

- Ensure that the collected samples are representative of the entire surface, with special attention paid to likely points for collection of contamination.
- Sample the following points of contamination:
  - Leakage points.
  - Rough surface areas.
  - Infrequently cleaned areas.
  - Work areas.
  - High-traffic areas.

SURFACE SAMPLE COLLECTION FOR BIOLOGICAL AGENTS

H-23. Collect sterile surface samples of biological agents on large, nonporous surfaces such as tabletops, counters, desks, file cabinets, and noncarpeted floors. The following are procedures for surface sample collection for biological agents:

- Remove a sterile 3 by 3 inches (or smaller) synthetic (noncotton) gauze pad (gauze, sterile sponges) from package. The sterile gauze (or other sample collection item) must be handled (removed from packaging) with sterile instruments (tweezers, forceps, or hemostat) to avoid contamination.
- Premoisten the gauze with appropriate buffer solution and use aseptic technique to prevent cross contamination for dry sample collection.

Note. Consult the laboratory personnel that will conduct the analysis to determine which gauze and solution is preferred (decreasing concentric squares or S-pattern).

- Wipe the surface. Recommended wipe area is approximately 1 square foot. Avoid letting the gauze pad dry completely.
- Make enough vertical S-strokes to cover the entire sample area, for chemical or radiological fold the exposed side of the pad. Make horizontal S-strokes over the same area. Place the sampled gauze in a sterile conical vial filled with buffer solution or sterile water to submerse the wipe and cap the vial.
- Label the vial, and place it in a self-sealing bag.
- Document the following sample data:
  - Unique number or identifier.
  - Collection area.
  - Sample type.
  - Collection date and time.
  - Name of person collecting sample.
  - Size of the area sampled.
  - Map of sample area.
- Clean the outside of the sealed bag with a 0.5 to 0.6 percent sodium hypochlorite solution just prior to leaving the contaminated area. A 0.5 percent sodium hypochlorite solution can be obtained by diluting household bleach 1:10 with water. For applications aboard naval ships, use a 0.5 calcium hypochlorite solution prepared according to guidance provided within *Naval Ships' Technical Manual*.
- Place the cleansed bag in another unused self-sealing bag.
- Repeat all previous steps to collect another sample.
- Change gloves between samples.
- Prepare samples for shipping according to applicable guidelines and submit the samples to the laboratory for analysis. Shipping information can be found in the CFR 49 and in International Air Transport Association (IATA) guidelines.

H-24. Table H-8, page H-18, provides additional guidance for determining the size or amount of the recommended sample for chemical, biological, and radiological agents. Background samples should be about the same size as contaminated sample taken from an incident area.

Table H-8. Recommended sample collection sizes

Chemical samples		
Item	***Size***	***Remarks***
Soil	10 by 5 by 1 centimeters	A larger area is more useful than a greater depth.
Liquid agent	50 milliliters	None.
Diluted agent	10 milliliters	The depth depends on the water source and the agent surface tension.
Water	50 milliliters (maximum)	The depth depends on the water source and the agent surface tension.
Vegetation	Equivalent to 3 leaves or 3 handfuls of grass	The size depends on the amount of contamination. The best samples are found closest to the release point.
Biological samples		
Item	***Size***	***Remarks***
Soil	10 x 5 x 1 centimeter	A larger area is more useful than a greater depth.
Liquid	25 to 50 milliliter	A C18 Sep-Pak™ cannot be used with medical samples.
Vegetation	About the size of a soft drink can	The best samples are found closest to the release point.
Radiological samples		
Item	***Size***	***Remarks***
Water	1 to 4 liters	This sample is obtained from surface or water discharges.
	1 to 4 liters	This sample is obtained from drinking water.
Soil	2 kilograms (about 1 meter x 1 meter x 8 centimeter)	This is the gamma spectrometry plus the gross alpha or beta.
	100 grams	This is the gross alpha or beta.

H-25. Although specific sample collection procedures may vary, there are common guidelines that apply to any sample collection operation. Safety is the foremost concern during any sample collection operation as the sample area may be inherently dangerous and contaminated.

- The administrative procedures assure a documented chain of custody and a detailed description of the collection procedure. After laboratory analysis of the sample, intelligence personnel analyze the data to produce intelligence to support operational requirements.
- Identify physical/mechanical hazards that may affect the sample collection operation. Adjust sample management plan accordingly to mitigate hazard.
- Ensure that the sample collection area is clear of secondary or additional devices before the sample collection operation. However, remain vigilant for the possibility that these devices may be present.
- Do not conduct operations in a contaminated area without backup personnel present, who are partially dressed in the appropriate PPE, prepared to don complete PPE, and enter the area as an emergency extraction team.
- Take the following steps so that contamination is not spread:
  - Establish hot, warm, and cold zones. Clearly mark the boundaries among the zones.
  - Identify clearly ingress and egress points after the zones are established.

    - Establish a decontamination area in the warm zone for personnel and equipment. Decontaminate sample collection R&S element members and sample containers according to applicable guidelines (as defined by the sample collection R&S element).
- Place a disposable, impermeable sheet on a field table or the ground for the staging of sample collection equipment and containers.
- Avoid cross-contaminating samples.
- Prepare prepackaged sample collection tools in the cold zone. The goal is to maximize the quantity of time the R&S element is able to spend collecting samples in the hot zone by preparing the sample collection gear in the cold zone.
- Collect critical samples and those that are most likely to be lost, destroyed, altered, or overlooked first; and then move them to the staging area.
- Ensure that the sample collection tools are precleaned, individually wrapped, and sterile. Do not reuse or recycle them. Use them to collect a single sample only.
- Avoid contaminating the outer surface of the primary container. Test the container for contamination if possible; for example, certain liquid military chemical agents can be detected with detector paper. If the container becomes contaminated, repackage the entire sample in an uncontaminated container.
- Place the primary container inside a secondary container for transport to the cold zone where it is packaged and shipped to a laboratory for analysis.
- Decontaminate secondary containers before removing them from the contaminated area.

H-26. Radiological sample collection operations are important to determine if and where a threat uses a radiological agent. The collection of samples and background information must be as detailed and comprehensive as possible. Each sample must be processed and analyzed to provide data for analysis. Sample processing includes the collection, packaging, storing, transporting, transferring, and tracking of the sample. The following are included in the sample process:

Note. The radiological sample collection described in this section is provided as a guide. Specialized units may use more detailed procedures found in references, such as *Allied Engineering Publication* (AEP) 49.

- A threat may scatter radiological agents as radionuclide dust or as pellets of radioactive materials. Radioactive dust will cover vegetation, soil, and water surfaces. Radioactive pellets will not cover vegetation surfaces like a dust, but will remain on the surface of the soil. Also, pellets will sink to the bottom of bodies of water. The R&S element can take samples of vegetation, soil, or water to collect the pellets or dust.
- Ensure that personnel involved in the operation have dosimetry devices and are dressed in the appropriate level of PPE according to Occupational Safety and Health Administration regulations.
- The R&S element conducts a ground radiological search to locate the contamination. Since the purpose of a sample collection mission is to collect radioactive samples, terminate the search after the radioactive area is found. The safety of the R&S element is a constant concern for the commander. The contaminated area may emit high dose rates of radiation; therefore, the R&S element monitors the radiation throughout the radiological sample collection mission and does not exceed the commander's OEG turn-back dose and turn-back dose rate.
- The R&S element collects radiological contaminated environmental samples. It chooses the sample media based on the measurements the collector makes with RADIAC. Ground contamination may vary significantly from place to place. Local dose rate averages are helpful in choosing a representative sample collection area. Conduct soil sample collection after the release has ended. Be aware of the commander's turn-back dose and turn-back dose rate guidance and of the hazards that may be encountered.

SAMPLE COLLECTION PROCEDURES

H-27. This section will provide sample collection procedures for two-man and three-man organizations for the following tasks:

- **Solid.** Take—
  - A solid chemical sample.
  - A solid biological sample.
  - An environmental vegetation sample.
  - A radiological surface soil sample.
  - A radiological vegetation and pasture sample.
  - Radiological samples in urban areas.
- **Liquid.** Take—
  - A liquid chemical sample.
  - A liquid chemical sample using tubing.
  - A liquid biological sample.
  - Take a radiological surface water sample.
- **Wipes and swabs.** Take—
  - A chemical wipe sample.
  - A dry biological swab sample.
  - A wet biological swab sample.
  - A dry biological wipe (sponge) sample.
  - A wet biological wipe (sponge) sample.

Note. Each set of primary and secondary containers used during these sample collection procedures should be placed in a third container (also called the sample transport container) for transport. This third container may be a zipper-locked bag, rubberized bag, cardboard or plastic shipping box, cooler, or other container. The outside of each container must be decontaminated as packaging proceeds to avoid the spread of contamination. Take care to avoid contacting the sample with decontaminant or getting decontaminant inside the primary sample container. Also, IPE/PPE is assumed.

SOLID

H-28. The sample collection R&S element equipment required for a solid chemical sample is identified in table H-9.

Table H-9. Sample collection R&S element equipment required for a solid chemical sample

Item	*Quantity*	*Sterility*
Sample collection spoon	1	nonsterile
Sample collection scoop	1	nonsterile
Scoop handle or	1	nonsterile
Scalpel	1	nonsterile

Table H-9. Sample collection R&S element equipment required for a solid chemical sample (continued)

Item	*Quantity*	*Sterility*
Sample container	1	nonsterile
Self-sealing laboratory tape	1	nonsterile
Tamper label	1	nonsterile
Bleach pack wipes	1	nonsterile
Scissors	1	nonsterile
Secondary container/bag	1	nonsterile
Ground tarp	1	nonsterile
Two-person sample collection R&S element		
Individual	***Personal protective equipment gloves***	***Nitrile Gloves***
Assistant sampler	X	
Sampler	X	X
Three-person sample collection R&S element		
Recorder	X	
Assistant sampler	X	
Sampler	X	X

H-29. The following are steps for two-person procedures (solid chemical sample):

- **Step 1.** The assistant sampler removes all identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools).
- **Step 2.** The sampler determines which tool he will use and tells assistant sampler.

Note. Use the sample collection scoop for sample collection of fine particulates. Use the spoon for sample collection of coarse particulates. Use the scalpel for scrapping wood, paint, or crusted/coated material.

- **Step 3.** The assistant sampler opens protective packing and allows the sampler to remove the identified tool.
- **Step 4.** The sampler inserts the sample collection scoop into the scoop handle.

Note. If using the sample collection spoon or scalpel, skip to step 5.

- **Step 5.** The assistant sampler removes sample container assembly from the kit; opens the outer container and removes sample container.
- **Step 6.** The assistant sampler opens sample container packing, removes identification labels and affixes one label to the sample container.
- **Step 7.** The assistant sampler verifies sample container number matches sample number on outer container; affixes sample number label to sample log notebook.
- **Step 8.** The assistant sampler opens sample container and hands it to the sampler.
- **Step 9.** The sampler scrapes or scoops the solid material/soil into the sample container until the container is at least two-thirds full. Whenever possible, sample containers should be completely filled, leaving no head space to minimize possible volatilization.
- **Step 10.** The sampler places cap on sample container and screws tight.
- **Step 11.** The assistant sampler removes bleach pack wipe from kit and hands to sampler.

- **Step 12.** The sampler decontaminates his hands and the sample container with the bleach pack wipe.
- **Step 13.** The assistant sampler removes self-sealing laboratory tape from kit, cuts an adequate section length, and hands to sampler.
- **Step 14.** The sampler places self-sealing laboratory tape around the sample container closure to seal cap to container.
- **Step 15.** The assistant sampler retrieves the outer container, opens it, and holds it open to the sampler.
- **Step 16.** The sampler places sealed container into outer container held by the assistant sampler ensuring he does not touch the plastic container.
- **Step 17.** The assistant sampler places cap on outer container and screws tight; places tamper seal tape across cap with the ends contacting the sides of the outer container (forming a seal that will be broken if the cap is removed); places outer container into sample transport bag.
- **Step 18.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

G-28. The following are steps for three-person procedures (solid chemical sample):

- **Step 1.** The assistant sampler removes all identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools).
- **Step 2.** The assistant sampler hands sample collection spoon or sample collection scoop and scoop handle or scalpel to assistant sampler.

Note. Use the sample collection scoop for sample collection fine particulates. Use the spoon for sample collection coarse particulates. Use the scalpel for scrapping wood, paint, or crusted/coated material.

- **Step 3.** The assistant sampler opens protective packing and allows the sampler to remove the sample collection spoon or sample collection scoop and scoop handle or scalpel.
- **Step 4.** The sampler inserts the sample collection scoop into the scoop handle.

Note. Skip to Step 5, if using the sample collection spoon or scalpel.

- **Step 5.** The assistant sampler removes sample container assembly from kit; opens the outer container and removes sample container.
- **Step 6.** The assistant sampler opens sample container packing; removes identification labels; hands one label to recorder and affixes the other label to the sample container.
- **Step 7.** The assistant sampler verifies sample container number matches sample number on outer container; affixes sample number label to sample log notebook.
- **Step 8.** The assistant sampler opens sample container and hands it to the sampler.
- **Step 9.** The sampler scrapes or scoops the solid material/soil into the sample container until the container is at least 2/3 full while assistant sampler takes a picture of the sample collection. Whenever possible, sample containers should be completely filled, leaving no head space to minimize possible volatilization.
- **Step 10.** The sampler places cap on sample container and screws tight while the sampler holds the container and verifies that the cap is secure and the assistant sampler takes a picture.
- **Step 11.** The assistant sampler removes bleach pack wipe from kit and hands to sampler.
- **Step 12.** The sampler opens bleach pack and decontaminates the outside of the sample container by wiping it with the bleach pack wipe.
- **Step 13.** The assistant sampler removes self-sealing laboratory tape from kit; cuts an adequate section length, and hands to sampler.
- **Step 14.** The sampler places self-sealing laboratory tape around the sample container closure to seal cap to container.

- **Step 15.** The sampler places sealed container into outer container held by the assistant sampler.
- **Step 16.** The assistant sampler places cap on outer container and screws tight; places tamper seal tape across cap with the ends contacting the sides of the outer container (forming a seal that will be broken if the cap is removed); places outer container into sample transport bag.
- **Step 17.** The R&S element members dispose of used sample collection equipment and remove nitrile gloves.

Take a Solid Biological Sample

H-30. The sample collection R&S element equipment required for a solid biological sample is identified in table H-10.

Table H-10. Sample collection R&S element equipment required for a solid biological sample

Item	*Quantity*	*Sterility*
Sample collection spatula, scalpel, or tweezers	1	sterile
Sample vial assembly or sample jar	1	sterile
Self-sealing laboratory tape	1	nonsterile
Scissors	1	nonsterile
Tamper label	1	nonsterile
Bleach pack wipes	1	nonsterile
Secondary container/bag	1	nonsterile
Ground tarp	1	nonsterile
Two-person sample collection R&S element		
Individual	***Personal protective equipment gloves***	***Nitrile gloves***
Assistant sampler	X	
Sampler	X	X
Three-person sample collection R&S element		
Recorder	X	
Assistant sampler	X	
Sampler	X	X

H-31. The following are steps for two-person procedures (solid biological sample):

- **Step 1.** The assistant sampler removes all identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools).
- **Step 2.** The assistant sampler opens protective packing and allows the sampler to remove the required tool.
- **Step 3.** The assistant sampler opens sterile inner sample vial assembly bag or sample jar bag and lays out on tarp.
- **Step 4.** The assistant sampler removes identification labels; affixes one label to the sample bag.
- **Step 5.** The assistant sampler verifies all sample numbers match; affixes the other sample number label to sample log notebook.
- **Step 6.** The assistant sampler opens inner sample vial assembly or sample jar and hands to sampler.
- **Step 7.** The sampler carefully collects the sample so that the sample collection end of the tool touches nothing but the sample, and transfers it to the inner sample vial assembly or sample jar.

- **Step 8.** The sampler holds the inner sample vial assembly or sample jar, when finished collecting the sample, while the assistant sampler puts on the cap.
- **Step 9.** The assistant sampler screws the cap on the inner sample vial assembly or sample jar while the sampler holds the vial.
- **Step 10.** The assistant sampler removes bleach pack wipe and gives it to the sampler.
- **Step 11.** The sampler decontaminates his hands and the inner sample vial with the bleach pack wipe.
- **Step 12.** The assistant sampler removes self-sealing laboratory tape from package; cuts enough to wrap once around the sample container top and gives it to the sampler.
- **Step 13.** The sampler uses the self-sealing laboratory tape to seal the cap to the vial or sample jar.
- **Step 14.** The assistant sampler holds outer sample vial or container.
- **Step 15.** The sampler places the inner sample vial assembly into the outer sample vial or container.
- **Step 16.** The assistant sampler places the cap on the outer sample vial or container, and places tamper seal tape over the outer sample vial or container cap.
- **Step 17.** The assistant sampler places the outer sample vial or container, containing the sample, into a sample bag; seals the bag.
- **Step 18.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

G-29. The following are steps for three-person procedures (solid biological sample):

- **Step 1.** The assistant sampler removes all identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools).
- **Step 2.** The assistant sampler opens protective packing and allows the sampler to remove the required tool.
- **Step 3.** The assistant sampler removes identification labels; affixes one label to the sample bag.
- **Step 4.** The recorder verifies that sample numbers match; affixes the other sample number label to sample log notebook.
- **Step 5.** The assistant sampler opens inner sample vial assembly or sample jar bag and hands to sampler.
- **Step 6.** The sampler carefully collects the sample so that the sample collection end of the tool touches nothing but the sample, and transfers it to the inner sample vial assembly or sample jar while recorder takes a picture of the sample collection.
- **Step 7.** The assistant sampler screws the cap on the inner sample vial assembly or sample jar.
- **Step 8.** The assistant sampler removes a bleach pack wipe and gives it to the sampler.
- **Step 9.** The sampler decontaminates the inner sample vial assembly or sample jar by wiping it with the bleach pack wipe.
- **Step 10.** The assistant sampler removes the self-sealing laboratory tape and cuts enough to wrap once around the inner sample vial assembly or sample jar and hands it to the sampler.
- **Step 11.** The sampler uses the self-sealing laboratory tape to seal the cap to the vial or jar.
- **Step 12.** The sampler places the inner sample vial assembly or jar in an outer sample vial or container held open by the assistant sampler.
- **Step 13.** The assistant sampler places the lid onto the outer sample vial or container and places tamper seal tape over the lid of the outer sample vial or container.
- **Step 14.** The assistant sampler places the outer sample vial or container, containing the sample, into a sample bag; seals the bag.
- **Step 15.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

Take an Environmental Vegetation Sample

H-32. The sample collection R&S element equipment required for an environmental vegetation sample is identified in table H-11.

Table H-11. Sample collection R&S element equipment required for an environmental vegetation sample

Item		*Quantity*	*Sterility*
Zipper lock bag		2	nonsterile
Collection tool (tweezers, forceps, or hemostat)		1	nonsterile
Sample label		1	nonsterile
Tamper label		1	nonsterile
Bleach pack wipes		1	nonsterile
Secondary container/bag		1	nonsterile
Ground tarp		1	nonsterile
Individual	***Personal protective equipment***		***Nitrile gloves***
Two-person sample collection R&S element			
Assistant sampler	X		
Sampler	X		X
Three-person sample collection R&S element			
Recorder	X		
Assistant sampler	X		
Sampler	X		X

H-33. The following are steps for two-person procedures (environmental vegetation sample):

- **Step 1.** The assistant sampler removes identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools).
- **Step 2.** The assistant sampler prepares sample labels.
- **Step 3.** The assistant sampler attaches sample label to the sample zipper lock bag.
- **Step 4.** The assistant sampler verifies all sample numbers match; affixes a sample label to sample log notebook.
- **Step 5.** The assistant sampler opens zipper lock bag and holds for sampler.
- **Step 6.** The sampler gathers vegetation and places in zipper lock bag using appropriate tool (tweezers, forceps, or hemostat).
- **Step 7.** The assistant sampler hands zipper lock bag to sampler.
- **Step 8.** The sampler closes bag, compressing the bag as much as possible and expending excess air before sealing the bag closed.
- **Step 9.** The assistant sampler removes a bleach pack wipe and gives it to the sampler.
- **Step 10.** The sampler decontaminates his hands and the zipper lock bag with the bleach pack wipe.
- **Step 11.** The assistant sampler holds another zipper lock bag open for the sampler.
- **Step 12.** The sampler places zipper lock bag with the vegetation sample inside the zipper lock bag held by assistant sampler.
- **Step 13.** The assistant sampler compresses the bag as much as possible and expends excess air before sealing the bag closed.

- **Step 14.** The assistant sampler places a tamper seal over the opening of the outer sample zipper lock bag.
- **Step 15.** The assistant sampler places the zipper lock bag into the sample transport bag.
- **Step 16.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

H-34. The following are steps for three-person procedures (environmental vegetation sample):

- **Step 1.** The assistant sampler removes all identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools).
- **Step 2.** The assistant sampler opens zipper lock bag and holds for sampler.
- **Step 3.** The sampler gathers vegetation and places in zipper lock bag using appropriate tool (tweezers, forceps, or hemostat). Recorder takes pictures of the collection.
- **Step 4.** The assistant sampler closes zipper lock bag, compressing the bag as much as possible and expending excess air before sealing the bag closed.
- **Step 5.** The assistant sampler prepares sample label.
- **Step 6.** The assistant sampler affixes sample label to zipper lock bag.
- **Step 7.** The recorder records sample label in sample log notebook.
- **Step 8.** The assistant sampler removes a bleach pack wipe and gives it to the sampler.
- **Step 9.** The sampler decontaminates the zipper lock bag by wiping it with the bleach pack wipe.
- **Step 10.** The sampler places zipper lock bag with vegetation sample inside the zipper lock bag (this provides the secondary containment) held open by the assistant sampler; the assistant sampler compresses the bag as much as possible and expending excess air before sealing the bag closed.
- **Step 11.** The assistant sampler places a tamper seal over the opening of the zipper lock bag.
- **Step 12.** The assistant sampler places the zipper lock bag into the sample transport bag.
- **Step 13.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

Take a Radiological Surface Soil Sample

H-35. The following are steps for radiological surface soil sample collection:

- **Step 1.**
  - ***Step 1a.*** Receive an initial briefing and assignment from the command.
  - ***Step 1b.*** Obtain the appropriate equipment.
  - ***Step 1c.*** Check the instrument's performance.
  - ***Step 1d.*** Conduct radio and GPS checks when leaving for the assignment.
- **Step 2.**
  - ***Step 2a.*** Wrap the instruments in plastic to prevent contamination (except for the detector window if there is one).
  - ***Step 2b.*** Preclean and bag or wrap the sample collection equipment.
  - ***Step 2c.*** Set the alarm levels of direct-reading dosimeters and dose rate meters.
  - ***Step 2d.*** Wear appropriate radiation protection equipment (see *Multiservice Tactics, Techniques, and Procedures for Nuclear, Biological, and Chemical [NBC] Protection*).
  - ***Step 2e.*** Wear disposable latex or vinyl gloves, and change them between sample areas.
- **Step 3.**
  - ***Step 3a.*** Select sample collection areas that permit easy resample collection at a later date if necessary.
  - ***Step 3b.*** Identify the position using a Global Positioning System reading, local landmarks, stakes, or other markers.
  - ***Step 3c.*** Select an area that has relatively little vegetation; is undisturbed since the radioactive release; well away from structures, that is, distance approximately twice the

height of nearest structures to minimize the effects of wind currents on deposition. The number of sample collection areas depends on the purpose of sample collection and the information required from the particular analysis. Obtain this information during the mission prebrief.

  - ***Step 3d.*** Take the sample in an area that is 450 to 900 square centimeters, and obtain a composite of 10 or more individual plugs or cores. If time is critical, collect only a single core. In general, collect the top 5 centimeters of the soil (for example, topsoil) for analyses. The sample collection pattern can include laying out a 5-meter straight line, transacting the line at about 50-centimeter intervals, and taking at least 10 samples and measuring out two 1-square-meter areas that are spaced about 3 meters apart and collecting samples from the middle and the corners of each square.

Notes.

1. Prevent sample collection equipment contamination by using a ground tarp to place tools, instruments, and collected samples.

2. Conduct a handheld gamma instrument survey to avoid hot spots and determine external exposure levels before collecting soil samples in a suspected contaminated area.

3. While collecting soil samples of a suspected contaminated area, use handheld gamma instruments to avoid hot spots.

- **Step 4.** Record the environmental conditions at each sample collection area at the time of sample collection. These include the weather conditions and the ambient gamma dose rate.
- **Step 5.** Collect a sample in moist or loamy soil.
- **Step 6.** Select the sample collection area and pattern. Don rubber gloves. Remove vegetation to a height of 1 to 2 centimeters above the soil, and save the vegetation for analysis if desired.
- **Step 7.** Use an indelible ink pen to mark the outside of the sample collection tool to the desired depth.
- **Step 8.** Press the sample collection tool into the ground to the desired depth without twisting or disturbing the grass cover or surface soil. Force may be required to enable the sample collection tool into the ground. This may be accomplished by stepping on the top of the sample collection tool or using a rubber mallet.
- **Step 9.** Gently twist the sample collection tool to cleanly remove the topsoil plug intact. If the plug cannot be removed intact, use another method of sample collection, such as inserting the sample collection tool in various places along the perimeter of a small circle until a plug is freed.
- **Step 10.** Place the plug in a new sample collection container. If the plug does not come out of the sample collection tool easily, use a long, flat-blade knife to remove it from the tool.
- **Step 11.** Take at least 10 topsoil cores in the sample collection pattern selected, and place them into the sample collection container.
- **Step 12.** Collect a sample in dry, loose, and sandy soils.
  - ***Step 12a.*** Select the sample collection area and pattern. Don rubber gloves. Remove all vegetation to a height of 1 to 2 centimeters above the soil, and save the vegetation for analysis if desired.
  - ***Step 12b.*** Press a 10 by 10 by 1 centimeter stamp into the desired area. Use a rubber mallet if necessary.
  - ***Step 12c.*** Use the matching scoop to slide beneath the stamp, trapping the sample within the stamped area.
  - ***Step 12d.*** Repeat with the specified pattern to obtain 10 samples and composites.
- **Step 7.**
  - ***Step 7a.*** Seal the bags with tape.

- *Step 7b.* With an indelible ink pen, write the sample identification, area (using GPS or grid coordinates), date and time of the sample collection, and the collector's initials on the sample collection container and the sample control form.
- *Step 7c.* Begin a chain-of-custody form if necessary.

- **Step 8.**
  - *Step 8a.* Clean the sample collection tools in clean (distilled) water, and dry them before proceeding to the next sample collection point.
  - *Step 9a.* Assess the tool for residual contamination using alpha/beta instruments.
- **Step 9.** Repeat steps 3 through 8 for necessary replicates, background samples, and other sample collection areas.
- **Step 10.**
  - *Step 10a.* Visually inspect the sample collection equipment, and replace or clean it if necessary.
  - *Step 10b.* Use alpha/beta instruments to determine if the sampler remains contaminated.
- **Step 11.**
  - *Step 11a.* Complete a soil sample collection form for each soil sample collected.
  - *Step 11b.* Place the original forms in a sealed plastic bag, and transport them with the sample.
- **Step 12.** Periodically survey the vehicle and personnel.
- **Step 13.** Perform personnel and equipment monitoring (contamination check) during and after the mission.

Take a Radiological Vegetation and Pasture Sample

H-36. The following steps are for radiological vegetation and pasture sample collection:

- **Step 1.**
  - *Step 1a.* Receive an initial briefing and assignment from the command.
  - *Step 1b.* Obtain the appropriate equipment.
  - *Step 1c.* Check the instrument performance.
  - *Step 1d.* Conduct radio and Global Positioning System checks when leaving for the assignment.
- **Step 2.**
  - *Step 2a.* Wrap the instruments in plastic to prevent contamination (except for the detector window if there is one).
  - *Step 2b.* Preclean and bag or wrap the sample collection equipment. Set the alarm levels of direct-reading dosimeters and dose rate meters.
  - *Step 2c.* Wear appropriate radiation protection equipment. See *Multiservice Tactics, Techniques, and Procedures for Nuclear, Biological, and Chemical (NBC) Protection*.
  - *Step 2d.* Wear disposable latex or vinyl gloves, and change them between sample areas.
- **Step 3.**
  - *Step 3a.* Collect all samples from areas that are unprotected from the wind and undisturbed since the release. The areas should be located in open level areas, away from walkways, roads, ditches, and trenches.
  - *Step 3b.* Ensure that a sample collection point near a building is at least twice the height of the building away from the building.
  - *Step 3c.* Use a handheld gamma survey instrument to locate an area with relatively uniform levels. Avoid hot spots.
  - *Step 3d.* Avoid sample collection in waterlogged areas and areas that contain a large proportion of dead plant material.

  - ***Step 3e.*** Take the sample from a defined area, if possible. A 1 by 1 meter area will often provide a sufficient vegetation sample. Unless directed otherwise, obtain at least 1 kilogram of material, expanding the defined area if necessary.
- **Step 4.**
  - ***Step 4a.*** Use the sample collection form to record the environmental conditions at each sample collection area at the time of the sample collection.
  - ***Step 4b.*** Include the weather conditions and the ambient gamma dose rate.
- **Step 5.**
  - ***Step 5a.*** Use shears or another instrument to cut the sample down to 1 to 2 centimeters above the ground.
  - ***Step 5b.*** Disposable scalpels limit cross-contamination problems.
- **Step 6.**
  - ***Step 6a.*** Fill a large, clean, unused polyethylene bag, taking care to minimize external contamination.
  - ***Step 6b.*** Seal the container.
- **Step 7.** Use an indelible ink pen to write the sample identification, area, date and time of sample collection, and the collector's initials on the sample collection container and the sample control form.
- **Step 8.** Complete the necessary sample collection forms, and begin a chain-of-custody form.
- **Step 9.**
  - ***Step 9a.*** Decontaminate the outside of the sample collection containers and tools by rinsing them with clean (distilled) water. Wipe them down.
  - ***Step 9b.*** Double-bag the sample.
  - ***Step 9c.*** Check the surfaces of the sample collection equipment with alpha/beta instruments for residual contamination.
- **Step 10.** Repeat steps 3 through 9 for necessary replicates, background samples, and other sample collection areas.
- **Step 11.** Periodically survey the vehicle and personnel.
- **Step 12.** Perform personnel and equipment monitoring (contamination check) during and after the mission.

Take Radiological Samples in Urban Areas

H-37. The following steps are general procedures for taking radiological samples in urban areas:

- **Step 1.**
  - ***Step 1a.*** Receive an initial briefing and assignment from the command.
  - ***Step 1b.*** Obtain the appropriate equipment.
  - ***Step 1c.*** Check the instrument performance.
  - ***Step 1d.*** Conduct radio and Global Positioning System checks when leaving for the assignment.
- **Step 2.**
  - ***Step 2a.*** Wrap the instruments in plastic to prevent contamination (except for the detector window if there is one).
  - ***Step 2b.*** Preclean and bag or wrap the sample collection equipment.
  - ***Step 2c.*** Set the alarm levels of direct-reading dosimeters and dose rate meters.
  - ***Step 2d.*** Wear appropriate radiation protection equipment. See *Multiservice Tactics, Techniques, and Procedures for Nuclear, Biological, and Chemical (NBC) Protection*.
- **Step 3.**
  - ***Step 3a.*** Use the sample collection form to record the environmental conditions at each sample collection area at the time of the sample collection.

    - *Step 3b.* Include the weather conditions and the ambient gamma dose rate. Annotate the sample collection location on an area map.
    - *Step 3c.* Take a digital or self-developing image of the area if possible.
- **Step 4.** Sample roof tiles.
    - *Step 4a.* Select buildings with roofs that are easy to access.
    - *Step 4b.* Obtain permission from the owner to take tiles that are still in place.
    - *Step 4c.* Select tiles that are oriented at ≤45° to the ground, if possible. Do not select tiles that are oriented vertically.
    - *Step 4d.* Use appropriate, clean tools to remove four to eight tiles. One or two tiles will represent each sample.
    - *Step 4e.* Transfer the tiles into a new, dry container.
    - *Step 4f.* Wipe the external surfaces of the container, and double-bag it.
    - *Step 4g.* Use an indelible ink pen to write the sample identification, area, date and time of sample collection, and the collector's initials on the sample collection container and the sample control form. Record the sample collection details, including the specific sample area and the exposed area.
    - *Step 4h.* Place and seal all sample bags inside a large, thick, black plastic bag.
- **Step 5.** Sample road dust.
    - *Step 5a.* Select areas where dust is clearly visible.
    - *Step 5b.* Use a new paintbrush to sweep the dust into a pile, and sweep it onto a small scoop. Use a new paintbrush for each new set of samples.
    - *Step 5c.* Place the scoop in the sample container, and slowly tip the dust into the container.
    - *Step 5d.* Wipe the external surfaces of the container, and double-bag it.
    - *Step 5e.* Use an indelible ink pen to write the sample identification, area, date and time of sample collection, and the collector's initials on the sample collection container and the sample control form. Record the sample collection details, including the specific sample area and the exposed area.
    - *Step 5f.* Place and seal all sample bags inside a large, thick, black plastic bag.
- **Step 6.** Sample roof gutter dirt.
    - *Step 6a.* Select buildings with roofs that are easy to access, and choose an area that is close to the gutter downpipe.
    - *Step 6b.* Use a gloved hand to remove dirt from the bottom of the gutter, and place it in a sample container.
    - *Step 6c.* Wipe the external surfaces of the container, and double-bag it.
    - Use an indelible ink pen to write the sample identification, area, date and time of sample collection, and the collector's initials on the sample collection container and the sample control form. Record the sample collection details, including the specific sample area and the exposed area.
    - *Step 6d.* Place and seal all sample bags inside a large, thick, black plastic bag.
- **Step 7.** Sample improvised air filters.

Note. The system airflow rate is particularly important. By estimating the time of plume passage, the approximate concentration of radioactivity in the air can be estimated.

    - *Step 7a.* Identify buildings or homes with ventilation systems that were operating and stationary during plume passage.
    - *Step 7b.* Determine the airflow rate of the system or engine, if possible, and record it on an air sample collection form.
    - *Step 7c.* Remove the filter cover. Determine if significant contamination is present by surveying with a beta/gamma or alpha contamination probe. Record the net count rate on the surface of the filter, and record the details of the instrument used.

- ***Step 7d.*** Place the filters into a polyethylene bag, wipe the external surface, and label it. Double-bag the sample.
- ***Step 7e.*** Use an indelible ink pen to write the sample identification, area, date and time of sample collection, and the collector's initials on the sample collection container and the sample control form. Record the sample collection details, including the specific sample area and the exposed area.

- **Step 8.** Periodically survey vehicles and personnel; and document the reading, time, and area.
- **Step 9.** Perform personnel and equipment monitoring (contamination check) after the mission.

LIQUID CHEMICAL SAMPLE

H-38. The sample collection R&S element equipment required for a liquid chemical sample is identified in table H-12.

Table H-12. Sample collection R&S element equipment required for a liquid chemical sample

Item	***Quantity***	***Sterility***
60-millimeter syringe (no needle)	1	nonsterile
Sample container assembly	1	nonsterile
Self-sealing laboratory tape	1	nonsterile
Tamper label	1	nonsterile
Bleach pack wipes	1	nonsterile
Scissors	1	nonsterile
Secondary container/bag	1	nonsterile
Ground tarp	1	nonsterile
Two-person sample collection R&S element		
Individual	***Personal protective equipment gloves***	***Nitrile gloves***
Assistant sampler	X	
Sampler	X	X
Three-person sample collection R&S element		
Recorder	X	
Assistant sampler	X	
Sampler	X	X

H-39. The following are steps for two-person procedures (liquid chemical sample):

- **Step 1.** The assistant sampler removes the identified sample collection tools from kit and lays them out on ground tarp designated as clean work area (see list of needed tools above).
- **Step 2.** The assistant sampler opens protective packing and allows the sampler to remove the syringe.
- **Step 3.** The assistant sampler opens self-sealing laboratory tape; cuts an adequate section length and places on ground tarp.
- **Step 4.** The assistant sampler opens sample container assembly from kit, removes sample container and sample labels. Places on ground tarp.
- **Step 5.** The assistant sampler affixes one label to the sample container, verifies sample container number matches sample number on outer container, affixes sample number label to sample log notebook, and records information in sample log notebook.
- **Step 6.** The assistant sampler opens syringe package exposing the back end and presents to the sampler.

- **Step 7.** The sampler removes syringe from packing and collects liquid sample from just below the surface.
- **Step 8.** The assistant sampler opens sample container and hands to sampler. The assistant sampler keeps the sample container cap.
- **Step 9.** The sampler expresses collected liquid into sample container and discards syringe in dirty area. Whenever possible, sample containers should be completely filled, leaving no head space to minimize possible volatilization.

Note. Do not completely empty the syringe, leave at least 5 milliliters of liquid in the syringe; otherwise, some of the liquid may be aerosolized, creating a contamination hazard.

- **Step 10.** The assistant sampler places cap on sample container, screws tight, and verifies that the cap is secure while the sampler holds the container.
- **Step 11.** The assistant sampler opens a bleach pack wipe and hands wipe to the sampler.
- **Step 12.** The sampler decontaminates his hands and the sample container with the bleach pack wipe.
- **Step 13.** The assistant sampler retrieves self-sealing laboratory tape from tarp and hands an adequate section length to sampler.
- **Step 14.** The sampler places self-sealing laboratory tape around the sample container closure to seal the cap to container.
- **Step 15.** The assistant sampler retrieves the outer container, opens it, and holds it open to the sampler.
- **Step 16.** The sampler places sealed container into outer container held by the assistant sampler, ensuring that he does not touch the outer container.
- **Step 17.** The assistant sampler places cap on outer container and screws tight, places tamper seal tape across the cap with the ends contacting the sides of the outer container (forming a seal that will be broken if the cap is removed) and places outer container into sample transport bag.
- **Step 18.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

H-40. The following are steps for three-person procedures (liquid chemical sample):

- **Step 1.** The assistant sampler removes all identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools).
- **Step 2.** The assistant sampler opens protective packing and allows the sampler to remove the syringe.
- **Step 3.** The sampler removes syringe from packing and collects liquid sample from just below the surface.
- **Step 4.** The assistant sampler opens sample container assembly from kit and removes sample container.
- **Step 5.** The assistant sampler opens sample container packing; removes identification labels; hands one label to recorder and affixes the other label to the sample container.
- **Step 6.** The recorder verifies sample container number matches sample number on outer container; affixes sample number label to sample log notebook; records information in sample log notebook.
- **Step 7.** The assistant sampler opens sample container and holds for sampler.
- **Step 8.** The sampler expresses collected liquid into sample container. Whenever possible, sample containers should be completely filled, leaving no head space to minimize possible volatilization. The recorder takes pictures of the collection.
- **Step 9.** The assistant sampler places cap on sample container and screws tight.
- **Step 10.** The assistant sampler opens bleach pack wipe and hands to sampler.
- **Step 11.** The sampler decontaminates outside of the sample container by wiping it with bleach pack wipe.

- **Step 12.** The assistant sampler opens self-sealing laboratory tape; cuts an adequate section length and hands it to the sampler.
- **Step 13.** The sampler places self-sealing laboratory tape around the sample container closure to seal cap to container.
- **Step 14.** The sampler places sealed container into the secondary container held open by the assistant sampler.
- **Step 15.** The assistant sampler places cap on the secondary container and screws tight, places tamper seal tape across cap with the ends contacting the sides of the outer container (forming a seal that will be broken if the cap is removed), and places outer container into sample transport bag.
- **Step 16.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

LIQUID CHEMICAL SAMPLE USING TUBING

H-41. The sample collection R&S element equipment required for a liquid sample using tubing is identified in table H-13.

Table H-13. Sample collection R&S element equipment required for a liquid sample using tubing

Item	*Quantity*	*Sterility*
60-milliliter syringe (no needle)	1	nonsterile
16 gauge blunt tip needle	1	nonsterile
25-feet tubing	1	nonsterile
Tubing weights	3	nonsterile
Sample container assembly	1	nonsterile
Self-sealing laboratory tape	1	nonsterile
Tamper label	1	nonsterile
Bleach pack wipes	1	nonsterile
Item	*Quantity*	*Sterility*
Scissors	1	nonsterile
Secondary container/bag	1	nonsterile
Ground tarp	1	nonsterile

Two-person sample collection R&S element		
Individual	*Personal protective equipment gloves*	*Nitrile gloves*
Assistant sampler	X	X
Sampler	X	X
Three-person sample collection R&S element		
Recorder	X	
Assistant sampler	X	X
Sampler	X	X

H-42. The following steps are for two-person procedures (liquid chemical sample using tubing):

- **Step 1.** The assistant sampler removes all identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools).

- **Step 2.** The sampler determines the length of tubing necessary to extract the sample.
- **Step 3.** The assistant sampler opens tubing package; pulls out one end of tubing and removes end cap.
- **Step 4.** The assistant sampler partially opens blunt tip needle package at the attachment end, removes blunt tip needle, and inserts needle into tubing for at least one-half inch.
- **Step 5.** The assistant sampler pulls tubing out of package to the desired length for sample collection. Using the scissors cuts the tubing at the desired length, allowing excess tubing to fall to the ground. Tubing may be set on clean ground tarp.
- **Step 6.** The assistant sampler opens the tubing weight packages and slides tubing weights onto far end of the tubing, ensuring that at least one inch of tubing extends past the last tubing weight.

Note. The number of tubing weights on sample end of the tubing is determined by length of tubing. One to three weights can be used.

- **Step 7.** The assistant sampler opens syringe package, removes syringe from package, and attaches syringe to blunt tip needle.
- **Step 8.** The assistant sampler hands syringe and tubing to sampler.
- **Step 9.** The assistant sampler removes self-sealing laboratory tape from kit, cuts an adequate section length, and places it on the tarp.
- **Step 10.** The sampler carefully lowers the weighted end of the tubing into the object to be sampled until it is below the liquid level while maintaining at least 4 inches of tubing above the object being sampled.
- **Step 11.** The sampler carefully draws back on the syringe plunger until the syringe fills with liquid.

Note. Do not fully retract the plunger.

- **Step 12.** The sampler unlocks the needle from the syringe and discards, once the sample is taken.
- **Step 13.** The assistant sampler removes sample container assembly from kit; opens outer container and removes sample container.
- **Step 14.** The assistant sampler opens sample container packing, removes identification labels, and affixes one label to the sample container.
- **Step 15.** The assistant sampler verifies sample container number matches sample number on outer container; affixes sample number label to sample log notebook.
- **Step 16.** The assistant sampler opens sample container and hands sample container to sampler while keeping the cap.
- **Step 17.** The sampler slowly expresses collected liquid against the inside of the sample container to minimize aerosol creation. Also, whenever possible, sample containers should be completely filled, leaving no head space to minimize possible volatilization.

Note. Do not completely empty the syringe, leave at least 5 milliliters of liquid in the syringe; otherwise, some of the liquid may be aerosolized, creating a contamination hazard.

- **Step 18.** The assistant sampler places cap on sample container, screws tight, and verifies that the cap is secure while the sampler holds the container.
- **Step 19.** The assistant sampler opens a bleach pack wipe and hands to the sampler.
- **Step 20.** The sampler decontaminates his hands and the sample container with the bleach pack wipe.
- **Step 21.** The assistant sampler retrieves self-sealing laboratory tape from tarp and hands to sampler.

- **Step 22.** The sampler places self-sealing laboratory tape around the sample container cap to seal the cap to container.
- **Step 23.** The assistant sampler retrieves the secondary container, opens it, and holds it open to the sampler.
- **Step 24.** The sampler places sealed container into the secondary container held by the assistant sampler ensuring that he does not touch the plastic container.
- **Step 25.** The assistant sampler places cap on the secondary container and screws tight, places tamper seal tape across cap with the ends contacting the sides of the secondary container (forming a seal that will be broken if the cap is removed), and places the secondary container into sample transport bag.
- **Step 26.** The R&S element members dispose of used sample collection equipment and remove nitrile gloves.

H-43. The following are three-person procedures (liquid chemical sample using tubing):

- **Step 1.** The assistant sampler removes all identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools).
- **Step 2.** The sampler determines the length of tubing necessary to extract the sample.
- **Step 3.** The assistant sampler opens tubing package; pulls out one end of tubing and removes end cap.
- **Step 4.** The assistant sampler partially opens blunt tip needle package at the attachment end.
- **Step 5.** The assistant sampler removes blunt tip needle and inserts needle into tubing for at least one-half inch.
- **Step 6.** The assistant sampler pulls tubing out of package to the desired length for sample collection; using the scissors cuts the tubing at the desired length, allowing excess tubing to fall to the ground.
- **Step 7.** The assistant sampler opens the tubing weight packages.
- **Step 8.** The assistant sampler slides tubing weight onto far end of the tubing ensuring that at least one inch of tubing extends past the last tubing weight.

Note. The number of tubing weights on sample end of the tubing is determined by length of tubing. One to three weights can be used.

- **Step 9.** The assistant sampler opens syringe package
- **Step 10.** The assistant sampler removes syringe from package while holding the tubing in one hand; attaches syringe to blunt tip needle.
- **Step 11.** The assistant sampler hands syringe and tubing to sampler.
- **Step 12.** The sampler carefully lowers the weighted end of the tubing into the object to be sampled until it is below the liquid level while maintaining at least four inches of tubing above the object being sampled. The recorder takes pictures of the collection.
- **Step 13.** The sampler carefully draws back on the syringe plunger until the syringe fills with liquid, ensuring to not fully retract the plunger while the recorder takes pictures of the collection.
- **Step 14.** The sampler unlocks the needle from the syringe and discards, once the sample is taken.
- **Step 15.** The assistant sampler removes sample container assembly from kit; opens outer container and removes sample container.
- **Step 16.** The assistant sampler opens sample container packing; removes identification labels; hands one label to recorder and affixes the other label to the sample container.
- **Step 17.** The recorder verifies sample container number matches sample number on outer container; affixes sample number label to sample log notebook.
- **Step 18.** The assistant sampler opens sample container.

- **Step 19.** The sampler slowly expresses collected liquid against the glass inside sample container to minimize aerosol creation. Whenever possible, sample containers should be completely filled, leaving no head space to minimize possible volatilization.

Note. Do not completely empty the syringe, leave at least 5 milliliters of liquid in the syringe; otherwise, some of the liquid may be aerosolized, creating a contamination hazard.

- **Step 20.** The assistant sampler places cap on sample container and screws tight and verifies that the cap is secure.
- **Step 21.** The assistant sampler removes bleach pack wipe from kit and hands to sampler.
- **Step 22.** The sampler opens bleach pack wipe and wipes the outside of the sample container to decontaminate it.
- **Step 23.** The assistant sampler removes self-sealing laboratory tape; cuts an adequate section length and hands to sampler.
- **Step 24.** The sampler places self-sealing laboratory tape around the sample container closure to seal cap to container.
- **Step 25.** The sampler places sealed container into secondary container held open by the assistant sampler.
- **Step 26.** The assistant sampler places cap on secondary container and screws tight, places tamper seal tape across cap with the ends contacting the sides of the secondary container (forming a seal that will be broken if the cap is removed), and places secondary container into a sample transport bag.
- **Step 27.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

LIQUID BIOLOGICAL SAMPLE

H-44. The sample collection R&S element equipment required for a liquid biological sample is identified in table H-14.

Table H-14. Sample collection R&S element equipment required for a liquid biological sample

Item	*Quantity*	*Sterility*
Sample collection pipette	1	sterile
Sample vial assembly	1	sterile
Self-sealing laboratory tape	1	nonsterile
Tamper label	1	nonsterile
Bleach pack wipes	1	nonsterile
Scissors	1	nonsterile
Secondary container/bag	1	nonsterile
Ground tarp	1	nonsterile
Two-person sample collection R&S element		
Individual	***Personal protective equipment gloves***	***Nitrile gloves***
Assistant sampler	X	
Sampler	X	X
Three-person sample collection R&S element		
Recorder	X	

Assistant sampler	X	
Sampler	X	X

H-45. The following are the steps for two-person procedures (liquid biological sample):

- **Step 1.** The assistant sampler removes identified sample collection tools from kit and lays them out on ground tarp.
- **Step 2.** The assistant sampler opens the protective packaging of the sterile disposable pipette (handle end).
- **Step 3.** The sampler removes the pipette (by the handle) from the packaging, being careful not to touch the sample collection end of the pipette.
- **Step 4.** The assistant sampler opens sterile inner sample vial assembly bag and lays it out on tarp.
- **Step 5.** The assistant sampler removes identification labels; affixes one label to the sample transfer container.
- **Step 6.** The assistant sampler verifies sample numbers match; affixes the other sample number label to sample log notebook.
- **Step 7.** The sampler carefully collects the sample so that the sample collection end of the pipette touches nothing but the sample. Gently squeezing the bulb on the pipette, inserting the tip into the liquid and slowly releasing the bulb to avoid the creation of aerosols during sample collection**.**
- **Step 8.** The assistant sampler opens inner sample vial assembly and hands to sampler, keeping the cap of the sample vial.
- **Step 9.** The sampler transfers the sample to the inner sample vial assembly.
- **Step 10.** The assistant sampler screws the cap on the inner sample vial assembly while the sampler holds the sample vial.
- **Step 11.** The assistant sampler removes a bleach pack wipe and gives it to the sampler.
- **Step 12.** The sampler decontaminates his hands and the inner sample vial assembly with the bleach pack wipe.
- **Step 13.** The assistant sampler removes self-sealing laboratory tape; cuts an adequate length and gives it to the sampler.
- **Step 14.** The sampler uses the self-sealing laboratory tape to seal the cap to the vial.
- **Step 15.** The assistant sampler holds outer sample vial for sampler.
- **Step 16.** The sampler places the inner sample vial assembly in the outer sample vial.
- **Step 17.** The assistant sampler places the cap on the outer sample vial and screws tight; places tamper seal tape over the cap of the outer sample vial.
- **Step 18.** The assistant sampler places the outer sample vial, containing the sample, into a sample transfer container.
- **Step 19.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

H-46. The following are steps for three-person procedures (liquid biological sample):

- **Step 1.** The assistant sampler removes all identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools).
- **Step 2.** The assistant sampler opens the protective packaging of the sterile disposable pipette (handle end).
- **Step 3.** The sampler removes the pipette (by the handle) from the packaging, being careful not to touch the sample collection end of the pipette.
- **Step 4.** The assistant sampler opens sterile inner sample vial assembly bag and lays it out on the tarp.
- **Step 5.** The assistant sampler removes identification labels and affixes one label to the sample transport container.

- **Step 6.** The recorder verifies sample numbers match; affixes the other sample number label to sample log notebook.
- **Step 7.** The assistant sampler opens inner sample vial assembly and holds for sampler.
- **Step 8.** The sampler carefully collects the sample so that the sample collection end of the pipette touches nothing but the sample. Gently squeezing the bulb on the pipette, inserting the tip into the liquid and slowly releasing the bulb to avoid the creation of aerosols during sample collection. The recorder takes pictures of the collection.
- **Step 9.** The sampler transfers the sample to the inner sample vial assembly.
- **Step 10.** The assistant sampler screws the cap on the inner sample vial assembly.
- **Step 11.** The assistant sampler removes a bleach pack wipe and gives it to the sampler.
- **Step 12.** The sampler decontaminates the inner sample vial assembly by wiping it with the bleach pack wipe.
- **Step 13.** The assistant sampler removes self-sealing laboratory tape from package; cuts an adequate length and gives it to the sampler.
- **Step 14.** The sampler uses the self-sealing laboratory tape to seal the cap to the vial.
- **Step 15.** The assistant sampler holds outer sample vial for assistant sampler.
- **Step 16.** The sampler places the inner sample vial assembly in the outer sample vial.
- **Step 17.** The assistant sampler places a tamper seal tape over the opening of the outer sample vial.
- **Step 18.** The assistant sampler places the outer sample vial, containing the sample, into a sample transport container.
- **Step 19.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

RADIOLOGICAL SURFACE WATER SAMPLE

H-47. Radiological surface water sample collection

- **Step 1.** Receive an initial briefing and assignment from the command, obtain the appropriate equipment, check the instrument performance, and conduct radio and Global Positioning System checks when leaving for the assignment.
- **Step 2.** Wrap the instruments in plastic to prevent contamination (except for the detector window if there is one), preclean and bag or wrap the sample collection equipment, set the alarm levels of direct-reading dosimeters and dose rate meters, wear appropriate radiation protection equipment, and wear disposable latex or vinyl gloves, and change them between sample areas.
- **Step 3.** Collect one to four liters at each sample collection area unless otherwise directed. Some typical areas include recreation areas, public water supply intakes, places where water is used (or obtained for use) by animals (for example, cattle), and places where water is obtained to irrigate crops. Be aware of—
  - The concentrations across a stream or river become more uniform proceeding downstream. Even so, the mixing can still be incomplete miles downstream of the release point, especially in large bodies of slow-moving water.
  - Radionuclide concentrations in a river are more uniform downstream of turbulence (for example, white water), meandering portions of the river, and after variations in depth and width.
  - One sample collection point at mid-depth in the center of the stream should suffice if the stream is relatively narrow and the water is well mixed. If the sample is collected from the bank rather than midstream, collect it from the bank on the outside of a bend where the flow is greatest.
  - Composites are required in larger, poorly mixed rivers. This involves at least one vertical composite consisting of a sample collected just below the surface, a sample from mid-depth, and a sample collected just above the bottom.

Notes.

1. Lakes and ponds experience less mixing and have a greater tendency to stratify than streams and rivers. This stratification is primarily due to temperature. For best results, determine the water temperature profile and sample the different layers independently.

2. A single vertical composite at the deepest point in a small impoundment or pond may be satisfactory. In a natural pond, this will usually be near the center. For a man-made body of water, the deepest point is close to a dam. Several vertical composites are required in lakes and large impoundments.

- **Step 4.** Use the sample collection form to record the environmental conditions at each sample collection area at the time of the sample collection and include the weather conditions, the ambient gamma dose rate, the water temperature, and the flow rate (if applicable).
- **Step 5.** Don gloves and boots.
- **Step 6.** Dip a bucket or another collection device into the water, rinse the collection device and the sample container. If using a portable peristaltic pump, ensure that the line is clean before pumping, and pump long enough that the source of water has an opportunity to rinse the inside of the tube.
- **Step 7.** Don waders; submerge the sample container or collecting device into the water again; allow the container to fill slowly and continuously; avoid surface disturbance; avoid collecting bottom sediment, vegetation, or small fish; and do not fill the sample containers to the very top.
- **Step 8.** Follow the procedures below using a long-handled dipper or another scooping type collecting device:
  - Open and slightly tilt the sample container.
  - Slowly empty the sampler contents into the container using a new, clean funnel. Allow the sample stream to flow gently down the side of the bottle with minimal disturbance.
  - Preserve the sample if directed.
  - Cap the container tightly, and wipe down the exterior surface. Tape the cap closed or seal it if specified.
  - Use an indelible ink pen to write the sample identification, area, date and time of sample collection, and the collector’s initials on the sample collection container and the sample control form.
- **Step 9.** Complete the necessary sample collection forms, and begin a chain-of-custody form if required.
- **Step 10.** Decontaminate the outside of the sample collection containers and apparatus by rinsing them with clean (distilled) water, and wipe them down. Be alert for oil, grease, or any other type of surface scum that might stick to the sample collection device.
- **Step 11.** Repeat the above steps for necessary replicates, background samples, and other sample collection areas.

Chemical Wipe Sample

H-48. The sample collection R&S element equipment required for a chemical wipe sample is identified in table H-15.

Table H-15. Sample collection R&S element equipment required for a chemical wipe sample

Item	*Quantity*	*Sterility*
Eight-inch hemostat or	1	sterile
Extension tool or	1	nonsterile
Alligator clip and wire	1	nonsterile
Alcohol wipe	1	sterile

Sample container assembly	1	nonsterile
Self-sealing laboratory tape	1	nonsterile
Tamper label	1	nonsterile
Bleach pack wipes	1	nonsterile
Scissors	1	nonsterile
Secondary container/bag	1	nonsterile
Ground tarp	1	nonsterile
Two-person sample collection R&S element		
Individual	***Personal protective equipment gloves***	***Nitrile gloves***
Assistant sampler	X	
Sampler	X	X
Three-person sample collection R&S element		
Individual	***Personal protective equipment gloves***	***Nitrile gloves***
Recorder	X	
Assistant sampler	X	
Sampler	X	X

H-49. The following are steps for two-person procedures(chemical wipe sample):

- **Step 1.** The assistant sampler removes identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools).
- **Step 2.** The assistant sampler opens protective packing and allows the sampler to remove the designated tool from the package using the handle ends.
- **Step 3.** The assistant sampler opens the alcohol wipe and holds it for the sampler.
- **Step 4.** The sampler removes the alcohol wipe from its packaging, using the biting end of the hemostat (or extension tool).
- **Step 5.** The sampler wipes the surface of the object to be sampled, do not exceed 1-square foot. If more surface area is to be sampled, use additional alcohol wipes.
- **Step 6.** The assistant sampler opens sample container assembly and removes sample container.
- **Step 7.** The assistant sampler opens sample container; removes identification labels, and affixes one label to the sample container.
- **Step 8.** The assistant sampler verifies sample container number matches sample number on outer container; affixes sample number label to sample log notebook.
- **Step 9.** The assistant sampler opens sample container and hands it to the sampler.
- **Step 10.** The sampler places used alcohol wipe into the sample container and discards tool when done.
- **Step 11.** The assistant sampler places cap on sample container and screws tight while the sampler holds the container and verify that the cap is secure.
- **Step 12.** The assistant sampler removes bleach pack wipe from kit and gives to sampler.
- **Step 13.** The sampler decontaminates his hands and the sample container with the bleach pack wipe.
- **Step 14.** The assistant sampler removes self-sealing laboratory tape; cuts an adequate section length, and hands to sampler.
- **Step 15.** The sampler places self-sealing laboratory tape around the sample container cap to seal cap to container.

- **Step 16.** The assistant sampler retrieves the secondary container, opens it, and holds it open to the sampler.
- **Step 17.** The sampler places sealed container into the secondary container held by the assistant sampler ensuring he does not touch the secondary container.
- **Step 18.** The assistant sampler places cap on secondary container and screws tight, places tamper seal tape across cap with the ends contacting the sides of the secondary container (forming a seal that will be broken if the cap is removed), and places outer container into sample transport bag.
- **Step 19.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

H-50. The following are steps for three-person procedures (chemical wipe sample):

- **Step 1.** The assistant sampler removes all identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools).
- **Step 2.** The assistant sampler opens protective packing and allows the sampler to remove the tool (8-inch hemostat, extension tool, or alligator clip and wire) from the package using the handle ends.
- **Step 3.** The assistant sampler opens the alcohol wipe and holds it for the sampler.
- **Step 4.** The sampler removes the alcohol wipe from its packaging, using the biting end of the hemostat (or extension tool).
- **Step 5.** The sampler wipes the surface of the object to be sampled, do not exceed 1-square foot. If more surface area is to be sampled, use additional alcohol wipes. Recorder takes picture of the collection.
- **Step 6.** The assistant sampler opens sample container assembly and removes sample container.
- **Step 7.** The assistant sampler opens sample container packing; removes identification labels; hands one label to recorder and affixes the other label to the sample container.
- **Step 8.** The recorder verifies sample container number matches sample number on outer container; affixes sample number label to sample log notebook.
- **Step 9.** The assistant sampler opens sample container and holds it for the sampler.
- **Step 10.** The sampler places used alcohol wipe into the sample container.
- **Step 11.** The assistant sampler places cap on sample container and screws tight, while the sampler holds the container and then verify that the cap is secure.
- **Step 12.** The assistant sampler opens bleach pack and hands it to the sampler. The sampler decontaminates the outside of the sample container by wiping it with the bleach pack wipe.
- **Step 13.** The assistant sampler removes self-sealing laboratory tape; cuts an adequate section length, and hands to sampler.
- **Step 14.** The sampler places self-sealing laboratory tape around the sample container closure to seal cap to container.
- **Step 15.** The sampler places sealed container into outer container held by the assistant sampler.
- **Step 16.** The assistant sampler places cap on outer container and screws tight, places tamper seal tape across cap with the ends contacting the sides of the outer container (forming a seal that will be broken if the cap is removed), and places outer container into sample transport bag.
- **Step 17.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

DRY BIOLOGICAL SWAB SAMPLE

H-51. The sample collection R&S element equipment required for a dry biological swab sample is identified in table H-16.

Table H-16. Sample collection R&S element equipment required for a dry biological swab sample

Item	*Quantity*	*Sterility*
Swab	1	sterile
Sample vial assembly	1	sterile
Self-sealing laboratory tape	1	nonsterile
Scissors	1	nonsterile
Tamper label	1	nonsterile
Bleach pack wipes	1	nonsterile
Appropriate buffer solution and sterile water	1	sterile
Secondary container/bag	1	nonsterile
Ground tarp	1	nonsterile
Two-person sample collection R&S element		
Individual	***Personal protective equipment gloves***	***Nitrile gloves***
Assistant sampler	X	
Sampler	X	X
Three-person sample collection R&S element		
Recorder	X	
Assistant sampler	X	
Sampler	X	X

H-52. The following are steps for two-person procedures (dry biological swab sample):

- **Step 1.** The assistant sampler removes all identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools).
- **Step 2.** The assistant sampler opens the sterile swab from the handle end and offers swab to sampler.
- **Step 3.** The sampler pulls the swab from the packaging by the nonsample collection end of the swab.
- **Step 4.** The assistant sampler opens the sterile buffer or sterile water and hands to the sampler.
- **Step 5.** The sampler moistens the sterile swab with the sterile buffer or water (ensure that when the swab is moistened that it is not dripping. Press swab against the wall of the vial to remove excess fluid).
- **Step 6.** The assistant sampler opens sterile inner sample vial assembly bag and lays it out on tarp.
- **Step 7.** The assistant sampler removes identification labels; affixes one label to the sample secondary container.
- **Step 8.** The assistant sampler verifies that the sample numbers match; affixes the other sample number label to sample log notebook.
- **Step 9.** The assistant sampler opens inner sample vial assembly and holds for sampler.
- **Step 10.** The sampler ensures that the sample vial is open/uncapped long enough for the sample to be inserted. Minimize the time that the inner vial is exposed to the ambient air. Sampler collects the sample by rubbing the swab against the selected surface. The swab should be gently rotated during sample collection. The sampler places the used swab in the inner sample vial assembly (held by the assistant sampler) and using the neck of the vial as a fulcrum, bends the handle of the swab to break the swab end into the vial. The wooden handle is discarded.

Note. Repeat procedure as needed; if swabs are used on the same sample collection area then multiple swabs can be placed in a single inner sample vial assembly.

- **Step 11.** The assistant sampler screws the cap on the inner sample vial and hands to the sampler.
- **Step 12.** The assistant sampler removes a bleach pack wipe and hands to the sampler.
- **Step 13.** The sampler decontaminates his hands and the inner sample vial using the bleach pack wipe.
- **Step 14.** The assistant sampler removes self-sealing laboratory tape; cuts an adequate section length, and gives it to the sampler.
- **Step 15.** The sampler uses the self-sealing laboratory tape to seal the cap to the vial.
- **Step 16.** The assistant sampler holds secondary container for sampler.
- **Step 17.** The sampler places the inner sample vial assembly in the secondary container.
- **Step 18.** The assistant sampler places the secondary container cap on the secondary container and screws tight; places tamper seal tape over the cap of the secondary container.
- **Step 19.** The assistant sampler places the secondary container, containing the sample, into a sample transport container.
- **Step 20.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

H-53. The following are steps for three-person procedures (dry biological swab sample):

- **Step 1.** The assistant sampler removes all identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools).
- **Step 2.** The assistant sampler opens the sterile swab from the handle end and offers swab to sampler.
- **Step 3.** The sampler pulls the swab from the packaging by the nonsample collection end of the swab.
- **Step 4.** The assistant sampler opens sterile inner sample vial assembly bag and lays out on tarp.
- **Step 5.** The assistant sampler removes identification labels; affixes one label to the secondary container.
- **Step 6.** The recorder verifies sample numbers match; affixes the other sample number label to sample log notebook.
- **Step 7.** The sampler collects the sample by rubbing the swab against the selected surface. The swab should be gently rotated during sample collection. The sampler places the used swab in the inner sample vial assembly (held by the assistant sampler) and using the neck of the vial as a fulcrum, bends the handle of the swab to break the swab end into the vial. The wooden handle is discarded. The recorder takes a picture of the collection.

Note. Repeat procedure as needed; if swabs are used on the same sample collection area then multiple swabs can be placed in a single inner sample vial assembly.

- **Step 8.** The assistant sampler opens inner sample vial assembly and holds for sampler.

Note. Repeat procedure as needed; multiple swabs can be placed in a single inner sample vial assembly.

- **Step 9.** The assistant sampler screws the cap on the inner sample vial assembly.
- **Step 10.** The assistant sampler removes a bleach pack wipe and gives it to the sampler.
- **Step 11.** The sampler decontaminates the inner sample vial assembly by wiping it with the bleach pack wipe.
- **Step 12.** The assistant sampler removes self-sealing laboratory tape; cuts an adequate length and gives it to the assistant sampler.

- **Step 13.** The sampler uses the self-sealing laboratory tape to seal the cap to the vial.
- **Step 14.** The assistant sampler holds outer sample vial for sampler.
- **Step 15.** The sampler places the inner sample vial assembly in the outer sample vial.
- **Step 16.** The assistant sampler places the lid onto the outer sample vial and places tamper seal tape over the lid of the outer sample vial.
- **Step 17.** The assistant sampler places the outer sample vial, containing the sample, into a sample transport container.
- **Step 18.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

WET BIOLOGICAL SWAB SAMPLE

H-54. The sample collection R&S element equipment required for a wet biological swab sample is identified in table H-17.

Table H-17. Sample collection R&S element equipment required for a wet biological swab sample

Item	Quantity	Sterility
Swab	1	sterile
Sample vial assembly	1	sterile
Self-sealing laboratory tape	1	nonsterile
Scissors	1	nonsterile
Tamper label	1	nonsterile
Bleach pack wipes	1	nonsterile
Secondary container/bag (zipper lock bag)	1	nonsterile
Ground tarp	1	nonsterile
Two-person sample collection R&S element		
Individual	***Personal protective equipment gloves***	***Nitrile gloves***
Assistant sampler	X	
Sampler	X	X
Three-person sample collection R&S element		
Recorder	X	
Assistant sampler	X	
Sampler	X	X

H-55. The following are steps for two-person procedures (wet biological swab sample):

- **Step 1.** The assistant sampler removes all identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools).
- **Step 2.** The assistant sampler opens sterile sample vial assembly bag and lays it out on the tarp.
- **Step 3.** The assistant sampler removes identification labels and affixes one label to the sample secondary container.
- **Step 4.** The assistant sampler verifies that sample numbers match and affixes the other identification label to sample log notebook.
- **Step 5.** The assistant sampler opens the sterile swab from the handle end and offers swab to sampler.

- **Step 6.** The sampler pulls the swab from the packaging by the nonsample collection end of the swab.
- **Step 7.** The sampler collects the sample by rubbing the swab against the selected surface. The swab should be gently rotated during sample collection. The sampler places the used swab in the inner sample vial (held by the assistant sampler) and using the neck of the vial as a fulcrum, bends the handle of the swab to break the swab end into the vial. The wooden handle is discarded.

Note. Repeat procedure as needed; if swabs are used on the same sample collection area then multiple swabs can be placed in a single inner sample vial.

- **Step 8.** The assistant sampler screws the cap on the inner sample vial and hands to the sampler.
- **Step 9.** The assistant sampler removes a bleach pack wipe and hands to the sampler.
- **Step 10.** The sampler decontaminates his hands and the inner sample vial using the bleach pack wipe.
- **Step 11.** The assistant sampler removes self-sealing laboratory tape; cuts an adequate length and gives it to the sampler.
- **Step 12.** The sampler uses the self-sealing laboratory tape to seal the cap to the vial.
- **Step 13.** The assistant sampler holds the outer sample vial for the sampler.
- **Step 14.** The sampler places the inner sample vial assembly in the outer sample vial.
- **Step 15.** The assistant sampler places cap on outer sample vial and screws tight; places tamper seal tape over the cap of the outer sample vial.
- **Step 16.** The assistant sampler places the outer sample vial, containing the sample, into a sample transport container zipper lock bag; seals the zipper lock of this bag.
- **Step 17.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

H-56. The following steps are three-person procedures (wet biological swab sample):

- **Step 1.** The assistant sampler removes all identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools).
- **Step 2.** The assistant sampler opens the sterile swab from the handle end and offers swab to sampler.
- **Step 3.** The sampler pulls the swab from the packaging by the nonsample collection end of the swab.
- **Step 4.** The assistant sampler opens the sterile sample vial assembly bag and lays out on tarp.
- **Step 5.** The assistant sampler removes identification labels and affixes one label to the sample secondary container.
- **Step 6.** The recorder verifies that all sample numbers match and affixes the other identification label to sample log notebook.
- **Step 7.** The sampler collects the sample by rubbing the swab against the selected surface. The swab should be gently rotated during sample collection. The sampler places the used swab in the inner sample vial (held by the assistant sampler) and using the neck of the vial as a fulcrum, bends the handle of the swab to break the swab end into the vial. The wooden handle is discarded. The recorder takes pictures of the collection.
- **Step 8.** The assistant sampler opens inner sample vial assembly and holds for sampler.

Note. Repeat procedure as needed; if swabs are used on the same sample collection area then multiple swabs can be placed in a single inner sample vial.

- **Step 9.** The assistant sampler screws the cap on the inner sample vial.
- **Step 10.** The assistant sampler removes bleach pack wipe and gives it to the sampler.

- **Step 11.** The sampler decontaminates the inner sample vial assembly by wiping it with the bleach pack wipe.
- **Step 12.** The assistant sampler removes self-sealing laboratory tape; cuts an adequate length and gives it to the sampler.
- **Step 13.** The sampler uses the self-sealing laboratory tape to seal the cap to the vial.
- **Step 14.** The sampler places the inner sample vial assembly in an outer sample vial held by the assistant sampler.
- **Step 15.** The assistant sampler places the lid onto the outer sample vial and places tamper seal tape over the lid of the outer sample vial.
- **Step 16.** The assistant sampler places the outer sample vial, containing the sample, into a sample transport container.
- **Step 17.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

Take a Dry Biological Wipe (Sponge) Sample

H-57. The sample collection R&S element equipment required for a dry biological wipe (sponge) sample is identified in table H-18.

Table H-18. Sample collection R&S element equipment required for a dry biological wipe (sponge) sample

Item		*Quantity*	*Sterility*
Gauze sponge		1	sterile
Sample vial assembly (with sterile water bottle)		1	sterile
Appropriate buffer solution or sterile water		1	sterile
Self-sealing laboratory tape		1	nonsterile
Sample collection pipette		1	sterile
Tamper label		1	nonsterile
Bleach pack wipes		1	nonsterile
Scissors		1	nonsterile
Tweezers, forceps, or hemostat		1	sterile
Secondary container/bag (zipper lock bag)		1	nonsterile
Ground tarp		1	nonsterile
Two-person sample collection R&S element			
Individual	***Personal protective equipment gloves***		***Nitrile gloves***
Assistant sampler	X		
Sampler	X		X
Three-person sample collection R&S element			
Recorder	X		
Assistant sampler	X		
Sampler	X		X

H-58. The following are steps for two-person procedures (dry biological wipe [sponge] sample):

- **Step 1.** The assistant sampler removes identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools below).

- **Step 2.** The assistant sampler opens the sterile tweezers, forceps, or hemostat package and offers it to the sampler.
- **Step 3.** The sampler pulls the sterile tweezers, forceps, or hemostat from the packaging by grasping it on the handle side (this will be the nongauze holding side).
- **Step 4.** The assistant sampler opens the sterile gauze sponge package and offers sterile gauze sponge to sampler.
- **Step 5.** The sampler pulls the sterile gauze sponge from the packaging by grasping it on one side (this will be the nonsample collection side) using the sterile tweezers, forceps, or hemostat.
- **Step 6.** The assistant sampler opens sterile sample vial assembly bag and lays out on tarp.
- **Step 7.** The assistant sampler removes identification labels; affixes one label to the sample zipper lock bag.
- **Step 8.** The assistant sampler verifies sample numbers match; affixes the other identification label to sample log notebook.
- **Step 9.** The assistant sampler opens sterile sample collection pipette package and removes pipette from bulb end; opens buffer or sterile water vial; draws up one milliliter of buffer or sterile water; replaces cap on sterile water vial; discards sterile water vial.
- **Step 10.** The sampler holds sterile gauze sponge with sample collection side up.
- **Step 11.** The assistant sampler squeezes contents of pipette onto sterile gauze sponge, wetting it; discards pipette.
- **Step 12.** The sampler collects the sample by rubbing the sterile gauze sponge against the selected surface while grasping the sponge in the center with the tweezers, forceps, or hemostat.
- **Step 13.** The assistant sampler opens inner sample vial and holds for sampler.
- **Step 14.** The sampler, using sterile nitrile gloves, folds the gauze sponge in half (with the sample collection side to the inside of the fold); carefully rolls the folded sponge into a tube; slides rolled up gauze into the inner sample vial. Whenever possible, the sample container should be big enough so that the gauze can be inserted using tweezers instead of gloved hands.
- **Step 15.** The assistant sampler screws the cap on the inner sample vial and hands to the sampler.
- **Step 16.** The assistant sampler removes a bleach pack wipe and hands to the sampler.
- **Step 17.** The sampler decontaminates his hands and the inner sample vial using the bleach pack wipe.
- **Step 18.** The assistant sampler removes self-sealing laboratory tape, cuts an adequate length, and gives it to the sampler.
- **Step 19.** The sampler uses the self-sealing laboratory tape to seal the cap to the vial.
- **Step 20.** The assistant sampler holds outer sample vial for sampler.
- **Step 21.** The sampler places the inner sample vial assembly in the outer sample vial.
- **Step 22.** The assistant sampler places the cap on the outer sample vial, screws the cap tightly to the vial, and places tamper seal tape over the cap.
- **Step 23.** The assistant sampler places the outer sample vial, containing the sample, into a sample transport container.
- **Step 24.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

H-59. The following are steps for three-person procedures (dry biological wipe [sponge] sample):

- **Step 1.** The assistant sampler removes identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools).
- **Step 2.** The assistant sampler opens the sterile tweezers, forceps, or hemostat package and offers it to the sampler.
- **Step 3.** The sampler pulls the sterile tweezers, forceps, or hemostat from the packaging by grasping it on the handle side (this will be the nongauze holding side).
- **Step 4.** The assistant sampler opens the sterile gauze sponge package and offers it to the sampler.

- **Step 5.** The sampler pulls the sterile gauze sponge from the packaging by grasping it using the sterile tweezers, forceps, or hemostat.
- **Step 6.** The assistant sampler opens the sterile the sample vial assembly bag and lays it out on the tarp.
- **Step 7.** The assistant sampler removes identification labels; affixes one label to the sample secondary container.
- **Step 8.** The recorder verifies sample numbers match; affixes the other identification label to sample log notebook.
- **Step 9.** The assistant sampler opens sterile sample collection pipette package and removes pipette from bulb end; opens buffer or sterile water vial; draw up one milliliter of buffer or sterile water; replaces cap on buffer or sterile water vial; discards buffer or sterile water vial.
- **Step 10.** The sampler holds sterile gauze sponge with sample collection side up.
- **Step 11.** The assistant sampler squeezes contents of pipette onto sterile gauze sponge, wetting it; discards pipette.
- **Step 12.** The sampler collects the sample by rubbing the sterile gauze sponge against the selected surface while grasping the sponge in the center, using the sterile tweezers, forceps, or hemostat. The recorder takes pictures of the collection.
- **Step 13.** The assistant sampler opens inner sample vial and holds for sampler.
- **Step 14.** The sampler, using sterile gloves, folds the gauze sponge in half (with the sample collection side to the inside of the fold); carefully rolls the folded sponge into a tube; slides rolled up gauze into the inner sample vial. Whenever possible the sample container should be big enough so that the gauze can be inserted using tweezers instead of gloved hands. The recorder takes pictures of this process.
- **Step 15.** The assistant sampler screws the cap on the inner sample vial.
- **Step 16.** The assistant sampler removes bleach pack wipe and gives it to the sampler.
- **Step 17.** The sampler decontaminates the inner sample vial assembly by wiping it with the bleach pack wipe.
- **Step 18.** The assistant sampler removes self-sealing laboratory tape; cuts an adequate length and gives it to the sampler.
- **Step 19.** The sampler uses the self-sealing laboratory tape to seal the cap to the vial.
- **Step 20.** The sampler places the inner sample vial assembly in an outer sample vial held open by the assistant sampler.
- **Step 21.** The assistant sampler places the lid onto the outer sample vial and places tamper seal tape over the lid of the outer sample vial.
- **Step 22.** The assistant sampler places the outer sample vial, containing the sample, into a sample transport container.
- **Step 23.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

Take a Wet Biological Wipe (Sponge) Sample

H-60. The sample collection R&S element equipment required for a wet biological wipe (sponge) sample is identified in table H-19.

Table H-19. Sample collection R&S element equipment required for a wet biological wipe (sponge) sample

Item	*Quantity*	*Sterility*
Gauze sponge	1	sterile
Sample vial assembly	1	sterile
Sample collection pipette	1	sterile

Self-sealing laboratory tape	1	nonsterile
Tamper label	1	nonsterile
Bleach pack wipes	1	nonsterile

Table H-19. Sample collection R&S element equipment required for a wet biological wipe (sponge) sample (continued)

Item		*Quantity*	*Sterility*
Scissors		1	nonsterile
Tweezers, forceps, or hemostat		1	sterile
Secondary container/bag		1	nonsterile
Ground tarp		1	nonsterile
Two-person sample collection R&S element			
Individual	*Personal protective equipment gloves*		*Nitrile gloves*
Assistant sampler	X		
Sampler	X		X
Three-person sample collection R&S element			
Individual	*Personal protective equipment gloves*		*Nitrile gloves*
Recorder	X		
Assistant sampler	X		
Sampler	X		X

H-61. The following are the steps for two-person procedures (wet biological wipe [sponge] sample):

- **Step 1.** The assistant sampler removes all identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools).
- **Step 2.** The assistant sampler opens the sterile tweezers, forceps, or hemostat package and offers it to the sampler.
- **Step 3.** The sampler pulls the sterile tweezers, forceps, or hemostat from the packaging by grasping it on the handle side (this will be the nongauze holding side).
- **Step 4.** The assistant sampler opens the sterile gauze sponge package and offers sterile gauze sponge to sampler.
- **Step 5.** The sampler pulls the sterile gauze sponge from the packaging by grasping it using the sterile tweezers, forceps, or hemostat.
- **Step 6.** The assistant sampler opens sterile the sample vial assembly bag and lays out on tarp.
- **Step 7.** The assistant sampler removes identification labels; affixes one identification label to the sample secondary container.
- **Step 8.** The assistant sampler verifies all sample numbers match; affixes the other identification label to sample log notebook.
- **Step 9.** The sampler collects the sample by rubbing the wet sterile gauze sponge against the selected surface using the sterile tweezers, forceps, or hemostat.
- **Step 10.** The assistant sampler opens inner sample vial and holds for sampler.
- **Step 11.** The sampler folds the gauze sponge in half (with the sample collection side to the inside of the fold); carefully rolls the folded sponge into a tube; slides rolled up gauze into the inner sample vial. Whenever possible the sample container should be big enough so that the gauze can be inserted using tweezers instead of gloved hands.
- **Step 12.** The assistant sampler screws the cap on the inner sample vial and hands to the sampler.
- **Step 13.** The assistant sampler removes a bleach pack wipe and hands to the sampler.
- **Step 14.** The sampler decontaminates his hands and the inner sample vial using the bleach pack wipe.
- **Step 15.** The assistant sampler removes self-sealing laboratory tape; cuts an adequate length and gives it to the sampler.

- **Step 16.** The sampler uses the self-sealing laboratory tape to seal the cap to the vial.
- **Step 17.** The assistant sampler holds outer sample vial for sampler.
- **Step 18.** The sampler places the inner sample vial assembly in the outer sample vial.
- **Step 19.** The assistant sampler places cap on outer sample vial and screws tight; places tamper seal tape over the cap of the outer sample vial.
- **Step 20.** The assistant sampler places the outer sample vial, containing the sample, into a sample transport container.
- **Step 21.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

H-62. The following are the steps for three-person procedures (wet biological wipe [sponge] sample):

- **Step 1.** The assistant sampler removes identified sample collection tools from kit and lays them out on ground tarp (see list of needed tools).
- **Step 2.** The assistant sampler opens the sterile tweezers, forceps, or hemostat package and offers it to the sampler.
- **Step 3.** The sampler pulls the sterile tweezers, forceps, or hemostat from the packaging by grasping it on the handle side (this will be the nongauze holding side).
- **Step 4.** The assistant sampler opens the sterile gauze sponge package and offers sterile gauze sponge to sampler.
- **Step 5.** The sampler pulls the sterile gauze sponge from the packaging using sterile tweezers, forceps, or hemostat.
- **Step 6.** The assistant sampler opens sterile sample vial assembly bag and lays it out on the tarp.
- **Step 7.** The assistant sampler removes identification labels; affixes one identification label to the sample secondary container.
- **Step 8.** The recorder verifies sample numbers match; affixes the other identification label to sample log notebook.
- **Step 9.** The sampler collects the sample by rubbing the sterile gauze sponge against the selected surface while grasping the sponge in the center. Recorder takes pictures of the collection.
- **Step 10.** The assistant sampler opens inner sample vial and holds for sampler.
- **Step 11.** The sampler, using sterile nitrile gloves, folds the gauze sponge in half (with the sample collection side to the inside of the fold); carefully rolls the folded sponge into a tube; slides rolled up gauze into the inner sample vial. Whenever possible the sample container should be big enough so that the gauze can be inserted using tweezers instead of gloved hands.
- **Step 12.** The assistant sampler screws the cap on the inner sample vial.
- **Step 13.** The assistant sampler removes a bleach pack wipe and gives it to the sampler.
- **Step 14.** The sampler decontaminates the inner sample vial assembly by wiping it with the bleach pack wipe.
- **Step 15.** The assistant sampler removes self-sealing laboratory tape; cuts an adequate length and gives it to the sampler.
- **Step 16.** The sampler uses the self-sealing laboratory tape to seal the cap to the vial.
- **Step 17.** The assistant sampler holds outer sample vial for sampler.
- **Step 18.** The sampler places the inner sample vial assembly in the outer sample vial.
- **Step 19.** The assistant sampler places the lid onto the outer sample vial and places tamper seal tape over the lid of the outer sample vial.
- **Step 20.** The assistant sampler places the outer sample vial, containing the sample, into a sample transport container.
- **Step 21.** The R&S element members dispose of used sample collection equipment; remove nitrile gloves.

PACKAGING AND LABELING SAMPLES

H-63. Packaging and labeling samples is as critical as the actual collection of the sample. Wear the proper IPE/PPE when handling the sample. See *Multiservice Tactics, Techniques, and Procedures for Nuclear, Biological, and Chemical (NBC) Protection,* including Change 1. See the applicable system-level technical manuals or technical orders for specific instructions on packaging liquid samples, such as sample vials or sample bottles. All samples must be packaged in three layers of containment to meet air transport regulations (primary container, secondary container, and outer packaging). Package the primary container in absorbent material within a secondary container, which is carried within an outer packaging or double-wrap or double-bag the primary container for less hazardous samples.

H-64. There are several physical and chemical characteristics that must be considered when selecting a suitable container for shipping and sample collection. Important characteristics include the container material, size, shape, and sealing method. Generally, a container should be made of material that is chemically nonreactive with the sample and it should maintain physical integrity during normal handling and shipment. The container must have sufficient volume to contain enough samples for all analyses required of the sample and for several repeat analyses. It should have an opening that allows for easy filling and emptying of the container and that minimizes external contamination of the container. All containers should be new and unused. Containers should be able to be written on or able to have marking tags or labels affixed to them.

H-65. To ensure an accurate analysis, it is critical that a sample does not become contaminated during the process of collection and transport. To avoid cross contamination, take the following precautions:

- Work from the suspected least contaminated area toward the suspected most contaminated area.
- Wear disposable gloves, and change them after taking each group of samples at one area (for example, discard gloves after collecting soil samples).
- Keep equipment away from dirt, dust, soil, and surfaces that are likely to be contaminated. Put the equipment on a clean, plastic sheet.
- Double-bag samples immediately after they are collected.
- Clean and decontaminate the sample collection equipment after taking each group of samples and check for residual contamination, or use disposable sample collection equipment.
- Avoid cross contamination. Wipe the outside of all containers with a 0.5 percent sodium hypochlorite solution (use 0.5 percent calcium hypochlorite solution on naval ships).

H-66. Depending on the sample media and the sample collection technique, the container selection must protect the sample and avoid further contamination. Container considerations are—

- **Collection bags**. A leakproof, clear, plastic collection bag can be used as the initial container for samples, such as protective masks and filter canisters, individual antidote and decontamination kits, ammunition fragments, and other items that are too large to place in a sample container. It can also be used to package containers, which ensures a vapor barrier in case the container is broken in transit. It acts as an initial or secondary vapor barrier that prevents air from leaking in and toxic material from leaking out. The following are the recommended steps for using leakproof, clear, plastic collection bags:
  - **Step 1.** Verify that the item has a command designated sample number if the sample or sample container is being packaged.
  - **Step 2.** Carefully place the sample in a bottom corner of the bag.
  - **Step 3**. Ensure that each layer of packaging is decontaminated using five percent chlorine solution
  - **Step 4.** Squeeze the air out of the bag and seal it.
- **Containers and tubes.** Glass, spun Teflon®, or polypropylene sample containers and tubes can be used for collection; however, do not store biological samples in polypropylene containers because proteins and deoxyribonucleic acid (DNA) may adhere to them. Use glass containers to hold small environmental samples. Use sterile polypropylene tubes to hold biological samples if no other alternative is available (such as glass). Use glass containers instead of plastic because

toxic agents may leach chemicals from plastics into a sample, introducing contamination and complicating analysis efforts.

- **Shipping containers**. Place samples in commercial, biohazard shipping containers for shipping.
- **Commercial air shipment containers**. When the samples must be transported on commercial aircraft, IATA-approved sample transport containers must be used for shipment and delivery to the designated location.

H-67. Samples submitted for analysis must be properly packaged, labeled, and shipped so that they arrive in an analytically acceptable condition. The samples should be maintained at 1°C to 4°C. Ideally, samples should arrive at the laboratory within six hours of collection. The samples should be delivered to the CONUS laboratory within 24 to 48 hours. If the biological samples cannot be delivered to CONUS within 48 hours, the supporting laboratories should subculture the samples and send the subculture to the CONUS laboratory.

H-68. Standard polyethylene or metal ice chests are the most easily procured items that can be used to ship chemical-biological samples. Even though an ice chest provides good insulation for samples and the coolant, place extra insulation and cushioning around the metal cans inside the ice chest. Plastic bubble wrap or foam rubber can be used with good results.

H-69. For double-bagging or double-wrapping, the plastic bags or plastic container containing the sample should be placed into a second bag. Excess air should be removed from the bag. The sample bags should be carried within an outer container packed with absorbent material.

H-70. Any breakable containers should be placed in more rigid containers to protect them from puncture or breakage. Commercially manufactured packs, specifically designed for the transport of dangerous pathogens and approved by the IATA, are widely available. The following should be considered when transporting materials:

- Material is placed in a securely closed, watertight container, which is then enclosed in a second, durable, watertight container. Several primary containers may be enclosed in a single secondary container, if the total volume of the primary containers enclosed does not exceed 50 milliliters. The following apply:
  - The space at the top, bottom, and sides between the primary and secondary containers contain enough nonparticulate absorbent material (paper towels) to absorb the contents of the primary containers if breakage or leakage occurs.
  - Each set of primary and secondary containers is enclosed in an outer shipping container (sample transfer case) constructed of corrugated fiberboard, cardboard, wood, or other material of equivalent strength.
- Packaging of material in volumes of 50 milliliters or more will comply with specified requirements based on the type of sample collected. The following apply:
  - In addition to packaging required for smaller volumes, a shock-absorbent material, in volume at least equal to the absorbent material between the primary and secondary containers, are placed at the top, bottom, and sides between the secondary container and the outer shipping container.
  - Single primary containers will not contain more than 1,000 milliliters of material. However, two or more primary containers whose combined volumes do not exceed 1,000 milliliters may be placed in a single secondary container.
  - The maximum quantity of agent that may be enclosed within a single outer shipping container will not exceed 4,000 milliliters.

H-71. Supporting documents must accompany the sample with clear labeling on the outside of the package. When samples are sent to a laboratory for theater validation or definitive identification, they must be properly packed and shipped to maintain security and chain-of-custody requirements. Evidence should be tagged at the scene as it is collected or at the place where it is received by attaching a locally-produced adhesive label or its equivalent. If evidence is placed in a heat-sealed bag, the tag on the bag may replace the adhesive label. Tagging, often referred to as a *shoe tag* may be used when labels disrupt the original state of evidence. In the absence of tags or labels, ensure that supporting documentation, at a minimum, contains the information shown in figure H-4. To prevent confusion, the sampler uses the sample identification number when referring to the sample or to information concerning its acquisition. The number contains the following:

- **Date acquired**. This six-digit numerical code represents the year, month, and day that the collector took the sample.
- **Sample sequence number**. The collector assigns this three-digit numerical code. It begins anew each collection day.
- **Sample collection**, **unit identification code.** This code represents the sample collection R&S element.
- **Sampler identification**. This two- or three-digit alphabetic abbreviation stands for the sampler's first and last name.

070702-001-WFG1AA-JD	
070702	The year, month, and day that the collector took the sample.
001	Sample sequence number (001 is first sample collected of the day).
WFG1AA	Sample collection unit identification code.
JD	Initials of sampler's first and last name (Joe Doe took the sample).

Figure H-4. Sample identification number

H-72. Specific materials are required to properly prepare a sample and the accompanying documentation for transport. The following are examples of some of the key items used to properly package the sample:

- A sample transfer case is used to transfer samples. Sample transfer cases can provide temporary storage for samples pending evacuation and should have an internal visual temperature monitoring capability. Samples should be kept at a temperature of 1°C to 4°C during storage and transportation.
- Vials and bottles are provided as part of each system and the associated sample collection kits. The container may vary in size depending on the system that is providing the sample.
- Clear plastic bags to double-bag collection items.
- Tamper-resistant tape.
- Laboratory film.
- Absorbent material.

Note. The U.S. Navy uses a shipping container specifically designed to ship infectious substances.

H-73. The following are steps for preparing a sample for shipment:

- **Step 1.** Obtain the primary container that contains the sample.
- **Step 2.** Mark the primary container with the sample identification number using an adhesive label or by marking the container.
- **Step 3.** Seal the primary container first with laboratory film, decontaminate, and then seal with tamper-resistant tape. If applicable, apply two strips of tape across the top of the container in an X-pattern ensuring that the tape reaches down both sides of the container. Ensure that the tape covers a portion of the label on the container, but does not cover the sample identification number.
- **Step 4.** Place the container inside a plastic bag or International Air Transport Association container containing absorbent material. Decontaminate the container. If using a plastic bag, remove excess air, twist the neck of the bag until it forms a tight coil with the bag snug around the container, and seal it with a strip bag tie.
- **Step 5.** Place an adhesive label containing the sample identification number on the International Air Transport Association container or plastic bag.

- **Step 6.** Place the tube inside a second bag or an International Air Transport Association container. Decontaminate the second bag. If using a plastic bag, remove the excess air, twist the neck of the second bag until it forms a tight coil, and seal it with a strip bag tie.
- **Step 7.** Place an adhesive label containing the sample identification number on the outer packaging.
- **Step 8.** Place the package inside the sample transfer case.
- **Step 9.** Complete the chain-of-custody document. Ensure that the operator handling the sample signs the initial signature block immediately.

Note. After steps 3, 4, and 6, spray and wipe the package with a 0.5 percent calcium hypochlorite solution.

H-74. The documents that support the evacuated sample are integral components of the evacuation package and must accompany the sample. There is only one complete sample evacuation package for each sample. Each completed sample evacuation package is comprised of the—

- Sealed and packaged sample container.
- Sealed document mailer.
- Chain-of-custody form (the completed chain-of-custody form is hand-carried by the sample courier).

SAMPLE EVACUATION EXECUTION

H-75. In preparing for the execution of a sample evacuation, the commander prioritizes the samples that should be evacuated with the help of the command surgeon and CBRN officer and staff. The commander considers the following when determining the priority of samples:

- What is the time sensitivity for a specific sample evacuation package?
- Where the sample was collected (the proximity of transportation or courier assets for sample transport)?
- What is the role of the sample in the overall process of the operation (is it being used to support "detect to treat" or "verification of agent or release" decisions)?
- How many resources (consumables) are needed to support analysis and testing?

H-76. The personnel packaging, transporting, and storing samples must ensure the integrity of the sample from the time it is first taken until it is delivered to the supporting laboratory. The temperature at which the sample is stored and transported is crucial to its viability. Samples should be transported and stored at 1°C to 4°C. The sample courier should be able to periodically check the temperature within the sample transfer case to ensure continued sample viability.

H-77. Designated samples are evacuated to laboratories for theater validation identification. Laboratories will prioritize sample analyses based on critical background information (for example, time sensitivity and role of the sample). The laboratory commander will determine the number and types of samples to be analyzed.

H-78. Sample evacuation execution relies on an effective means to evacuate the sample. Specialized assets may be available; however, if specialized assets are not available, additional courier personnel can be trained to perform escort responsibilities.

H-79. Sample evacuation packages from CBRN elements may require field confirmatory or theater validation identification support. The applicable Service component prepares the sample, and an escort element transports the sample. The supporting medical and/or environmental laboratory destination for theater validation testing could be a ship-based laboratory, U.S. Air Force laboratory, or U.S. Army medical laboratory.

THEATER SAMPLE MANAGEMENT PROCESS

H-80. The geographic combatant commander (GCC) identifies a theater sample manager to manage the movement of samples within theater and to definitive laboratories outside the theater based on feedback from the GCC command surgeon, CBRN staff, and supporting laboratories. The decision to return a sample to a CONUS definitive laboratory for further analysis is made by the field confirmatory/theater validation laboratory, GCC surgeon, theater commander, and/or CONUS higher commands.

H-81. Before a CBRN sample is evacuated to a specific laboratory there are detailed requirements that must be met. As discussed in chapter 1, the need to evacuate samples to fulfill the commander's information and PIRs will drive the sample management process. Proper identification of CBRN hazards affect decisions such as the administration of effective prophylaxis, troop movements, individual and collective protective postures, and selection of proper decontamination methods. These decisions are critical to the success of operations in a CBRN environment. Issues to be considered prior to the movement of CBRN samples include the following:

- Coordinate actions with the theater surgeon or medical officer.
- Ensure that proper chain-of-custody procedures are being followed.
- Prioritize the transport and analysis of samples.
- Provide appropriately trained personnel or forces to escort samples to the transfer point or laboratory.
- Coordinate with the appropriate command and staff transportation authorities to help so that the transport and transfer of a sample is uninterrupted across international borders or to another government agency. The intent is unimpeded and controlled sample flow.
- Evacuate background samples to a laboratory for analysis.
- Maintain sample tracking and visibility.

H-82. Figure H-5, page H-56, provides a snapshot of the sample identification process.

CHAIN OF CUSTODY AND SUPPORTING DOCUMENTATION

H-83. A strict chain of custody needs to be initiated and maintained for every sample collected. When filled out properly, the chain of custody provides uninterrupted chronological documentation of the collection, custody, control, transfer, analysis, and disposition of a sample. It provides a documented record of information pertaining to a specific sample during transport from the point of collection, to the receiving medical laboratory, to the final disposition of the sample. Individuals receiving a sample from another individual or courier must sign the document transferring custody of the sample and then annotate in writing what happened to the sample while in their custody. This includes the custody transfer that occurs whenever supervision of the sample changes, such as the operator changes shifts. The document will provide answers to the following questions about the sample:

- When was it collected?
- Who has maintained custody of it?
- What has been done with it at each change of custody?
- What was collected?
- How much was collected?
- How was it packaged?

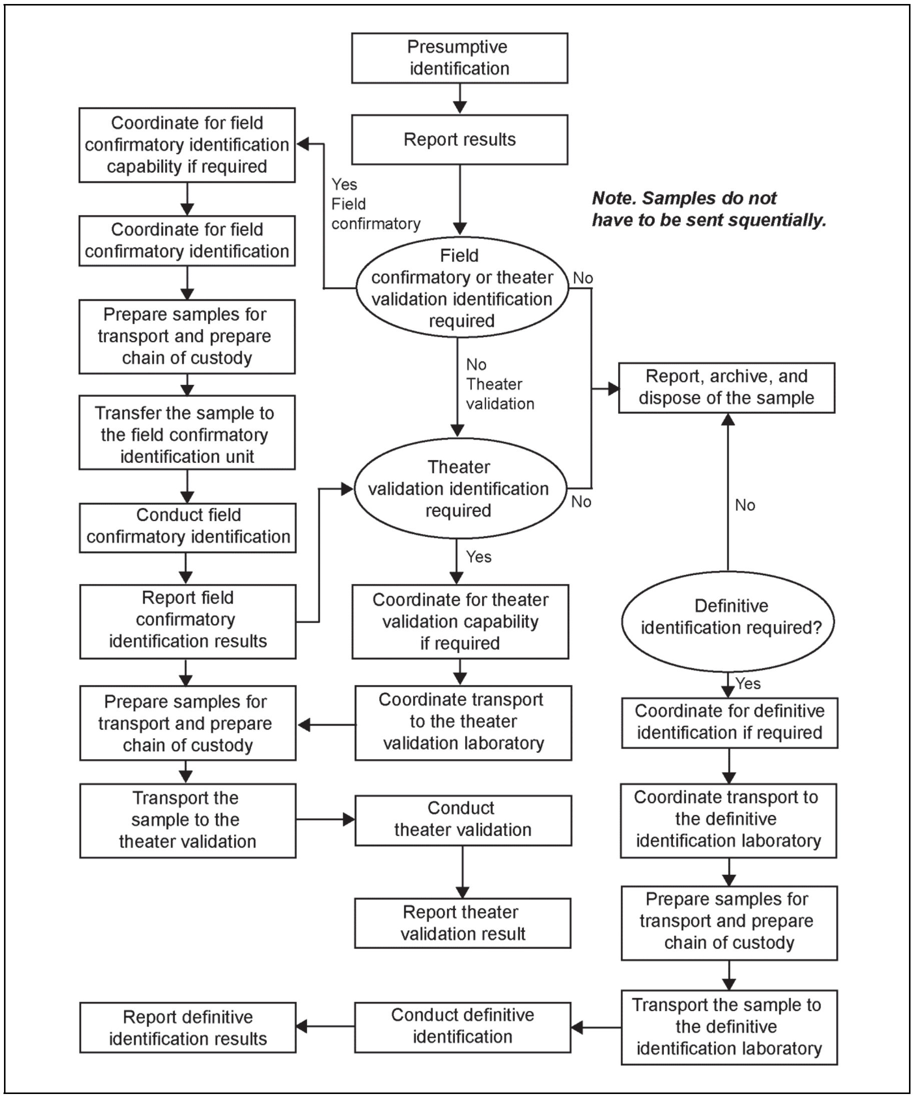

Figure H-5. Sample identification process

H-84. A complete history of the circumstances surrounding the acquisition of each sample must be documented and provided to the analyzing agency. These documents should also accompany shipments to the confirmatory laboratory. Critical information includes the—

- **Meteorological conditions.** Describe the meteorological conditions at the time of sample collection and at the time of the alleged incident.
- **Incident to collection time.** State the estimated length of time after the alleged incident when the sample was taken.
- **Circumstances of the acquisition.** Describe how the sample was obtained and indicate the source of the sample.
- **Physical description.** Describe the physical state (solid, liquid, powder, viscosity), color, approximate size, weight or volume, identity (military nomenclature, dirt, leaves), and dose rate (if radiologically contaminated).
- **Circumstances of the agent deposition**. Describe the type of delivery system; how the system or weapon functioned; how the agent acted on release; sounds heard during dissemination; a description of craters or shrapnel found associated with the burst; and colors of smoke, flames, or mist that may be associated with the incident.

- **Agent effects on vegetation**. Describe the general area (jungle, mountain, and grassland) and changes in the vegetation after agent deposition (that is, color change, wilting, drying, and dead) in the main incident and fringe areas.
- **Agent effects on humans**. Describe how the agent affected personnel in the main incident area versus the fringe areas; the duration of agent effects; peculiar odors that may have been noticed in the area before, during, and after the incident; measures taken that alleviated or worsened the effects; and the approximate number of victims and survivors (include age and gender).
- **Agent effects on animals**. Describe the types of animals that were and were not affected by the incident and a description of how they were affected.
- **Grid coordinates**. Identify the area where the sample was taken.
- **Chemical and biological support form**. A sample support form may be used to accompany the chain-of-custody forms.

H-85. Figure H-6 provides an example and instruction of a current form (DD Form 1911 *[Materiel Courier Receipt)* that may be used as a chain-of-custody form.

MATERIEL COURIER RECEIPT	SHIPPER'S CONTROL/DOCUMENT NO. 31U FN 1217731500 (3)
SHIPPER Phillip Owens, Tsgt, NCOIC BioDet Team (1)	SUPPLY ACCOUNT NUMBER BioDet TM 1, Ops (4)
DESTINATION Operational Biodetection 010902 (2)	SUPPLY ACCOUNT NUMBER 999CES/CEX (5)

I certify by my signature that I have received the materiel listed on this form and am aware of the applicable safety and security requirements.

SHIPMENT TRANSFERS

	LOCATION OF TRANSFER / RECIPIENT'S PRINTED NAME *(Last, First, Middle Initial)* / SIGNATURE	DATE *(YYYYMMDD)* / ORGANIZATION OR ACCOUNT NO.
FIRST	31U FN 1217731500, Shift change (6)	2012080 (7)
	Ricky Robinson, Ssgt, BioDet Team Member (8)	BioDet TM 1, Ops (9)
	SIGNATURE Ricky Robinson (10)	
SECOND	31U FN 1217731500, Released for packaging and evacuation	20120809
	Phillip Owens, Tsgt, NCOIC BioDet Team	BioDet TM 1, Ops
	SIGNATURE Phillip Owen	
THIRD	31U FN 1217731500, Released for escort to laboratory	20120809
	Mark Williams, SSG, Tech Escort	A Co, 22nd Chem, TE
	SIGNATURE Mark Williams	
FOURTH		
	SIGNATURE	
FIFTH		
	SIGNATURE	

SHIPMENT DESCRIPTION

LINE NUMBER	QUANTITY	SERIAL NUMBERS	REMARKS
1	1	US010902012 WAAZZZ1A	Sample vail containing less than 10 ml of sample wrapped in lab film, sealed with tamper resistant tape, placed in 50 ml tube, with absorbent material, in double clear plastic bags. Sample vial and clear plastic bags individual labeled US01090212 WAAZZZ1A (14)
(11)	(12)	(13)	

DD FORM 1911, APR 2010 PREVIOUS EDITION IS OBSOLETE Reset Adobe Professional 8.0

Sample

Figure H-6. Sample materiel courier receipt

H-86. The following are steps for completing the material courier receipt:

- **Step 1**. Give name, grade, and title of person taking sample.
- **Step 2**. Enter the destination where the sample is being sent, and date-time group.
- **Step 3**. Enter the area from where sample was obtained. The area should be precision lightweight GPS receiver coordinates.

- **Step 4.** Enter the R&S element designation.
- **Step 5**. Enter the unit designation.
- **Step 6**. Enter the area (GPS coordinates) of transfer and reason for transfer. Some example reasons are—
  - Shift change.
  - Released for evacuation.
  - Released for escort to laboratory.
  - Release 5 milliliters (example amount) for in-theater analysis.
- **Step 7**. Enter the date of transfer of chain of custody.
- **Step 8**. Enter the name, grade, and title of the person assuming responsibility for the items described in the shipment description.
- **Step 9.** Enter the unit designation of the person assuming responsibility for the items described in the shipment description.
- **Step 10**. Affix the signature of the person assuming responsibility for the items described in the shipment description.
- **Step 11**. Enter and itemize each package being evacuated.
- **Step 12**. Quantity will always be "1" for each item.
- **Step 13**. Enter the sample identification number of the sample to be transferred.
- **Step 14**. Describe the evacuation items as follows:

Note. The example description that follows is for a sample evacuation product.

  - **Sample vial**. The sample vial, containing less than 50 milliliters of sample, wrapped with laboratory film, sealed with tamper-resistant tape, placed in a clear zipper lock bag, labeled, inside another labeled clear zipper lock bag, labeled. Sample vial and individual clear bags labeled 010902001WAAZZZ1A.
  - **Supporting documents**. Other documents that may accompany the form are such things as detection analysis printouts, incident tracking reports, CBRN reports, and a chemical and biological support form.

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Appendix I
Marking

This appendix provides information on marking and techniques for use in a CBRN environment and signs used to mark areas of suspected contamination. The purpose and proper use of these signs and markings provide warnings and instruction for U.S. and allied forces as they navigate a potentially contaminated area. Marking of a CBRN-contaminated area is a follow-on task that is performed by CBRN R&S elements to indicate contamination before direct movement by military personnel into or through designated areas. This appendix provides information on CBRN marking procedures and signs used to mark areas of suspected contamination. Marking will be according to *MultiService Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Avoidance.*

MARKING PURPOSES

I-1. Marking a CBRN-contaminated area warns U.S. and allied forces of contamination threats/hazards, but the signs must be placed where they are most likely to be seen. Without visible markings, unprotected military personnel may enter into a contaminated area and become casualties.

I-2. CBRN reconnaissance is conducted to detect contamination:

- Before forces must move into or through or occupy an area of unknown CBRN contamination.
- When boundaries of a known contaminated area must be identified and marked.
- When, at the time of survey, identification of a route or other key terrain as uncontaminated is required.

I-3. Once a CBRN R&S element surveys an area and CBRN contamination is located, the area is marked using CBRN marking signs and a CBRN report is submitted to the requesting headquarters. Marking a contaminated area or equipment designates a hazard. A more detailed reconnaissance survey determines the extent and intensity of the contamination. Markings warn individuals and forces visually, identify routes through or around contaminated areas to maximize operational maneuverability, and identify equipment that is hazardous to military personnel.

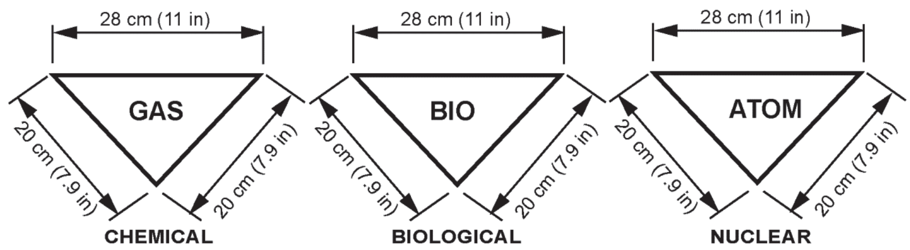
I-4. Marking of a contaminated area, bypasses, and surveyed uncontaminated key terrain is accomplished in two ways:

- **Hasty**. Action taken as soon as possible, following the identification of contaminated terrain to mark the area with the intent of avoiding an unwarned encounter with the hazard.
- **Deliberate**. Actions taken to improve hasty marking, adding additional markers, increasing visibility, and adding control measures when time and other resources permit.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR MARKING SIGN DESCRIPTION

I-5. There are specific standard signs, shapes, and inscriptions used for CBRN marking signs. Standardizing these signs allows for rapid identification, understanding, and situational awareness across the force when these signs are encountered.

I-6. Signs used for marking contaminated areas are standard throughout NATO in color, shape, and size. A contamination marking set is available for use by U.S. and NATO forces. Examples are shown in figure I-1.



• Yellow background with red lettering. • Agent name if known. • Detection time and date.	• Blue background with red lettering. • Agent name if known • Detection time and date.	• White background with black lettering. • Dose rate. • Reading time and date. • Burst time and date if known.

- Use expedient markers when standard markers are not available.
- Use suitable material to construct expedient markers.
- Construct expedient markers to the approximate size and shape shown.
- Write the discovery date and time and the hazard information on the marker with an indelible marker.

Legend:
cm centimeter
in inch

Figure I-1. Sample CBRN signs

1-33. Information on CBRN signs is as follows:

- **Color.** The primary and secondary colors of the CBRN marking signs are used to indicate the nature of the contamination hazard. The primary color refers to the color used for the background of the front surface of the marking sign. The secondary color refers to the color used for any markings and/or inscriptions (preferably on the front surface of the sign) In the case of danger due to CBRN contamination, the primary color, and the pattern of the signs by themselves will be the principal means of recognizing the type of contamination. As a safeguard, the words “ATOM” (for nuclear contamination), “BIO” (for biological contamination) or “GAS” (for chemical contamination), with the optional addition of a symbol where required by national authorities, is painted or written with the secondary color on the front surface. The language used for these inscriptions is selected by the forces erecting the sign. During joint operations, the language for inscriptions is English. The inscriptions are written parallel to the longer side of the sign.
- **Shapes and sizes.** CBRN signs should be—
  - The shape of the sign will be a right-angled isosceles triangle.
  - The base of the triangle will be approximately 28 centimeters (11 inches) and the opposite sides will be approximately 20 centimeters (8 inches).
  - Triangles will be made of metal, wood, plastic, composition board, adhesive material, or any adequate material available.
  - Existing stocks of colored triangular signs of slightly divergent shapes and sizes will be retained and used until stocks are exhausted.

Note. Infrared and visual beacons can also be used to assist in marking CBRN-contaminated areas. Beacons may be visible at night over a range of up to 1500 meters. Chemical lights can be attached to flag clips and placed between the beacons.

INSCRIPTIONS

I-7. Additional details concerning the CBRN contamination, if known, are to be inscribed on each marking sign, preferably on the front surface. The extra details inscribed depend on the kind of CBRN contamination.

- Multiple CBRN contamination may exist in some operational areas. In this case, the contaminated area would be marked with the relevant marking signs, which would be placed adjacent to each other.
- Military forces follow combatant command or joint operations area standards for marking CBRN hazards. When those standards are not provided or when standard markers are unavailable, military forces conducting reconnaissance operations may use expedient markers.

MARKING PROCEDURES

I-8. Marking contaminated areas, and marking lanes through and around them, involves attention to detail and a carefully considered marking plan.

MARKING CONTAMINATED AREAS

I-9. CBRN R&S elements should place contamination markers where the markers are most likely to be seen by approaching military personnel and friendly forces. CBRN R&S elements that locate contamination will place the markers creating a 200-meter buffer from contamination. Survey techniques shown in appendixes D and E are used to create this 200-meter buffer. Place adjacent marking signs at intervals of 10 to 100 meters, depending on the terrain, to prevent military forces from missing posted markers and inadvertently entering contaminated areas. When marking a contaminated area in open terrain (that is, desert, plains, rolling hills), raise the markers to a desired height that permits approaching military forces to view the markers at distances up to 200 meters.

I-10. The following are CBRN marking sign inscriptions for persistent chemical agents, biological agents, and toxic industrial chemical (TIC) or toxic industrial biological (TIB)

- Name/symbol of the agent/chemical used (if known), TIC if an unknown toxic industrial chemical is suspected, or TIB if contamination from an unknown toxic industrial biological is suspected.
- Date-time group (DTG) of detection.
- DTG of detonation/release (if known).
- Concentration (if known).

I-11. The following are CBRN marking sign inscriptions for radiological contamination including toxic industrial radiological (TIR):

- Substance/emitter (if known) (or TIR if contamination from a toxic industrial radiological is suspected.
- Dose rate and DTG of detection.
- DTG of detonation/release (if known).

I-12. The CBRN signs should be placed at waist height, right-angled apex downward, with the front of the sign facing away from the contaminated area being marked and spaced at intervals of 10 to 100 meters depending on the terrain. Place the CBRN signs on fences, trees, rocks, poles, supplied marking sign poles, and other appropriate mounting mediums, or by putting the apex into the ground if a solid sign. This latter method should not be used if the other methods can be adopted, as the signs might be obscured by grass and other undergrowth and may be readily knocked down. Make sure the signs are clearly visible to the eye at a distance of approximately 50 meters in most conditions of visibility. If the signs are placed within a CBRN-contaminated area, the signs are to face away from the area of higher dose rate or higher concentration if such can be determined. The marking will indicate the general area of ground contamination but will take no account of downwind CBRN hazards. CBRN-contaminated areas may be of such extent that complete marking of the whole perimeter will be impracticable. Military units should therefore take into consideration that such areas might be marked only in the area of immediate concern.

I-13. CBRN R&S elements normally mark contaminated areas on all sides to warn follow-on and support units of the hazard. Signs are normally placed to create a 200-meter buffer around the area of actual contamination. Additional marking at intersections of roads leading to CBRN hazards may be required to funnel or steer traffic away from the hazard area. Clear zones (safe lanes) may also be marked to provide greater freedom of movement by forces through or around areas contaminated with CBRN agents/materials.

LANES AND BYPASS MARKING TERMS

I-14. When marking lanes and bypasses through contaminated areas, the terms below provide a common basis for discussing marking and the various placements of signs. Appropriate CBRN marking signs (chemical, biological, or radiological) are used for each type of marker. Their placement and use in relation to the contamination identify them as a certain type of lane/bypass marker (entrance, handrail, exit, entrance funnel, final approach, or far recognition.

Entrance Markers

I-15. Entrance markers indicate the start of a lane through a contaminated area. They signify the uncontaminated-side boundary of the contaminated area and the point at which movement is restricted by the lane width and path. Entrance markers also indicate the lane width. Therefore, it is critical for a maneuvering force to distinguish the entrance point clearly, since it signifies the point at which passing vehicles can no longer adjust their movement in reaction to the situation (direct and indirect fires) without jeopardizing the force. Entrance markers must be visually different from handrail markers to help a force distinguish this critical point in the lane. The distance between entrance markers must be the same as the width of the created lane. Entrance markers placed a minimum of 4.5 meters apart indicate a lane capable of supporting mounted movement, while markers placed a minimum of 1 meter apart indicate a dismounted lane.

Handrail Markers

I-16. Handrail markers define the lane path through a contaminated area and indicate the limits of the lane width. As a minimum, mounted and dismounted lanes have a left handrail. Mounted and dismounted forces moving through a lane should keep the left handrail immediately to the left of their vehicle or person. The lane width is defined by the entrance markers. Therefore, when only the left handrail is marked, drivers use entrance and handrail markers to gauge the lane width and path. As the operation progresses, lane marking may be upgraded to include left and right handrails.

Exit Markers

I-17. Exit markers indicate the farside limit of a lane through a contaminated area. For a passing force, the exit marker signifies the point at which movement is no longer confined to the lane path. Like entrance markers, exit markers must be distinguishably different from handrail markers; however, the exit may be marked the same as the entrance. Exit markers are placed to the left and right of an exit point and spaced the width of the reduced lane. This visual reference is critical when only a left handrail is marked. The combination of entrance, left handrail, and exit markers gives the driver and the tank commander visual cues (entrance and exit points, lane width, and path) to pass safely along a lane.

Entrance Funnel Markers

I-18. Entrance funnel markers augment entrance marking. The V formed by the funnel markers forces approaching elements into a column formation and assists drivers and tank commanders in making last-minute adjustments before entering the lane.

Final Approach Markers

I-19. Final approach markers are highly visible, more robust markers that augment the visual signature of entrance funnel markers. Units must be able to see the entrance funnel and/or the entrance funnel markers from the final approach marker. The final approach marker—

- Provides the element commander with a highly visible reference point toward which to maneuver his formation.
- Signals element commanders to begin changing to a column formation.

Far Recognition Markers

I-20. Far recognition markers are highly visible markers located between the final approach marker and the friendly element. They are primarily used when passing large-sized (for example, Army battalion-size) forces through a lane where direct observation of the final approach marker is denied due to distance, visibility, or terrain. Far recognition markers should be different from the final approach marker. Far recognition markers indicate the point at which forces begin changing their formation to posture for the passage. A single far recognition marker may serve up to two lanes when located 200 to 400 meters apart. Once lanes are upgraded to two-way traffic, far recognition markers are required for each two-way lane. Far recognition markers should be visually alterable so that they can be distinguished from the far recognition marker of an adjacent lane. This assists the mission command/C2 of large formations when passing on several adjacent lanes. When a far recognition marker serves more than one lane, a guide or a traffic control point/post is collocated with the far recognition marker nearest the obstacle.

LEVELS OF LANE MARKING AND PATTERNS

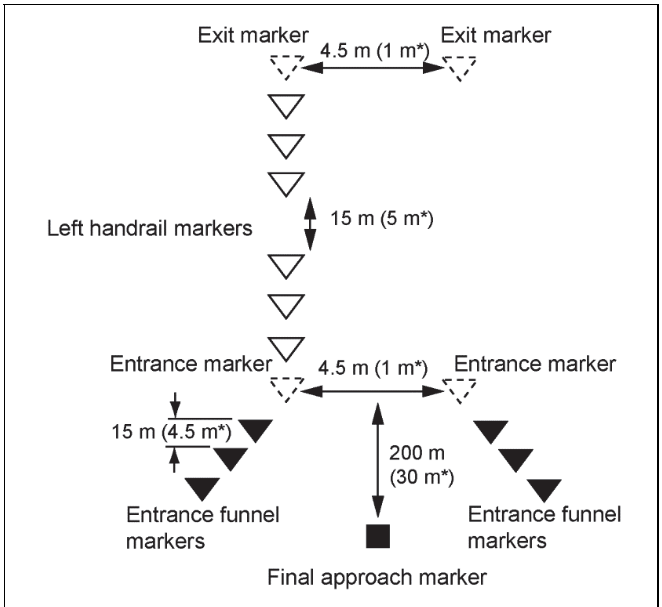
I-21. There are two levels of lane marking for CBRN hazards—initial and intermediate. Each lane-marking level provides an increase in lane signature and capability. Lane requirements change over time as operations mature from the passage of the assault force to the passage of larger follow-on forces. Initial lane-marking requirements are driven by the nature of the fight through the CBRN hazard area. Initially, marking must be rapid, providing only the bare minimum signature needed to safely pass initial small units (company teams, platoons). This contrasts with lane requirements during later phases of an operation where larger units (battalion and above) require improvements to existing initial hasty marked lanes. Two-way traffic becomes a priority for the simultaneous forward passage of combat units and return traffic (ambulances, empty supply vehicles) necessary to sustain the force. With the increase in traffic, volume comes more diverse forces and levels of driver experience. Lane-marking limits must be clear to the most inexperienced driver or crewmember; do not assume he has knowledge of the unit SOP.

I-22. Commanders must be aware of how the lane needs of a force change with the operation so that they can anticipate lane marking and lane capability requirements. Integrating the levels of lane marking into the overall CBRN defense and avoidance plan ensures that a unit's needs are satisfied. The forces necessary to mark and upgrade lanes must be allocated and tasked with that mission. The scheme of maneuver and the service support plan are the basis for analyzing lane requirements. The following paragraphs describe lane-marking patterns in detail and provide guidelines on when a commander should upgrade lane marking and lane capability.

Initial Lane Marking

I-23. The CBRN R&S element emplaces the initial lane-marking pattern (see figure I-2, page I-6) immediately after the lane across the CBRN hazard is determined. This is a signal to the supported unit commander that the lane is ready for traffic. Initial lane marking is kept to a minimum, focusing on the markings needed to pass immediate forces (company teams and smaller) through the lane to secure the point of penetration on the farside if needed. Normally, a security force observes the lane as it is being marked and does not need the greater visual signature of mature lane marking. The initial lane-marking pattern contains—

- Entrance markers.
- Left handrail markers.
- Exit markers.
- Entrance funnel markers.
- A final approach marker.



Note. The distance between markers is driven by mission variables. Distances shown are a recommendation.

Legend:

*	distance for dismounted lanes
m	meter

Figure I-2. Initial lane marking

Intermediate Lane Marking

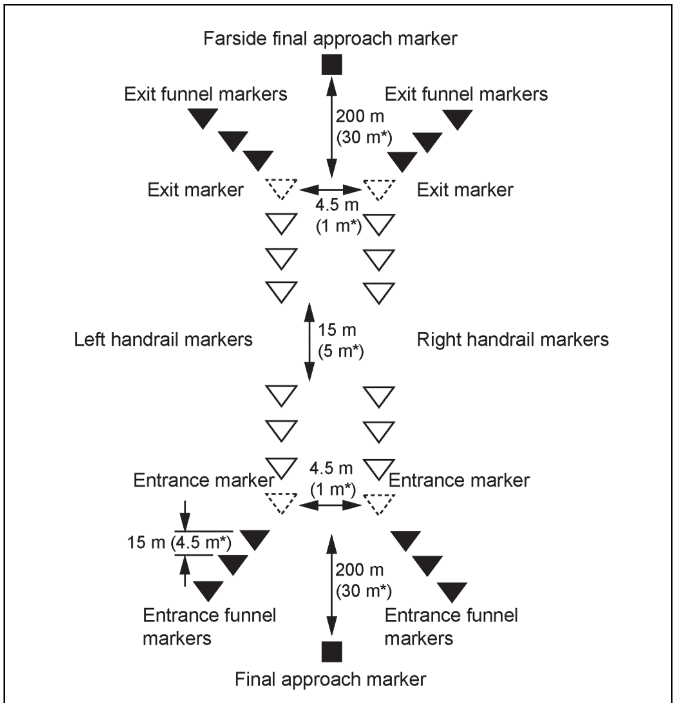
I-24. Upgrading initial lane marking to intermediate lane marking is triggered by one of two key events:

- Commitment of larger combat forces that are unable to directly observe the CBRN-hazard area as it was marked.
- Rearward passage of sustainment traffic (casualty evacuation and vehicle recovery).

I-25. Intermediate lane marking has two goals:

- Increasing the lane signature to assist in the passage of larger combat forces.
- Providing sufficient marking for two-way, single-lane traffic.

I-26. Intermediate lane marking builds on the initial lane-marking pattern by adding right handrail markers, exit funnel markers, far recognition markers, and a farside final approach marker. Figure I-3 shows the intermediate lane-marking pattern.



Note. The distance between markers is driven by mission variables. Distances shown are a recommendation.

Legend:

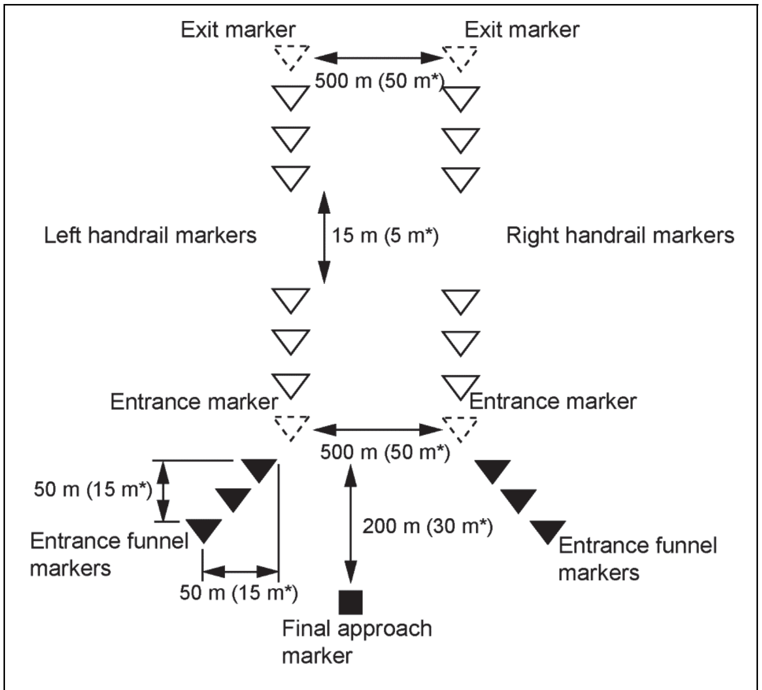
*	distance for dismounted lanes
m	meter

Figure I-3. Intermediate lane marking

BYPASS MARKING

I-27. Bypasses are marked using the same lane-marking patterns, marking signs, and visual cues as a lane. However, marking a bypass around a CBRN hazard is much different from marking a lane through a CBRN hazard because the amount of room available for forces to maneuver must be determined. While lanes through a CBRN hazard are normally expanded to the left, bypasses are expanded away from the CBRN hazard.

I-28. Bypasses must show where it is safe to rapidly pass around a CBRN hazard, without unnecessarily restricting the force's ability to maneuver. To accomplish this, the marking unit will mark the bypass with a bypass-marking pattern (modified initial lane-marking pattern with right handrail markers added). The unit will perform reconnaissance and initially mark the bypass 500 meters wide to allow platoons to maneuver around the CBRN hazard. The width of the bypass is increased as time allows further reconnaissance. Limited visibility or additional CBRN hazards discovered at the flank of the CBRN hazard that is being bypassed may constrain the marked width of the path to less than 500 meters. (The right handrail markers must be visible from the left handrail markers.) In addition to bypass marking, units should consider establishing mobile guards on the friendly side of the CBRN hazard to prevent vehicles/personnel from entering it. Figure I-4, page I-8, provides an illustration of bypass marking.



Note. The distance between markers is driven by mission variables. Distances shown are a recommendation.

Legend:

*	distance for dismounted lanes
m	meter

Figure I-4. Bypass marking

ENHANCED MARKING

I-29. In times of reduced visibility (for example, darkness, fog, rain) enhanced visual marking can be used. Enhanced visual marking occurs by attaching sources of light where the actual marker is placed. The additional lights are attached using various means such as clips, wire, ties, and string. This includes—

- **Infrared markers (nonvisible spectrum).** Infrared markers cannot be seen unless using night-vision devices with infrared capability. They are attached to actual contamination markers. They can be used when friendly forces are equipped with night-vision devices that can see infrared. Marking with infrared markers may occur when a military advantage would be obtained, such as when an adversary does not have night vision infrared capability.
- **Visual spectrum lights.** These lights can include chemical lights or battery operated lights placed along with the actual contamination markers. They ensure markers can be seen in reduced visibility using the naked eye.

I-30. Another form of marking can occur by transmitting marker placement on shared digital formats for others to see on their various virtual maps. Examples of these include the use of overlay systems and various Service mission command/C2 suites.

URBAN AREA MARKING CONSIDERATIONS

I-31. When marking CBRN hazards in urban areas, additional steps should be considered. METT-TC/METT-T will drive how CBRN hazards are marked. Additional marking considerations are:

- Additional marking requirements may be required by the host country.
- Entryways of suspect buildings and other facilities that may be contaminated with CBRN agents/materials must be marked at critical points, for example, doorways and windows.

- Additional marking at intersections of roads leading to CBRN hazards may be required to funnel or steer traffic away from the hazard area.

Marking Contaminated Equipment and Supplies

I-32. Material contaminated by chemical, biological, and radiological agents must be marked to protect military personnel from accidentally coming into contact with the contamination. Place contamination markers on unmarked equipment present in the CBRN attack area. Military personnel using equipment after it has been through decontamination must take precautions against vapor, particulate, and liquid contamination that may be trapped inside filters, assemblies, and joints. The CBRN contamination could pose a hazard while equipment is being used or maintained. Figure I-5 is a sample of a hazard warning tag.

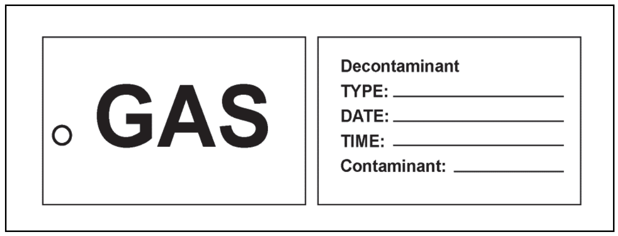


Figure I-5. Sample CBRN hazard warning tag

I-33. CBRN signs may be placed centrally on at least two adjacent sides of a complete equipment or unit load pallet, right-angled apex downward. The signs must be clearly visible from all likely avenues of approach. Irregularly shaped items, and nonpalletized stores, will be marked in the obvious and convenient places.

Radiological Marking Procedures

I-34. Marking of a radiologically contaminated area merely indicates the presence of a radiological hazard, the extent of which must be determined by qualified Service members using instrument readings, surveys, or information from other forces.

Note. In case of limited space on the front surface of the sign, as a minimum, the name/symbol of the agent (if known) and/or the dose rate/concentration (if known) is to be written on the front surface. Any other details may be written on the back surface.

I-35. A radiologically contaminated area may not be marked when a military advantage would be obtained by not doing so. This decision would be made at the discretion of the commander. In such cases, positive measures will be taken to warn other allied forces of the existence of the radiologically contaminated area.

I-36. Following a nuclear incident, radiological signs are to be placed on all probable routes leading into radiologically contaminated areas. When the dose rate is above 1 centigray per hour, radiological contamination signs showing the actual dose rate are to be placed on all probable route boundaries leading into the contaminated area. Lower radiation contamination levels normally are not marked even though long stays in areas of old contamination might produce significant doses. Military forces planning prolonged stays in an area during a nuclear attack should check the area with RADIAC instruments regardless of whether it is marked.

I-37. In the case of toxic industrial radiologicals, radiological signs are to be placed on all probable routes leading into contaminated areas. When the dose rate is above 2 micrograys per hour, signs showing the actual dose rate are to be placed. Also, move or correct the radiological sign periodically as radioactivity decays over a period of time.

I-38. Forces leaving a contaminated area or otherwise relinquishing responsibility for an area leave perimeter marking signs in place. The command taking over responsibility for the area will continue the periodic correction or movement of the signs or remove them when they are no longer a hazard to personnel or forces.

I-39. Radiologically contaminated material deposited in dumps is marked at intervals around the perimeter.

Appendix J
Reports

This appendix provides information on CBRN R&S reports that enhance a commander's situational awareness and how they contribute vital information to establish and maintain a COP. Nontraditional CBRN reports (such as medical reports) outlined in this appendix support the execution of CBRN assessment by non-CBRN forces (such as PVNTMED assets), and exploitation and WMD elimination operations by specialized CBRN teams. The timely and accurate collection, evaluation, and exchange of CBRN information are vital in avoiding and mitigating CBRN threats/hazards in the operational environment, and to address exposure documentation and medical surveillance determinations. Reports pertaining to CBRN information support the process of predicting, detecting, identifying, warning of, and reporting CBRN attacks. These reports inform forces of potential CBRN hazards within the operational environment. The reports that result from the information and data collection will also serve as the future record for the incident that may be used in various assessments, including determination for long- term medical and health surveillance. Commanders at all levels require timely, accurate, and evaluated information that results from locating and assessing CBRN threats and hazards in the operational environment. Locating CBRN threats and hazards (such as clandestine CBRN laboratories and other hazardous materials, explosives, and munitions) by forward maneuver units can affect operations and planned R&S activities. Incidents involving CBRN agents or materials on land, in air, or at sea can have a significant effect on military operations, plans, and decisions. The CBRNWRS is the primary means of warning forces and reporting an actual or predicted CBRN hazard. The CBRNWRS allows commanders and CBRN staffs to determine required protective measures and plan operations accordingly. Commanders have the responsibility at all levels so that plans, directives, and SOPs consider CBRN defense a priority. The CBRNWRS must be coordinated with the medical surveillance and information systems and the personnel/casualty systems so that data captured from a CBRN event related to personnel exposure can be saved and archived for future use.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR WARNING AND REPORTING SYSTEM

J-1. The CBRNWRS is most effective when visualized and implemented as a collective system of premission, mission execution, and postmission reports and messages. Ensuring that sufficient information is available prior to execution of R&S missions supports the rapid and effective execution of tactical missions while reducing the impact of uncertainty. During the execution of R&S operations, valuable information is collected to better assess the overall CBRN threat or hazard to the force and the execution of exploitation or WMD elimination operations. Table J-1, page J-2, represents reports and/or messages that support premission planning, mission execution, and postmission activities.

Table J-1. Reports and messages supporting CBRN R&S missions

Premission	*Mission Execution*	*Postmission*
• SPOTREPs • SALUTE reports • Intelligence reports ▪ INTREPs ▪ Aerial/ground imagery ▪ HUMINT/COMINT ▪ Target folders • CBRN1, 2, and 3 reports • Meteorological data (estimated) • UXO/IED reports • CBRN technical reports ▪ Medical/health/safety ▪ Weapon systems ▪ Delivery systems ▪ Munitions ▪ Agents/hazards ▪ Modeling/effects • Assessment report	• SPOTREPs • SALUTE reports • CBRN4 report • Meteorological data (local) • UXO/IED reports • Preliminary technical report (EOD) • Assessment report • Chain of custody	• CBRN5 and 6 report • Complementary technical report (EOD) • Survey report • Laboratory analysis reports
Legend:		
CBRN	chemical, biological, radiological, and nuclear	
COMINT	communications intelligence	
EOD	explosive ordnance disposal	
HUMINT	human intelligence	
IED	improvised explosive device	
INTREP	intelligence report	
SPOTREP	spot report	
SALUTE	size, activity, location, unit, time, and equipment	
UXO	unexploded explosive ordnance	

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR WARNING AND REPORTING SYSTEM

J-2. During R&S activities, the CBRNWRS is an information management function that entails collecting and analyzing data from assessments within the operational area to support tactical operations. It provides quality information to the right person at the right time in a usable form to simplify understanding and decision making, which allows commanders and CBRN staffs to determine requirements on protective measures and plan CBRN operations.

Note. The North Atlantic Treaty Organization (NATO) conducts CBRNWRS activities according to STANAG 2103/Allied Tactical Publication (ATP)-45(series), and U.S. forces have implemented this agreement in *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Avoidance*.

J-3. CBRNWRS capabilities include manual and automated processes in the creation, collection and control, dissemination, and storage and retrieval of information obtained from affected forces, coalition partners, and appropriate nongovernmental organizations and indigenous agencies. Capabilities may range from detectors and alarms that are not integrated to fully integrated sensors at selected locations—allowing the commander and CBRN staffs to anticipate future conditions and accurately assess risks. The vertical and horizontal exchange of CBRN-related information relayed through the CBRNWRS keeps different commands, agencies, coalition partners, and functional/staff personnel informed. The CBRN staff determines the need for specific types of CBRN information (for example, when and where the CBRN attack occurred).

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR INFORMATION MANAGEMENT

J-4. CBRN information management focuses on obtaining relevant data about the operational area, which can be processed by the CBRN staff into operationally significant information. To be useful, CBRN information must be collected, reported, and evaluated. Once the CBRN information is evaluated, it can be used to update intelligence, plan force protection and avoidance measures, initiate exploitation operations, or conduct WMD elimination planning. The volume of information collected and reported could easily disrupt communications and tactical operations if not properly managed. See *Multiservice Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Avoidance* for additional information on information management.

TYPES OF CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR REPORTS

J-5. The CBRNWRS consists of six standard reports for reporting CBRN incidents or attacks, or locating and reporting CBRN hazards within the operational environment. (See *Multiservice Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Aspects of Contamination Avoidance*.)

Note. In addition to the standard CBRN reports, other formatted reports are also used to provide details regarding CBRN attacks or concerning the location of CBRN weapons or materials. For example, operational reports series 3 (OPREP-3) messages are a requirement to quickly report significant events and incidents such as CBRN attacks to highest levels of command. The following two subsections describe specialized CBRN reports used by U.S. Army and U.S. Marine Corps units to provide tactical level situational awareness to the supported command and staff during execution of operations or in support of CBRN exploitation and WMD elimination operations. (See Army Tactics, Techniques, and Procedures [ATTP] 3-90.15.)

SURVEY FORMS

J-6. Collection site, attack information, and other information may be collected by reconnaissance teams during sample collection. This information may be collected on sample documentation as shown in figure J-1, page J-4. Information from a survey or monitoring mission discovering chemical contamination can be recorded on the chemical data sheet (see figure J-2, page J-5).

OTHER TACTICAL REPORTS

J-7. Other tactical reports include unexploded explosive ordnance (UXO), spot, and size, activity, location, unit, time, and equipment (SALUTE) reports and system-specific reports. Any force may provide a spot or SALUTE report that includes information on contamination, locating CBRN ordnance, hazardous material, or other suspicious activities (for example, clandestine laboratory). Sensor suites provide system-specific reports containing component- and system-level detection and identification results.

CHEMICAL/BIOLOGICAL SAMPLE DOCUMENTATION

For use of this form, see ATP 3-11.37; the proponent agency is TRADOC.

INSTRUCTIONS

Place the biological sample inside a refrigerator, ice chest, or insulated container; and keep it as cool as possible at all times.

SAMPLE IDENTIFICATION NUMBER:	DATE SAMPLE COLLECTED:	TIME SAMPLE COLLECTED:
001	20160309	18:20:00

REASON FOR COLLECTION *(Check those that apply)*:

- [X] Chemical/Biological Attack
- [ ] Chemical/Biological Alarm Activated
- [ ] Positive M256 Chemical Detection
- [ ] Positive Recon Team Findings
- [ ] Soldiers Becoming Sick
- [ ] Soldiers Dying
- [ ] Other

LOCATION OF ATTACK: *(UTM or place)*	DATE OF ATTACK:	TIME OF ATTACK:	UNIT IDENTIFICATION: *(Co, Bn, Bde, Div, Corps)*
Belize	20160309	18:00:00	12th CM Co

TERRAIN DESCRIPTION *(Check those that apply)*:

- [ ] Flat [ ] Hills [ ] Mountains [ ] Desert [ ] Jungle [ ] Forest [ ] Urban
- [ ] Grassy [X] Sparse Trees/Shrubs [ ] Other

WEATHER *(Check those that apply)*:

- [ ] Clear [ ] Cloudy [X] Rain [ ] Fog [ ] Snow [ ] Dust [ ] Mist
- [ ] Other

WIND AT COLLECTION SITE *(Check only one)*:

- [X] None/Calm [ ] Mild Breeze [ ] Windy [ ] Gusts

ODOR *(Check those that apply)*:

- [ ] None [ ] Sweet [ ] Fruity [ ] Irritating [ ] Pepper [ ] Flower [ ] Changing
- [X] Other Smells like almonds

SYMPTOMS *(Check those that apply)*:

- [ ] None [ ] Skin Swelling [ ] Difficulty Breathing [ ] Blurred Vision
- [ ] Dizziness [ ] Skin Rash [ ] Nausea [ ] Dry Mouth
- [ ] Fever [ ] Dark Skin Blotches [ ] Unconscious [ ] Headache
- [X] Bleeding Sores [ ] Other

TIME OF ONSET *(of symptoms)*:	DURATION *(of symptoms)*:
18:15	

DELIVERY METHOD *(Check those that apply)*:

- [X] Unknown [ ] Artillery [ ] Mortar [ ] RPG/Grenade [ ] Rocket [ ] Aircraft [ ] Aerosol
- [ ] Generator [ ] Other

STATE OF AGENT AT TIME OF COLLECTION *(Check only one)*:

- [ ] Liquid [X] Vapor [ ] Powder [ ] Solid [ ] Smoke [ ] Mist [ ] Dust (cloud)
- [ ] Gel [ ] Other

DESCRIPTION OF SAMPLE *(Check only one)*:

- [ ] Vegetation [X] Soil [ ] Other

BIOMEDICAL:

- [ ] Urine [ ] Blood [ ] Tissue

COLOR OF SAMPLE:	SIZE OF SAMPLE:	OTHER:
	2 ml	

ADDITIONAL REMARKS:

DA FORM 1971-6, MAR 2017 PREVIOUS EDITIONS ARE OBSOLETE. APD LC v1.00

SAMPLE

Figure J-1. Sample chemical/biological sample documentation

CHEMICAL DATA SHEET - MONITORING OR SURVEY

For use of this form, see ATP 3-11.37; the proponent agency is TRADOC.

DATE	PAGE NO	NO OF PAGES

UNIT:
12th CBRN Co

MONITORING OR SURVEY TEAM NUMBER:
Team 1

MAP USED:

MONITOR OR SURVEY TEAM MEMBER (*Print Name*):
SGT Schmecklheimer

LOCATION/TIME OF TEST OR INDICATION	TYPE DETECTOR USED			AGENT DETECTED
	PAPER	ALARM	KIT	
Checkpoint 1		JCAD		Nerve
1400Z	M8		M256	Nerve

REMARKS
Dismounted survey

SAMPLE

DA FORM 1971-2 MAR 2017 PREVIOUS EDITIONS ARE OBSOLETE. APD LC v1.00ES

Figure J-2. Chemical data sheet monitoring or survey form

MEDICAL CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR REPORTS

J-8. CBRN incident medical reports are to be prepared for incidents and provided to medical channels in a timely and adequate manner. The documentation and archiving of actual or potential CBRN exposures is essential (and required) to address future investigation and/or health surveillance of potentially exposed personnel.

J-9. The medical "incident report" actually consists of two 'forms' or sets of reported information. The first is referred to as the Initial Field Account Survey (IFAS). In some documents, the IFAS has been called the Basic Exposure Evaluation Form (BEEF). The IFAS is a documentation of the onsite field information regarding the CBRN hazard, detection results, exposures, symptoms, visual and witness information, and other details. This form is especially critical and will typically need to be completed by units involved in an attack, and CBRN units or personnel involved in collection of CBRN samples and reporting. There may be multiple units completing separate IFASs. The second form is referred to as the Incident Report Survey (IRS). The IRS has been referred to as the Health Incident Technical Summary report in other documents). This form is a postincident health assessment typically prepared by HSS/FHP/PVNTMED assets. PVNTMED assets cannot complete the IRS without adequate information from the IFAS (also known as BEEF). It is therefore essential that CBRN personnel ensure that such forms are completed and provided to appropriate medical/PVNTMED assets.

J-10. The IFAS and IRS forms are available as electronic data fields in the official DOD environmental data archive known as the Defense Occupational and Environmental Health Readiness System (DOEHRS): <https://mesl.apgea.arrmy.mil/mesl/doehrsResources/initialize.do>. Use of the DOEHRS module will allow for real-time data archiving; however, typically only PVNTMED assets will have access to this system. For the most current versions of these forms, access and download from the DOEHRS website. If completed as hardcopy, then these forms must be submitted to the Occupational and Environmental Health Surveillance Data Portal via e-mail using the following addresses:

- Unclassified data: <oehs.data@us.army.mil>.
- Classified data: <oehs@usachppm.army.smil.mil>.

INITIAL FIELD ACCOUNT SURVEY

J-11. The IFAS ensures that CBRN incident details and a roster of exposed and medically treated personnel are adequately captured. This is critical for future use in medical surveillance considerations. FHP/PVNTMED personnel will use information on the IFAS, along with other pertinent documents, when documenting a health risk assessment summary of the incident.

J-12. The determination that an occupational and environmental health (OEH) exposure is significant enough to report it as an *incident* is somewhat subjective, but there are certain criteria that indicate a report should be prepared. The most obvious scenarios are those events that result in real-time health impacts that require medical countermeasures or treatment. However, even events where there is no notable impact to human health or mission should be documented if something triggers a specific evaluation or investigation of the potential presence of a CBRN/OEH hazard. For these types of incidents, documentation of negative findings can be important to address future medical queries. It is essential that Service members understand that it is to their own benefit to help so that potential exposure incidents are adequately documented if they have future health concerns or claims that may be attributed to such exposures.

J-13. The IFAS should be completed by FHP personnel and the chain of command involved in the incident. Details in the IFAS and the underlying reports such as SIGACTs and roster may be classified. Unit security personnel must review the IFAS and determine the classification it should have. Since standard SIGACTs typically do not include all the required information for CBRN/OEH exposure incidents, a form called IFAS is provided in this appendix as a template to expand the information that may have been put in the SIGACT. If a SIGACT already contains all the required information, then a separate IFAS is not required; otherwise, the IFAS should be completed and should just reference the SIGACT number. By completing the IFAS, PVNTMED specialists can properly investigate the exposure and work with medical personnel so that appropriate medical follow-up and health surveillance is conducted. In addition, the information can provide valuable lessons learned that could help mitigate future health impacts from similar events. Complete the form as thoroughly as possible and submit to the command surgeon/FHP officer within 24 hours of an incident. The following are indicators that and IFAS should be completed:

- The presence of an occupational and environmental health (OEH) hazard is plausibly associated with actual observed (acute) clinical health outcomes that are reported and/or treated (for example, complaints of headaches, dizziness, skin/eye irritation/burning, coughing, nausea, and other abnormal signs).
- The presence of an acute OEH hazard is indicated through positive detection using real-time field equipment. For example, M8/M256/improved chemical agent monitor detectors for chemical warfare agents, and radiation detection, indication and computation (RADIAC) meters for radioactive materials.
- Evaluation of data or related information by an appropriate medical professional indicates that exposure to the OEH hazard could plausibly result in some significant (moderate or higher risk level) clinically relevant adverse health outcome (significant long-term chronic effects).
- Visual/sensory cues indicating potential presence of an OEH hazard (obscurants/cloud, odors, strange liquid/powders) are present.

INCIDENT REPORT SURVEY FORM

J-14. The IRS report is a consolidated assessment of overall incident information pertaining to personnel exposures and any associated health effects. Completion of the IRS ensures that the necessary information is consolidated and submitted to the designated DOD data archive. Ideally, this information is prepared in as an unclassified document so that personnel and providers can have access. A PVNTMED unit designated by the command surgeon/FHP officer will prepare the IRS. While details in some of the underlying documents and reports (SIGACTs, IFAS, and roster) may be classified, to the extent possible the IRS report itself should be completed at the lowest classification possible for the widest distribution. The IRS form consists of six basic sections. Most sections are straightforward but some additional information is described below:

- Most of the required elements listed on the IRS report form should be contained in other documents. Information such as SIGACT, IFAS, rosters, field and/or analytical data, risk communication documents, may be referred to as attachments. However, some assessment/interpretation of the information is necessary to provide an overall summary of the required information. For example, the PVNTMED personnel should summarize the incident information and provide a qualitative risk estimate of the level of the acute health effects presented during the incident, and, a risk estimate of the potential for long term chronic health consequences of concern (see USAPHC [Provisional]) TG 230 for information regarding OEH risk estimation). Depending on the incident, risk communication products (for example, fact sheets and briefings) may be prepared.
- Health effects and medical information.
  - Include reference to the roster that indicates those persons medically treated and their disposition. Provide any rapid medical evaluation (RME) reports and any Standard Form (SF) 600 (*Chronological Record of Medical Care*) overlays.
  - Describe overall types and severity of acute and chronic health effects and the ‘risk levels’ ranking assigned for each. If none are identified, state “none identified/anticipated.” If health effects/risk is only to unique personnel/units, explain.

J-15. The following are short-term risk levels, health effects, and medical treatment that may occur during the mission:

- **Extremely high.** Loss of ability to accomplish the mission if hazards occur during mission. Notable in-theater medical countermeasures/resources were required (protection, treatment, exposure documentation).
- **High.** Significant degradation of mission capabilities in terms of the required mission standard, inability to accomplish all parts of the mission, or inability to complete the mission to standard if hazards occur during the mission. Some in-theater medical countermeasures/resources (for example, protection, treatment, and exposure documentation) were required.
- **Low.** Expected losses have little or no impact on accomplishing the mission. No in-theater medical resources required/anticipated other than documentation for health incident technical summary.

Note. Personnel may be grouped into different exposure categories (reflecting different exposure levels/durations/estimated severity of exposure). These different groups may then each be designated with different risk levels.

J-16. The following are long-term risk levels, chronic effects, and medical surveillance that may occur postdeployment:

- **Extremely high.** Significant future medical surveillance activities and medical provider resources anticipated. Document IRS and exposure data in designated DOD archive and designate a registry to actively track the identified personnel/group and conduct specific active surveillance and/or medical follow-up procedures for life cycle of identified group.
- **High.** Notable future medical surveillance activities and related resources anticipated. Document IRS and exposure data in designated DOD archive; specifically identified exposed personnel/group documented; possible passive medical surveillance activities for this group.
- **Moderate.** Limited future medical surveillance activities and related resources anticipated. Document IRS and exposure data in designated DOD archive; document potential groups/personnel of interest.
- **Low.** No specific medical action required. Document IRS and exposure data in designated DOD archive.

Note. Personnel may be grouped into different exposure categories (reflecting different exposure levels/durations/estimated severity of exposure). These different groups may then each be designated with different risk levels. It is recommended that long-term risk estimates be coordinated with a Service health surveillance center physician.

J-17. When completing the IRS, especially for assessing the degree of any potential long-term health risks of concern and/or follow-up medical surveillance, and preparing risk communication products (fact sheets, briefings), PVNTMED personnel should contact Service SMEs for consultative assistance (see table J-2).

Table J-2. Service consultative assistance

U.S. Army	***U.S. Navy***	***U.S. Air Force***
U.S. Army Public Health Command Phone: (800) 222-9698 http://phc.amedd.army.mil ***Note.*** For specific assistance with health risk reporting and documentation of potential for long-term health effects and medical surveillance, contact the U.S. Army Public Health Command Environmental Medicine Clinical Consult Service at: USAPHC-environmentalmedicineprogram@AMEDD.army.mil Phone: (410) 436-2714	Navy and Marine Corps Public Health Center Phone: (757) 953-0700 http://www- nehc.med.navy.mil	U.S. Air Force School of Aerospace Medicine http://www.wpafb.af.mil/afrl/711hpw/USAFSAM ESOH Service Center esoh.service.center@wpafb.af.mil Toll Free: 1-888-232-3764 Phone: (937) 938-3764 DSN: 798-3764 Fax: (937) 656-8637 Please subscribe to the ESOH Service Center website: https://hpws.afrl.af.mil/dhp/OE/ESOHSC/

J-18. When completed, the IRS and the associated attachments/documents (including copies of IFAS, associated roster, analytical data, medical treatment/RME information, and risk communication products [for example, fact sheets and briefings]) should be submitted to the combined joint task force surgeon/FHP officer who is ultimately responsible for final determination and submittal to the Deployment Occupational and Environmental Health Surveillance (DOEHS) data portal (via: <oehs.data@us.army.mil> for unclassified data or <oehs@usachppm.army.smil.mil> for classified data) for archiving and notifying/coordinating with the combatant command surgeon and Service health organizations.

J-19. Additional technical SME evaluation/investigation would be requested through the combatant command surgeon/FHP officer who submits request to appropriate organizations.

Glossary

SECTION I – ACRONYMS AND ABBREVIATIONS

AEP	allied engineering publication
AFDD	Air Force doctrine document
AFH	Air Force handbook
AFMAN	Air Force manual
AFMAN(I)	Air Force manual (instruction)
AFPD	Air Force policy directive
AFVA	Air Force visual aid
AOR	area of responsibility
ATP	allied tactical publication
ATTP	Army tactics, techniques, and procedures
BEEF	basic exposure evaluation form
C2	command and control
CB	chemical-biological
CBR	chemical, biological, and radiological
CBRN	chemical, biological, radiological, and nuclear
CBRNCC	chemical, biological, radiological, and nuclear control center
CBRNWRS	chemical, biological, radiological, and nuclear warning and reporting system
CCIR	commander's critical information requirement
CFR	Code of Federal Regulations
CJCS	Chairman of the Joint Chiefs of Staff
CLS	combat lifesaver
COA	course of action
COMSEC	communications security
CONOPS	concept of operations
CONUS	continental United States
COP	common operational picture
CP	command post
CW	chemical warfare
DA	Department of the Army
DHHS	Department of Health and Human Services
DNA	deoxyribonucleic acid
DOD	Department of Defense
DODD	Department of Defense directive
DODI	Department of Defense instruction
DOEHS	deployment occupational and environmental health surveillance
DOEHRS	Defense Occupational and Environmental Health Readiness System
DOT	Department of Transportation

DTG	date-time group
EOD	explosive ordnance disposal
FCM	Foreign Consequence Management
FDPMU	forward deployable preventive-medicine unit
FFIR	friendly force information requirement
FHP	force health protection
FM	field manual
FMI	field manual interim
FP	force protection
FRAGORD	fragmentary order
GCC	geographic combatant commander
GPS	Global Positioning System
HD	a mustard agent
HN	host nation
HSPD	Homeland Security Presidential Directive
HSS	health service support
HUMINT	human intelligence
IATA	International Air Transport Association
ID	identification
IDN	initial distribution number
IED	improvised explosive device
IFAS	Initial Field Account Survey
IPB	intelligence preparation of the battlespace
IPE	individual protective equipment
IPOE	intelligence preparation of the operational environment
IR	information requirement
IRS	Incident Report Survey
ISR	intelligence, surveillance, and reconnaissance
JP	joint publication
LEL	lower explosive limit
LOA	limits of advance
LOR	limits of reconnaissance
LOS	line of sight
LRN	Labatory Response Network
LTIOV	latest time information is of value
LZ	landing zone
MCDP	Marine Corps doctrine publication
MCPP	Marine Corps planning process
MCRP	Marine Corps reference publication
MCWP	Marine Corps warfighting publication
MDMP	military decisionmaking process

METT-T	mission, enemy, terrain and weather, troops and support available—time available
METT-TC	mission, enemy, terrain and weather, troops and support available-time available and civil considerations (Army)
MIL STD	military standard
MMA	military mission area
MOP	measures of performance
MOPP	mission-oriented protective posture
MTTP	military tactics, techniques, and procedures
MSR	main supply route
NAI	named area of interest
NARP	Nuclear Weapon Accident Response Procedures
NATO	North Atlantic Treaty Organization
NAVSUP	Navy supplement
NBC	nuclear, biological, and chemical
NDP	Navy doctrine publication
NTRP	Navy tactical reference publication
NTTP	Navy tactics, techniques, and procedures
NWP	Navy warfare publication
OEG	operational exposure guide
OEH	occupational and environmental health
OP	observation post
OPLAN	operation plan
OPNAVINST	Chief of Naval Operations instruction
OPORD	operation order
PCC	precombat check
PCI	precombat inspection
PIR	priority intelligence requirement
PMCS	preventive maintenance checks and services
PMS	planned maintenance system (Navy)
PPE	personal protective equipment
PVNTMED	preventive medicine
QA	quality assurance
QC	quality control
R&S	reconnaissance and surveillance
RDD	radiological dispersal device
RADIAC	radiation detection, indication and computation
RFI	request for information
RME	rapid medical evaluation
ROE	rules of engagement
SA	situational awarness
SALUTE	size, activity, location, unit, time, and equipment

SCBA	self-contained breathing apparatus
SIGACT	significant activity
SIR	specific information requirement
SME	subject matter expert
SOP	standard operating procedure
SPOD	seaport of debarkation
STANAG	standardization agreement (NATO)
TAI	target area of interest
TBM	theater ballistic missles
TE	technical escort
TG	technical guide
TIB	toxic industrial biological
TIC	toxic industrial chemical
TIM	toxic industrial material
TLP	troop leading procedures
TOC	tactical operations center
TTP	tactics, techniques, and procedures
UAS	unmanned aircraft system
UEL	upper explosive limit
UGV	unmanned ground vehicle
USA	U.S. Army
USAF	U.S. Air Force
USMC	U.S. Marine Corps
USN	U.S. Navy
UXO	unexploded explosive ordnance
VA	Virginia
VOC	volatile organic compound
VX	O-Ethyl S-Diisopropylaminomethyl
WARNORD	warning order
WMD	weapons of mass destruction

SECTION II – TERMS

***chemical, biological, radiological, or nuclear sample management**

Chemical, biological, radiological, and nuclear (CBRN) sample management is the process whereby CBRN samples are collected, packaged, transported, stored, transferred, analyzed, tracked, and disposed. It begins with the decision to collect CBRN samples and continues to the reporting of information produced by the final analysis of that sample. This process includes safeguarding and prioritizing CBRN samples, tracking their movements and analytical status, and reporting the end result of sample analysis. The CBRN sample management process establishes procedures, guidelines, and constraints at staff and unit levels to protect and preserve the integrity of CBRN samples that may have tactical, operational, and/or strategic implications.

***definitive identification**

The employment of multiple state-of-the-art, independent, established protocols and technologies by scientific experts in a nationally recognized laboratory to determine the unambiguous identity of a chemical, biological, radiological, and/or nuclear hazard with the highest level of confidence and degree of certainty necessary to support strategic-level decisions.

***field confirmatory identification**

The employment of technologies with increased specificity and sensitivity by technical forces in a field environment to identify chemical, biological, radiological, and/or nuclear hazards with a moderate level of confidence and the degree of certainty necessary to support follow-on tactical decisions.

***presumptive identification**

The employment of technologies with limited specificity and sensitivity by general-purpose forces in a field environment to determine the presence of a chemical, biological, radiological, and/or nuclear hazard with a low level of confidence and the degree of certainty necessary to support immediate tactical decisions.

***theater validation identification**

The employment of multiple independent, established protocols and technologies by scientific experts in the controlled environment of a fixed or mobile/transportable laboratory to characterize a chemical, biological, radiological, and/or nuclear hazard with a high level of confidence and the degree of certainty necessary to support operational-level decisions.

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