Joint Publication 3-11

# Operations in Chemical, Biological, Radiological, and Nuclear Environments

29 October 2018

# PREFACE

## 1. Scope

This publication provides doctrine for planning, conducting, and assessing military operations in chemical, biological, radiological, and nuclear environments.

## 2. Purpose

This publication has been prepared under the direction of the Chairman of the Joint Chiefs of Staff (CJCS). It sets forth joint doctrine to govern the activities and performance of the Armed Forces of the United States in joint operations, and it provides considerations for military interaction with governmental and nongovernmental agencies, multinational forces, and other interorganizational partners. It provides military guidance for the exercise of authority by combatant commanders and other joint force commanders (JFCs), and prescribes joint doctrine for operations and training. It provides military guidance for use by the Armed Forces in preparing and executing their plans and orders. It is not the intent of this publication to restrict the authority of the JFC from organizing the force and executing the mission in a manner the JFC deems most appropriate to ensure unity of effort in the accomplishment of objectives.

## 3. Application

a. Joint doctrine established in this publication applies to the Joint Staff, commanders of combatant commands, subordinate unified commands, joint task forces, subordinate components of these commands, the Services, and combat support agencies.

b. The guidance in this publication is authoritative; as such, this doctrine will be followed except when, in the judgment of the commander, exceptional circumstances dictate otherwise. If conflicts arise between the contents of this publication and the contents of Service publications, this publication will take precedence unless the CJCS, normally in coordination with the other members of the Joint Chiefs of Staff, has provided more current and specific guidance. Commanders of forces operating as part of a multinational (alliance or coalition) military command should follow multinational doctrine and procedures ratified by the United States. For doctrine and procedures not ratified by the US, commanders should evaluate and follow the multinational command's doctrine and procedures, where applicable and consistent with US law, regulations, and doctrine.

For the Chairman of the Joint Chiefs of Staff:

DANIEL J. O'DONOHUE
Lieutenant General, USMC
Director, Joint Force Development

# SUMMARY OF CHANGES
## REVISION OF JOINT PUBLICATION 3-11
## DATED 04 OCTOBER 2013

- **Synchronizes and updates language in Joint Publication (JP) 3-11, *Operations in Chemical, Biological, Radiological, and Nuclear Environments,* with JP 3-40, *Countering Weapons of Mass Destruction,* and JP 3-41, *Chemical, Biological, Radiological, and Nuclear Response.***

- **Recognizes the proponent change for global countering weapons of mass destruction operations responsibility from United States Strategic Command to United States Special Operations Command.**

- **Removes the "Prepare, Prevent, Protect, Respond, and Recover" model.**

- **Synchronizes planning discussion with JP 5-0, *Joint Planning*.**

- **Updates discussion on logistics and sustainment execution in chemical, biological, radiological, and nuclear (CBRN) environments.**

- **Adds discussion of CBRN operations proximate to and effects of intentional or unintentional release of hazards in urban environments.**

- **Adds discussion on information function as it relates to operations in CBRN environments.**

- **Updates toxic industrial materials and radiological hazard considerations.**

- **Adds classified appendix for nontraditional agents.**

- **Adds, revises, or deletes numerous definitions.**

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# EXECUTIVE SUMMARY
## COMMANDER'S OVERVIEW

- **Presents the fundamentals of planning, conducting, and assessing military operations in chemical, biological, radiological, and nuclear environments.**

- **Discusses strategic and operational planning to conduct prompt, sustained, and decisive military operations in chemical, biological, radiological, and nuclear environments.**

- **Outlines the role of hazard awareness and understanding and situational awareness in the execution of military operations in chemical, biological, radiological, and nuclear environments.**

- **Describes how a staff should monitor and evaluate the aspects of the chemical, biological, radiological, and nuclear environment as part of the assessment process.**

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### Fundamentals

This publication describes the chemical, biological, radiological, and nuclear (CBRN) environment in a strategic context; provides necessary strategic and operational considerations; and describes CBRN defense activities and tasks applicable to joint operations.

The CBRN environment includes CBRN threats and hazards present and their potential effects on operations. These effects can be created through the intentional or unintentional release of CBRN materials in the operational environment (OE). Operations in CBRN environments are conducted using specific policies and procedures to minimize or negate CBRN threats and hazards. Such operations may require the employment of strategic and operational capabilities.

CBRN hazards are CBRN materials that could create adverse effects if released or disseminated accidentally, deliberately, or even naturally.

A CBRN incident is any occurrence involving the emergence of CBRN hazards resulting from the use of CBRN weapons or devices; the emergence of secondary hazards due to counterforce targeting or other friendly force action; or any other occurrence that causes the release of toxic industrial biologicals, toxic industrial chemicals, or toxic industrial radiologicals into the OE.

CBRN defense refers to the employment of capabilities that counter the entire range of CBRN hazards.

***National Strategy***

The Department of Defense (DOD) approach to countering weapons of mass destruction (WMD) is guided by the desired end states (no new WMD possession, no WMD use, and minimization of WMD effects) and directly supports the priority objectives (reduce incentives to pursue, possess, and employ WMD; increase barriers to the acquisition, proliferation, and use of WMD; manage WMD risks emanating from hostile, fragile, or failed states and safe havens; and deny the effects of current and emerging WMD threats through layered, integrated defenses).

***Strategic Context***

The worldwide availability of advanced military and commercial technologies and information (including dual-use and emerging nontraditional threats), combined with commonly available transportation and delivery means, may allow adversaries opportunities to acquire, develop, and employ WMD or create a CBRN environment without regard for national or regional boundaries. Such situations could also expose US military operations to CBRN threats and hazards.

***Operational Context***

With the exception of a number of allies, many of whom are charter members of the North Atlantic Treaty Organization, most of our multinational partners have limited capability to operate in a CBRN environment. While the adversaries in those operational areas may not possess WMD or other CBRN materials, other forms of CBRN hazards may be present that could result in CBRN environments, if released. US forces must be trained and fully capable of operating in those CBRN environments to accomplish all assigned missions.

***Relation to the Joint Functions***

Joint functions refer to related capabilities and activities organized into seven groups—command and control, intelligence, fires, movement and maneuver, protection, sustainment, and information—to help joint force commanders (JFCs) synchronize, integrate, and direct joint operations. Each of these joint functions may be affected when conducting operations in an area where CBRN threats or hazards are present.

## Planning

Combatant commanders (CCDRs) consider potential adversary CBRN capabilities when developing their campaign plans or contingency plans. CCDRs map WMD and CBRN hazard sources; establish target folders; and plan for plausible, intentional, or unintentional releases of toxic industrial materials.

***Understanding the Chemical, Biological, Radiological, and Nuclear Operational Environment***

The actual or threatened employment of WMD or CBRN weapons can affect friendly forces by causing them to prepare for or conduct CBRN defense activities, contamination mitigation, and, if directed, CBRN response operations. The use or threat of use of WMD may also disrupt contractor and host-nation support. Intelligence planners collaborate with all-source analysts to produce tailored joint intelligence preparation of the OE products to support the JFC's planning and operations efforts by assessing the potential for deliberate or accidental release of CBRN materials or employment of WMD and characterizing the enemy intent of actual or anticipated WMD-related activities.

***Strategic and Operational Planning***

**Strategic-Level Planning.** Factors that impact the combatant command's strategic-level CBRN planning include treaties; international law, customs, and practices; DOD policies; existing agreements/arrangements with host nations en route to and within the operational area; and the use of propaganda to influence US public and world opinion. Political factors, sociocultural factors, and economic characteristics of the OE assume increased importance for deterrence at the strategic level.

**Operational-Level Planning.** The use of threat assessments, capability assessments, and vulnerability assessments during the development of operational-level plans provides the commander and staff with shared understanding of the effects that may be created by CBRN incidents within the OE.

***Planning Considerations***

Focused JFC staff planning related to conducting operations in CBRN environments includes the following:

- Establish cooperative policies, procedures, and networks for the joint force and host nation and with other friendly forces to operate in a CBRN environment.
- Recognize the most likely CBRN threats and hazards from updated enemy tactics, capabilities, intentions, and the environment.
- Conduct assessments (threat, vulnerability, previous-incident/past-use, impact, hazard prediction modeling).
- Provide recommendations for the critical asset list and defended asset list.
- Coordinate unit protection measures, especially individual protective equipment (IPE), troop safety criteria, operational exposure guidance, automatic masking criteria, bypass criteria, collective protection equipment, and decontamination equipment and procedures.
- Determine CBRN defense training and readiness requirements.
- Establish the appropriate recovery and mitigation actions to match the threat, hazards, and locations.
- Coordinate logistics activities, personnel services support, health services (including vaccinations and medical countermeasures), and reconstitution efforts.
- Coordinate CBRN health surveillance activities (including biosurveillance) through the applicable command surgeon channel.
- Coordinate and integrate the CBRN defense actions of other interagency and multinational partners and the host nation into the plan.
- Synchronize the policies, people, and processes for expedited collection, transport, and analysis of medical specimens and environmental samples from CBRN incidents.
- Provide commanders' guidance for forces and facilities to ensure they are prepared to operate in CBRN environments.

***Preparation Considerations***

During preparation, the focus is on deterring and preventing threats from taking actions that affect combat power. Since the force is most often vulnerable to surprise and attack during preparation, the implementation of hazard awareness and understanding activities, protection of critical assets, and contamination mitigation measures with ongoing preparation activities assists in the prevention of negative effects.

***Sustainment Considerations***

For operations in a CBRN environment, unique sustainment considerations should include:

- Coordinating the resupply of CBRN defense and monitoring equipment. Some CBRN-related equipment is often commercial off-the-shelf items that may need special consideration for maintenance and replacement.
- Maintaining force health protection measures.
- Conducting contamination mitigation.
- Coordinating health services, medical readiness, mass casualty management, and mortuary affairs.

## Execution

During execution in a CBRN environment, the staff assesses how CBRN threats, hazards, and incidents have affected operations.

Assessment recommendations concerning the impact of CBRN environments on joint operations help commanders adjust operations and the application of resources, determine when to develop and execute appropriate branches and sequels, and ensure current and future operations remain aligned with the mission and military end state. Execution continues until the mission is accomplished and/or termination criteria have been met.

***Hazard Awareness and Understanding and Situational Awareness***

The information concerning the causes of CBRN incidents and environments (hazard awareness) have to be properly processed, managed, and shared to create the necessary shared understanding (hazard understanding) that results in the wisdom essential to sound decision making. Sharing of CBRN hazard awareness and hazard understanding may be accomplished through antiterrorism or force protection or by establishing CBRN working groups.

***Protection***

Throughout the operation or campaign, the JFC employs active defense measures, such as air and missile defense and physical security, to defend against conventionally and asymmetrically delivered WMD. These capabilities deny an adversary the benefit to the use of CBRN threats and can influence their decision to employ them.

The JFC employs CBRN defense capabilities (e.g., integration of IPE and other equipment to protect against WMD and CBRN or demonstrating to an adversary that personnel are trained) to reduce or negate vulnerabilities and minimize the effects of CBRN contamination.

***Contamination Mitigation***

As part of execution, contamination mitigation enables joint forces to sustain operations in a contaminated environment without prolonged interruption of operational tempo. It also enables the quick restoration of essential capabilities or combat power required to accomplish the current mission and achieve operational objectives.

***Sustainment Considerations***

Operations will slow as tasks are performed by personnel encumbered by protective equipment or exposed to CBRN environments which may require abandonment or limited use of contaminated areas, transfer of missions to uncontaminated forces, or avoidance of contaminated terrain and routes.

## Operational Assessment

Assessment of operations conducted in CBRN environments will increase the quantity and nature of variables that must be considered and analyzed to provide commanders with the most viable courses of action.

***Operation Assessment Process***

The assessment process is directly tied to the commander's decision cycle throughout planning, preparation, and execution of operations. It entails three distinct tasks: continuously monitoring the situation and the progress of the operations; evaluating the operation against measures of effectiveness and measures of performance to determine progress relative to the mission, objectives, and end states; and developing recommendations and/or guidance for improvement.

The staff should monitor and evaluate the following aspects of the CBRN environment as part of the assessment process:

- Changes to CBRN threats and hazards.
- Changes in CBRN force vulnerabilities.

- Changes to unit capabilities.
- Validity of assumptions as they pertain to CBRN defense.
- Staff and commander estimates.
- CBRN environments and their conditions and changes.
- CBRN resource allocations.
- Increased risks.
- Supporting efforts.

## CONCLUSION

This publication provides doctrine for planning, conducting, and assessing military operations in chemical, biological, radiological, and nuclear environments.

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# CHAPTER I
## FUNDAMENTALS

> *"Chemical weapons continue to pose a threat in Syria and Iraq. Damascus [government of Syria] has used chemicals against the opposition on multiple occasions since Syria joined the Chemical Weapons Convention. ISIL [Islamic State of Iraq and the Levant] has also used toxic chemicals in Iraq and Syria, including the blister agent sulfur mustard—the first time an extremist group has produced and used a chemical warfare agent in an attack since Aum Shinrikyo used sarin in Japan in 1995."*
>
> **James R. Clapper**
> **Director of National Intelligence**
> **Senate Armed Services Committee Hearing**
> **February 9, 2016**

### 1. General

a. Hostile state and non-state actors, including terrorists and their affiliates, who possess or are seeking to acquire weapons of mass destruction (WMD), may pose a threat to the US and its allies. The intent, capability, or actual employment of chemical, biological, radiological, and nuclear (CBRN) materials, including toxic industrial materials (TIMs), and nontraditional agents (NTAs) can seriously challenge US military operations. Further, the loss of control or theft of CBRN materials, TIMs, NTAs, and other WMD in theater constitutes a significant threat to the joint force, as can naturally occurring phenomena such as pandemic influenza and infectious disease. The deadly, destructive, and disruptive effects of these weapons, materials, and phenomena merit continuous consideration by the joint force commander (JFC) and supporting commanders. The US military trains for and remains prepared to conduct the range of military operations throughout the operational environment (OE).

b. This publication focuses on maintaining the joint force's ability to conduct operations in a CBRN environment. It describes the CBRN environment in a strategic context, provides necessary strategic and operational considerations, and describes CBRN defense activities and tasks applicable to joint operations. The strategic environment consists of a variety of national, international, and global factors that affect the decisions of senior civilian and military leaders with respect to the employment of US instruments of national power. Although the basic nature of war has not changed, the character of war has evolved. The OE and the threats it presents are increasingly transregional, multi-domain, and multifunctional in nature. The crises and contingencies joint forces face today cut across multiple combatant commands (CCMDs); cut across land, sea, air, space, and cyberspace; and involve conventional and unconventional capabilities. The OE is influenced by the strategic environment. Decision making is informed by the *Department of Defense Strategy for Countering Weapons of Mass Destruction* and works in concert with Joint Publication (JP) 3-40, *Countering Weapons of Mass Destruction,* and JP 3-41, *Chemical, Biological, Radiological, and Nuclear Response*.

c. The CBRN environment includes CBRN threats and hazards present and their potential effects on operations. These effects can be created through the intentional or unintentional release of CBRN materials in the OE. Operations in CBRN environments are conducted using specific policies and procedures to minimize or negate CBRN threats and hazards. Such operations may require the employment of strategic and operational capabilities. Those that occur in the US are likely carried out under different laws and authorities and using different doctrine and partners than similar operations conducted outside the US. Enemy information operations may seek to cause or enhance the impact of CBRN incidents by spreading misinformation or panic, especially in an urban environment. For operations in a CBRN environment in the homeland, see JP 3-27, *Homeland Defense;* JP 3-28, *Defense Support of Civil Authorities;* and JP 3-41, *Chemical, Biological, Radiological, and Nuclear Response.*

(1) CBRN hazards are CBRN materials that could create adverse effects if released or disseminated accidentally, deliberately, or even naturally. They include TIMs (including toxic industrial chemicals [TICs], toxic industrial biologicals [TIBs], and toxic industrial radiologicals [TIRs]), chemical and biological agents, biological pathogens that result in the spread of infectious disease and radioactive material, and those hazards resulting from the employment of WMD or encountered by the Armed Forces of the United States or multinational forces during military operations.

(a) Chemical hazards include any toxic chemical manufactured, used, transported, or stored which can cause death or other harm through exposure. This includes chemical weapon agents and chemicals developed or manufactured for use in industrial operations or research that pose a hazard, collectively characterized as TIC.

(b) Biological hazards include any organism, or substance derived from an organism, that poses a threat to the health of any living organism. Biological hazards are a threat to conducting military operations. This can include medical waste, samples of a microorganism, virus, or toxin (from a biological source) that can impact human health and spread infectious disease. Biological material that is manufactured, used, transported, or stored by industrial, medical, or commercial processes, which could pose an infectious or toxic threat, are collectively characterized as TIB.

(c) Radiological hazards include ionizing radiation that can cause damage, injury, or destruction from either external irradiation or radiation from radioactive materials within the body. Radiological material that is manufactured, used, transported, or stored by industrial, medical, or commercial processes are collectively characterized as TIR.

(d) Nuclear hazards are those dangers associated with the overpressure, thermal, and radiation effects from a nuclear explosion. Nuclear hazards come from the employment of nuclear weapons and devices that can generate radiation; low-altitude, nuclear air-burst shock waves; severe winds; electromagnetic pulse (EMP); and intense heat that can cause casualties and damage through burning, crushing, bending, tumbling, breaking, penetrating debris, and residual radiation in the form of fallout.

(2) A CBRN incident is any occurrence involving the emergence of CBRN hazards resulting from the use of CBRN weapons or devices; the emergence of secondary hazards due to counterforce targeting or other friendly force action; or any other occurrence that causes the release of TIB, TIC, or TIR into the OE.

(3) CBRN defense refers to the employment of capabilities that counter the entire range of CBRN hazards. CBRN defense reduces the vulnerability of the force to and mitigates the effects of CBRN incidents and helps to maintain the joint force's ability to continue military operations in a CBRN environment.

*For further information on operations in a CBRN environment, see Field Manual (FM) 3-11/Marine Corps Reference Publication (MCRP) 10-10E.3(Marine Corps Warfighting Publication [MCWP] 3-37.1)/Navy Warfare Publication (NWP) 3-11/Air Force Tactics, Techniques, and Procedures (AFTTP) 3-2.42,* Multi-Service Doctrine for Chemical, Biological, Radiological, and Nuclear Operations.

## 2. National Strategy

a. The *National Security Strategy* (NSS) states, "No threat poses as great a danger to our security and well-being as the potential use of nuclear weapons and materials by irresponsible states or terrorists." Keeping nuclear materials from terrorists and preventing the development, proliferation, or use of WMD remains a high priority in securing US strategic objectives. As stated in the NSS, "Vigilance is required to stop countries and non-state actors from developing or acquiring nuclear, chemical, or biological weapons, or the materials to build them." The NSS also highlights nonproliferation concerns and examination of the *Treaty on the Non-Proliferation of Nuclear Weapons* (more commonly known as the *Nuclear Nonproliferation Treaty*) and special emphasis on stemming the spread of materials necessary to develop WMD.

b. The Department of Defense (DOD) approach to countering weapons of mass destruction (CWMD) is guided by the desired end states (no new WMD possession, no WMD use, and minimization of WMD effects) and directly supports the priority objectives (reduce incentives to pursue, possess, and employ WMD; increase barriers to the acquisition, proliferation, and use of WMD; manage WMD risks emanating from hostile, fragile, or failed states and safe havens; and deny the effects of current and emerging WMD threats through layered, integrated defenses). These objectives are advanced through three CWMD lines of effort: **prevent acquisition, contain and reduce threats, and respond to crises.** These lines are supported by one strategic enabler: **prepare.** Taken together, these four elements comprise DOD's approach and represent the full range of CWMD efforts undertaken by DOD. At any given time, DOD and its interorganizational partners will pursue multiple efforts against a broad set of actors seeking to develop, acquire, proliferate, and employ WMD.

c. Where proliferation or indigenous CBRN weapon development (including WMD) has occurred, the principle US national objective is to deter an enemy's employment of CBRN weapons. To support deterrence, US forces should be prepared to operate effectively in CBRN environments. Should deterrence fail, US forces need to mitigate the effects of a WMD attack or other CBRN weapons' employment. Success in these activities depends on accurate and complete CBRN risk assessments and mitigations, to include assessments that address adversary capabilities that may be used against US forces. Security cooperation activities can help shape the OE to dissuade or deter WMD or CBRN use. If deterrence fails, US forces may be called upon to conduct operations to neutralize CBRN threats or hazards.

*See JP 3-40,* Countering Weapons of Mass Destruction, *for more information on the various strategic measures available to the US to neutralize an adversary's ability to employ WMD.*

*See JP 3-41,* Chemical, Biological, Radiological, and Nuclear Response, *for more information on the US military response to reduce the effects of a CBRN incident.*

*For chemical, biological, radiological, nuclear, and high-yield explosives (CBRNE)-specific guidance and standards for DOD installations worldwide to use when preventing, protecting against, mitigating, responding to, and recovering from CBRNE incidents, see Department of Defense Instruction (DODI) 3020.52,* DOD Installation Chemical, Biological, Radiological, Nuclear, and High-Yield Explosive (CBRNE) Preparedness Standards.

## 3. Strategic Context

a. A variety of crises and conflicts challenge US interests. They include disputes and hostilities within nation-states (e.g., insurgencies and civil wars); quasi-states; failed states; and between and among nation-states, coalitions of nation-states, and transnational terrorists. Other crises could arise from epidemic or pandemic disease outbreaks that exceed the capabilities of a host nation (HN). These situations may threaten regional and global stability and may involve the territory and populations of the US, its allies, multinational partners, other friendly countries, and a range of other US interests.

b. The worldwide availability of advanced military and commercial technologies and information (including dual-use and emerging nontraditional threats), combined with commonly available transportation and delivery means, may allow adversaries opportunities to acquire, develop, and employ WMD or create a CBRN environment without regard for national or regional boundaries. Such situations could also expose US military operations to CBRN threats and hazards.

c. When their core interest or power bases are threatened, nation-states may choose to disregard international protocols, agreements, and treaties. In some cases, nation-states may be willing to acquire WMD or CBRN material, despite being signatories or parties to international agreements and treaties forbidding such actions. Transnational terrorists do not consider themselves bound by such agreements and treaties. A continuously evolving, asymmetric threat presents a variety of operational options for disrupting US forces by threatening attack using CBRN capabilities. In an effort to circumvent defensive capabilities, several adversaries have the potential to use the expanding knowledge of chemical warfare and biological warfare or the global proliferation of relatively low-cost advanced technologies to develop new CBRN capabilities. US and friendly forces could be exposed to CBRN hazards anywhere in the operational area and at any phase of conflict, even during peacekeeping or stability and support activities. Friendly force exposure to CBRN effects could occur from an attack with WMD or from releases of CBRN elements due to accident or from attacks on infrastructure, including urbanized industrial areas. DOD continually develops new CBRN defense capabilities to address the complexities of the strategic context in which US forces perform missions in CBRN environments.

## 4. Operational Context

a. The combatant commanders (CCDRs) support United States Government (USG) efforts to cooperate with and support partners as part of CWMD activities. However, this cooperation and support does not necessarily guarantee a capacity for friendly forces to operate in a CBRN environment. With the exception of a number of allies, many of whom are charter members of the North Atlantic Treaty Organization (NATO), most of our multinational partners have limited capability to operate in a CBRN environment. While the adversaries in those operational areas may not possess WMD or other CBRN materials, other forms of CBRN hazards may be present that could result in CBRN environments, if released. US forces must be trained and fully capable of operating in those CBRN environments to accomplish all assigned missions.

b. Even if an adversary does not intend to employ WMD or use CBRN material to create a hazardous environment, the existence of CBRN threats and hazards in any operational area creates potential risks. In addition to optimal intelligence of the CBRN threats, the existence of CBRN hazards in the form of TIMs or infectious diseases must also be considered in each OE. CBRN hazards may be used for antiaccess and area denial activities against US installations and facilities, ports of embarkation and debarkation, and the lines of communication between the US and its forces deployed to an HN. Finally, a third party may use, on behalf of, or supply CBRN weapons to an adversary.

c. Military support to emergency preparedness (EP) consists of active measures taken prior to an incident to reduce the loss of life and property and to protect a nation's institutions from all types of hazards. JFCs support EP in a CBRN environment through development of a response plan, participation in joint and multinational exercises, and training of HN personnel and units on CBRN tasks. When suitable, CBRN forces are partnered with like HN capabilities to maximize the value of their specific expertise, to familiarize all forces with the capabilities and strengths of their counterparts, and to assist in preparing for an incident.

d. Clearly established supporting and supported command relationships provide clarity of military authorities and facilitate effective interaction with interagency partners. These clearly established relationships are required to reduce vulnerability and minimize the effects of CBRN threats employed against key allied, HN, and US forces, installations, and facilities.

e. Operating in a CBRN environment can impact freedom of movement and the preservation of combat power. Because of the potentially devastating consequences of CBRN hazards from intentional or unintentional release, measures are planned, prepared, executed, and assessed to enable forces to continue effective operations in a CBRN environment, as well as protect and mitigate the effects of CBRN hazards on military and nonmilitary personnel, equipment, and infrastructure.

## 5. Relation to the Joint Functions

Joint functions refer to related capabilities and activities organized into seven groups—command and control (C2), intelligence, fires, movement and maneuver, protection, sustainment, and information—to help JFCs synchronize, integrate, and direct joint operations. Each of these joint functions may be affected when conducting operations in an area where CBRN threats or hazards are present.

a. **C2.** C2 encompasses the exercise of authority and direction by a commander over assigned and attached forces to accomplish the mission. It includes those tasks and systems associated with understanding friendly CBRN defense capabilities and information systems, managing relevant information, and directing and leading subordinates in CBRN environments. The joint force should have CBRN staff organizations and units that can characterize the CBRN hazard; develop a clear understanding of the current and anticipated CBRN situations; and collect and assimilate information from intelligence, health, and specific CBRN reconnaissance and surveillance sources in near real time. The CBRN staff assesses and provides warning and reporting and predictions on potential effects that may be created by CBRN threats and hazards. This information can help the JFC identify those critical CBRN-related objectives and an end state so the JFC may visualize the sequence of events in a course of action (COA) that moves the force from its current state to the envisioned end state. Operations in these environments will demand the integration of CBRN warning and reporting systems with homeland defense or emergency management systems to provide real-time warning and specific directions for action.

*For additional information on the C2 function, see JP 3-0,* Joint Operations, *and Army Techniques Publication (ATP) 3-11.36/MCRP 10-10E.1(MCRP 3-37B)/Navy Tactics, Techniques, and Procedures (NTTP) 3-11.34/Air Force Tactics, Techniques, and Procedures (Instruction) (AFTTP[I]) 3-20.70,* Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Aspects of Command and Control.

b. **Intelligence.** The CBRN staff collaborates with the JFC’s intelligence staff to establish CBRN intelligence requirements and support the identification of CBRN threats and hazards. The intelligence sought addresses the commander’s priority intelligence requirements (PIRs) concerning the threat’s ability to use CBRN weapons (to include environmental factors and potential effects). Intelligence provides the JFC and staff significant details such as determination and evaluation of enemy intentions, capabilities, types of agents, cover and deception methods, sensors, protective posture, line of sight influences on direct fire, and friendly vulnerabilities to enemy strengths. Information collected using CBRN reconnaissance and surveillance assets assists in validating the intelligence used in the joint intelligence preparation of the operational environment (JIPOE) process. The use of joint force intelligence assets in support of CBRN response operations in a domestic environment for non-intelligence purposes is called incident awareness and assessment (IAA). IAA is essential for shared situational awareness among interagency partners and federal, state, and local responders and is the keystone to ensure a timely, coordinated, and effective CBRN response. Any use of joint force intelligence assets in support of CBRN response operations, whether for intelligence purposes or IAA, must be in accordance with DOD policy.

*See JP 2-0,* Joint Intelligence, *and JP 2-01.3,* Joint Intelligence Preparation of the Operational Environment, *for additional information on intelligence aspects within a CBRN environment.*

*See Department of Defense Directive (DODD) 5240.01,* DOD Intelligence Activities; *DODD 3025.18,* Defense Support of Civil Authorities (DSCA); *Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3125.01,* Defense Response to Chemical, Biological, Radiological, and Nuclear (CBRN) Incidents in the Homeland; *and JP 3-28,* Defense Support of Civil Authorities, *for guidance on IAA.*

c. **Fires.** The role of fires in targeting CBRN threats includes the consideration and employment of all means to minimize, if not prevent, potential collateral effects (e.g., CBRN incidents, conflict escalation, damaged infrastructure, and civilian deaths). When operations are required in a CBRN environment, the JFC, component commanders, and unit commanders should determine the fires and maneuvers necessary to counter WMD threats and avoid CBRN hazards that could affect timely achievement of the JFC's objectives. Effects of fires must be observable and measurable to support the battle damage assessment and operational assessment processes. CBRN threats and significant indigenous CBRN hazards are identified and considered during the JIPOE and targeting processes. Pertinent information collected by the units for each target is maintained in the target folder for use in a future response. Consideration of potential collateral damage from attack on a CBRN facility must be factored into planning. Detailed weather, terrain, and population information must be assimilated and collateral effects mitigated to the extent possible.

*See JP 3-09,* Joint Fire Support, *and JP 3-60,* Joint Targeting, *for additional information on fires and targeting.*

d. **Movement and Maneuver.** Accomplishing movement and maneuver in a CBRN environment can be more difficult, and in some situations, the JFC or unit commanders may direct movement and maneuver to avoid CBRN-contaminated areas. Preserving combat power from the effects of CBRN incidents is essential for commanders to seize, retain, and exploit the initiative. Maintaining movement control, keeping lines of communication open, managing reception and transshipment points, and obtaining HN support are critical to CBRN defense and continuing operations in a CBRN environment.

*See JP 3-0,* Joint Operations, *for additional information on movement and maneuver.*

e. **Protection.** The purpose for implementing CBRN defense measures is to provide the best possible protection against CBRN threats and hazards, to improve survivability by avoiding contamination, to continue the mission, and to reestablish the readiness of forces. Force health protection measures include those measures to protect the force from CBRN and other health hazards.

(1) JFCs rely on strategic guidance and use all available means, including those of interagency and multinational partners, to identify and analyze CBRN threats and hazards; plan to prevent and protect against CBRN threats, hazards, and their effects; and properly react to the effects of the release of CBRN hazards. Layered and integrated CBRN defensive measures should help reduce the effectiveness of WMD or other CBRN material's intentional or unintentional release. Protection encompasses measures to defend against WMD by minimizing the vulnerability of the force to, and mitigating the effects of, CBRN incidents and maintaining the joint force's ability to continue military operations in a CBRN environment. Success depends on the effective use of unit and individual protective equipment; CBRN defense training; and proven protective tactics, techniques, and procedures (TTP). Therefore, it is imperative all commanders consider the CBRN threats and hazards and, if necessary, integrate CBRN defense into their mission planning, preparation, execution, and assessments, regardless of the mission type.

(2) CBRN defense is improved when working in conjunction with multinational partners and the HN, to include civil ministries. However, while many multinational partners and HN forces maintain some capability, very few maintain capacities sufficient for CBRN defense, despite regional adversaries with some form of WMD; local CBRN hazards due to significant quantities of TIMs; or the prevalence of infectious diseases and the inability to manage, control, and contain their outbreak. Providing CBRN defense and timely warnings of CBRN hazards and being prepared to react to a CBRN incident are key to preserving the joint force's fighting potential. Protection relies on intelligence and C2 for indications of CBRN threats and incidents, which may be a challenge in multinational operations due to information sharing and complex command and organizational relationships.

*See JP 3-0,* Joint Operations, *and Chapter III, "Execution," for additional information on protection and aspects within a CBRN environment.*

f. **Sustainment.** Sustainment planning during all phases of an operation, to include predeployment and redeployment planning, must include operations in a CBRN environment due to the challenges inherent in normal sustainment activities, as well as sustaining CBRN defense resources. The ability of sustainment planners to assess the potential effects of CBRN hazards and environments on their mission is a critical factor in deciding priorities for CBRN defense and efficiently allocating and moving resources, including medical support. Normal logistics activities are adversely affected when supplies and lines of communications become contaminated. The requirement for protective equipment and resources further burdens the supply system and use of logistics assets. The

CBRN environment will have a significant impact on site selection for logistics bases and the need for transshipment points and dramatically increase the use of water for human consumption and decontamination.

*See JP 4-0,* Joint Logistics, *and JP 4-02,* Joint Health Services, *for additional information on sustainment aspects within a CBRN environment.*

g. **Information.** The information function provides JFCs the ability to integrate the generation and preservation of friendly information while leveraging the inherent informational aspects of all military activities to achieve the commander's objectives and attain the end state. Information planning during all phases of an operation must include operations in a CBRN environment due to the challenges inherent in normal information planning, as well as deliberate integration with other joint functions. Potential effects of CBRN hazards and environments remain a critical factor in deciding priorities for information activities. Normal information activities are adversely affected when operating in a CBRN environment. The requirement for protecting information resources remains a key component in operating in a degraded mode while in a CBRN environment.

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# CHAPTER II
## PLANNING

### 1. General

a. US forces should be prepared to conduct prompt, sustained, and decisive military operations in CBRN environments. An enemy's use of WMD or CBRN weapons or any intentional or unintentional release of CBRN hazardous material can create effects that disrupt or delay operations to achieve US and multinational objectives. The planning, preparation, and sustainment considerations contained in this chapter will assist JFCs and subordinate and supporting commanders with planning and preparation for military operations in a CBRN environment.

b. CCDRs consider potential adversary CBRN capabilities when developing their campaign plans or contingency plans. CCDRs map WMD and CBRN hazard sources; establish target folders; and plan for plausible, intentional, or unintentional releases of TIMs. This is critical, as their concentration could cause a CBRN environment detrimental to friendly forces movement and maneuver, especially in urban industrial areas. Campaign and supporting plans must include options for generating adequate and timely force capabilities in the event of early enemy CBRN employment in the supported area of responsibility (AOR) or other/supporting areas, to include the US. CCDRs establish PIRs and indicators to observe and collect information on an enemy's use, or impending use, of WMD or other CBRN threats; to minimize opportunities for them to create a CBRN environment; and to enable planning and actions to mitigate the effects of a CBRN incident.

**WEAPONS OF MASS DESTRUCTION IN OPERATION IRAQI FREEDOM**

**While it's true no plan lasts past the first contact with the enemy, the process of planning helps ensure you are as prepared for that first encounter as possible. The perceived threat from Iraq's weapons of mass destruction (WMD) was a key consideration when Operation IRAQI FREEDOM (OIF) commenced 20 March 2003. After the 1991 Persian Gulf War, both the United States and the United Kingdom asserted that Iraq still possessed large stockpiles of WMD and was clandestinely procuring and producing more.**

**The assumption that a WMD capability was available to the Iraqi forces was a key concern of military planners during OIF. Consequently, coalition forces conducted extensive tactical training in chemical, biological, radiological, and nuclear (CBRN) protective gear and performed various CBRN response exercises. This allowed leaders and planners to gauge the operational effectiveness of forces executing missions in CBRN environments and to apply these considerations during the planning process. While CBRN preparedness is critical, avoidance of CBRN environments is ideal.**

**Various Sources**

## 2. Understanding the Chemical, Biological, Radiological, and Nuclear Operational Environment

a. Command staffs strive to provide a perspective of the interrelated variables that make up their specific OE. The JIPOE analytical process includes a detailed analysis of the various CBRN threats and hazards to adequately define the entire OE and determine appropriate COAs for forces.

b. The actual or threatened employment of WMD or CBRN weapons can affect friendly forces by causing them to prepare for or conduct CBRN defense activities, contamination mitigation, and, if directed, CBRN response operations. The use or threat of use of WMD may also disrupt contractor and HN support. Intelligence planners collaborate with all-source analysts to produce tailored JIPOE products to support the JFC's planning and operations efforts by assessing the potential for deliberate or accidental release of CBRN materials or employment of WMD and characterizing the enemy intent of actual or anticipated WMD-related activities.

(1) **Define the OE.** With regard to CBRN threats and hazards, the analysis of the OE should encompass the following:

(a) All countries or groups known or suspected of possessing a WMD capability and their intent or commitment to using it.

(b) All current and potential locations of WMD delivery systems (e.g., missiles, rockets, artillery, aircraft, mines, and torpedoes).

(c) All known and suspected adversary CBRN capabilities, and the location of their storage and production facilities.

(d) Asymmetric CBRN threats would likely include a covert means of delivery. Examples include dirty bombs; radiological dispersal devices (RDDs); or the use of CBRN materials against potential targets, such as the food, water, and supply systems or postal systems.

(e) Advanced capabilities or weapons or materials capabilities (e.g., nanotechnology, biotechnology, advanced genetics, space-based capabilities, and advances in computing that would allow more efficient access to information or production techniques).

(f) Proliferation networks used to gain or transfer access to weapons, material, technology, and expertise.

(g) Friendly and neutral nation-states' CBRN threats and hazards, as well as their storage and production facilities within the operational area.

(h) Friendly and neutral nation-states' capabilities and limitations to counter WMD, to include CBRN defense and CBRN response.

(2) **Describe the Impact of the OE**

(a) Identify and evaluate the vulnerability of key friendly logistic facilities and infrastructure, including contractors and HN support, to CBRN attack.

(b) Identify all known and suspected CBRN hazards in the operational area, including nontraditional sources (e.g., nuclear power plants and reactors, dual-use or commercial chemical manufacturing facilities, and medical facilities).

(c) Identify critical weather and terrain information needed to determine the effects of weather on potential CBRN hazards, regardless of the manner of release. Analyze the seasonal or monthly normal variations in weather patterns that might affect the use of CBRN weapons and their potential CBRN environments.

(d) Analyze the land and maritime surface dimensions to identify potential target areas for CBRN attack, such as choke points, key terrain, and transportation nodes.

(e) Identify and assess state and non-state actors of proliferation concern.

(f) Identify CBRN-related material, capabilities, expertise, and sensitive/dual-use technologies.

(3) **Evaluate the Adversary and Other Relevant Actors**

(a) Analyze adversary and other relevant actors' capabilities and intent to employ specific types of WMD. Determine the locations, volume, and condition of adversary CBRN materials and potential hazards.

(b) Identify the specific types and characteristics of all adversary and other relevant actor CBRN-related delivery systems, with special attention to minimum and maximum operational reach.

(c) Evaluate adversary and other relevant actor doctrine to determine if employment of CBRN weapons and devices or release of CBRN materials, including TIMs, is terrain-oriented, force-oriented, or a combination of both.

(d) Analyze the level and proficiency of adversary and other relevant actor training and experience in use of CBRN weapons and protective measures.

(e) Evaluate the practicality and timeliness of an adversary's and other relevant actors' exploitation of a new or different technology to develop a CBRN capability and delivery means.

(f) Evaluate an adversary's past or potential use of weapons, such as improvised explosive devices (IEDs) weaponized with CBRN materials.

*For additional information on IEDs, see JP 3-15.1,* Counter-Improvised Explosive Device Activities. *See JP 3-25,* Countering Threat Networks, *for additional information on countering improvised weapon networks.*

(g) Be prepared to participate in exploitation of identity intelligence to assist in identifying threat networks.

*See JP 2-01,* Joint and National Intelligence Support to Military Operations, *for additional information on exploitation support to counter threat networks.*

(4) **Determine Adversary and Other Relevant Actor COAs**

(a) Identify friendly assets the adversary and other relevant actors are most likely to target for CBRN attack.

(b) Determine locations where the adversary and other relevant actors are most likely to deploy delivery systems. These locations should be within range of potentially targeted friendly assets, yet still consistent with the adversary's deployment doctrine.

(c) Evaluate those characteristics of the adversary's and other relevant actors' WMD or CBRN material stockpile that may dictate or constrain the adversary's ability to create a CBRN weapon. These may include factors such as the quantity and yield of nuclear weapons, the age and shelf life of stored chemical munitions, and the production and handling requirements for biological agents.

(d) Determine types and quantities of CBRN materials likely to be employed by an adversary and other relevant actors.

*For additional information on JIPOE, see JP 2-01.3,* Joint Intelligence Preparation of the Operational Environment.

c. JFCs account for the impact of information on their OE. They recognize employment of WMD has significant physical and psychological impact and may result in confusion, misunderstanding, and broad public panic if information is not properly managed. JFCs must be prepared to retain the information advantage, primarily by ensuring the free-flow of factual and timely information.

## 3. Strategic and Operational Planning

a. **Strategic-Level Planning.** Factors that impact the CCMD's strategic-level CBRN planning include treaties; international law, customs, and practices; DOD policies; existing agreements/arrangements with HNs en route to and within the operational area; and the use of propaganda to influence US public and world opinion. Political factors, sociocultural factors, and economic characteristics of the OE assume increased importance for deterrence at the strategic level. These factors may, in fact, have an overriding influence on any COAs involving WMD. At this level, the analysis of the threat's strategic capabilities will concentrate on considerations such as psychology of political leadership, national will and morale, ability of the economy to sustain industrial and technological capabilities for warfare, possible willingness to obtain or use CBRN weapons, and possible intervention by third-party countries and non-state actors, all weighed against US deterrence strategy and capabilities for attribution.

b. **Operational-Level Planning.** The use of threat assessments, capability assessments, and vulnerability assessments during the development of operational-level plans provides the commander and staff with shared understanding of the effects that may be created by CBRN incidents within the OE. When examining the threat's order of battle, the analysis should include:

(1) Their release procedures for the use of CBRN weapons and means of delivery of WMD and any special operations forces (SOF) and paramilitary force capabilities.

(2) The characteristics and decision-making patterns (i.e., CBRN use, release procedures) of the threat's strategic leadership and field commanders.

(3) The threat's strategy, intention, or strategic concept of operations for use of CBRN weapons, which should include the desired end state, perception of friendly vulnerabilities, and intentions regarding those vulnerabilities.

(4) The threat's ability to integrate use of CBRN weapons into their offensive or defensive operations in their overall concept of operations.

(5) The composition, disposition, movement, strength, doctrine, tactics, training, and combat effectiveness of threat forces with to the ability to create CBRN hazards include:

(a) Principal strategic and operational objectives and lines of operation.

(b) CBRN strategic and operational sustainment capabilities.

(c) Ability to create effects in and through the information environment.

(d) Use or ability to access data from space systems to support their targeting process.

(e) CBRN weapons, materials, and storage location vulnerabilities.

(f) Capability to conduct attacks against globally distributed friendly force critical support nodes.

(g) Ability to conceal or obscure initial deployment of or their responsibility regarding deployment of CBRN weapons.

(h) Relationship with possible allies and the ability to enlist their support.

(i) Capabilities for force protection (FP), and protection of the civilian population and infrastructure.

(j) Identities of personnel which may pose a threat.

## 4. Chemical, Biological, Radiological, and Nuclear Staff Assessment Components

a. **Threat Assessment**

(1) CBRN threat assessment helps commanders make better-informed decisions about which protective measures to adopt. It helps identify the most likely CBRN threats and hazards units and personnel will face, allowing units to identify the protective and vulnerability reduction measures most likely to keep them safe. When deciding on protective and vulnerability reduction measures, commanders and staffs must address two competing objectives:

(a) **Effectiveness.** Effectiveness is adopting appropriate protective measures that will protect forces from specific threats that are most likely to occur, while maintaining the ability to accomplish the given mission or task and achieve the objective.

(b) **Efficiency.** Efficiency is avoiding the adoption of unnecessary protective measures that have significant costs (financial costs or diversion of time, effort, and focus).

(2) CBRN threat assessment is not a one-time event but a process of continuous reevaluations of CBRN threats and hazards throughout planning and execution to ensure units continue to have appropriate protective measures in place. Joint forces should:

(a) Conduct an initial CBRN threat assessment during planning and before operations begin, and recommend the appropriate protective measures.

(b) Update the CBRN threat assessment at regular intervals (to help avoid subconsciously becoming habituated to previously identified threats and hazards) and whenever threats, hazards, or phases of operations change.

(c) Modify CBRN protective measures in accordance with threat assessment.

(3) The CBRN threat status is used to assign the threat a serial number that is determined by the most current enemy or hazard situation as depicted by the continuously updated JIPOE process. While initially designed for use when analyzing an enemy's military and security forces, it has expanded to also cover non-state actors and can be

adapted for use in environments that pose accidentally created or naturally occurring CBRN hazards. This system allows local commanders to increase the threat status as conditions change in their operational area. Threat status governs the initial deployment of CBRN assets (equipment, specialized units) and the positioning of those assets in the operational area. The probability of threat is defined below.

(a) **Serial 1 (Zero Probability).** Opposing force does not possess CBRN defense equipment, is not trained in CBRN defense or employment, and does not possess the capability to employ CBRN weapons. Further, the opposing force is not expected to gain access to such weapons, and if they were able to acquire these weapons, it is considered highly unlikely the weapons would be employed against US forces.

(b) **Serial 2 (Low Probability).** The opposing force has an offensive capability to create a CBRN hazard and has received training in defense and employment techniques, but there is no indication of the use of CBRN weapons in the immediate future. An indication may be the dispersal or deployment of CBRN materials/devices or the stated objectives and intent of opposing forces.

(c) **Serial 3 (Medium Probability).** The opposing force is equipped and trained in CBRN defense and employment techniques. CBRN weapons and employment systems are readily available. CBRN weapons have been employed in other areas of the theater. The continued employment of CBRN weapons is considered probable in the immediate future. Indicators would be as follows:

1. CBRN weapons, or their normal means of delivery, are deployed.

2. Enemy troops wearing or carrying CBRN protective equipment.

3. CBRN reconnaissance elements observed with conventional reconnaissance units.

4. CBRN decontamination elements moved forward.

(d) **Serial 4 (High Probability).** The opposing force possesses CBRN materials and delivery systems, CBRN weapons have already been employed in the theater, and attack is considered imminent. In the case of nation-states, CBRN defense equipment is available and training status is considered at par or better than that of US forces. Indicators are:

1. CBRN attack in progress but not in the current operational area.

2. CBRN warnings/signals to enemy troops.

3. CBRN weapons within range of friendly forces.

4. Movement of surface-to-surface missiles to a launch site.

b. **Friendly Capability Assessment.** Commanders conduct the friendly force capability assessment continuously from initial planning through all phases of the operation in determining how to employ forces and equipment in a CBRN environment. The capability assessment is a comparison of current unit capabilities for protection and CBRN defense, to include the proficiency of individual CBRN staff officers, command posts, cells, and elements, with the proficiency and resources required to support the commander. It involves the continuous assessment of unit plans, organization, manpower, equipment, logistics, training, leadership, infrastructure, facilities, and readiness. The following list provides a representative sampling of various CBRN-related capabilities that require continuous assessment:

(1) CBRN forces.

(2) CBRN staffs.

(3) CBRN equipment.

(4) CBRN reconnaissance and surveillance.

(5) Collective protection (COLPRO).

(6) Decontamination.

(7) Automated warning and reporting.

(8) Hazard prediction and modeling.

(9) Medical countermeasures.

(10) Casualty management.

(11) Analytical capabilities—in theater and available by reachback.

(12) Capabilities of partner nations and organizations.

(13) Incident/hazard risks.

(14) EMP hardening and survivability.

(15) Information flow, exchange, and accuracy.

## 5. Planning Considerations

a. Planning supports the commanders' decision cycle. Focused JFC staff planning related to conducting operations in CBRN environments includes the following:

(1) Establish cooperative policies, procedures, and networks for the joint force, HN, and with other friendly forces to operate in a CBRN environment.

(2) Recognize the most likely CBRN threats and hazards from updated enemy tactics, capabilities, intentions, and the environment.

(3) Conduct assessments (threat, vulnerability, previous-incident/past-use, impact, hazard prediction modeling).

(4) Provide recommendations for the critical asset list and defended asset list.

(5) Coordinate unit protection measures, especially individual protective equipment (IPE), troop safety criteria, operational exposure guidance (OEG), automatic masking criteria, bypass criteria, COLPRO equipment, and decontamination equipment and procedures.

(6) Determine CBRN defense training and readiness requirements.

(7) Establish the appropriate recovery and mitigation actions to match the threat, hazards, and locations.

(8) Coordinate logistics activities, personnel services support, health services (including vaccinations and medical countermeasures), and reconstitution efforts.

(9) Coordinate CBRN health surveillance activities (including biosurveillance) through the applicable command surgeon channel.

(10) Coordinate and integrate the CBRN defense actions of other interagency and multinational partners and the HN into the plan.

(11) Synchronize the policies, people, and processes for expedited collection, transport, and analysis of medical specimens and environmental samples from CBRN incidents.

(12) Provide commanders' guidance for forces and facilities to ensure they are prepared to operate in CBRN environments.

b. Specific planning considerations may vary considerably for all phases of a joint operation/campaign and at the strategic, operational, and tactical levels due to differences in the responsibilities and authorities at those levels for the application of C2, complexity of assigned missions, available resources, and the size of the operational areas and areas of interest. The use or the threatened use of WMD or CBRN materials can dramatically influence strategic and operational objectives and COAs. Planners and commanders at all levels will integrate CBRN defense and other FP considerations into the overall planning and decision-making processes.

c. In addition to friendly force considerations, commanders and planners should consider the impact a release of CBRN materials will have on the local population. This is especially true when the joint force is operating amidst the civilian population in urban areas, against a threat that may have CBRN materials, or in areas that have a concentration of industrial sites containing TIMs. In either case, the JFC considers the availability of CBRN defense medical and nonmedical protection for civilian populations, in the event of a significant CBRN attack or intentional or unintentional release of CBRN material.

*See JP 3-06,* Joint Urban Operations, *for additional information on impacts of CBRN threats in an urban environment.*

d. Operations in CBRN environments make sustainment planning more complex. Operating tempo (OPTEMPO), logistic operations, health services, personnel services support, and reconstitution efforts may be profoundly affected by the introduction of CBRN materials that present separate and distinct hazards to personnel, units, equipment, and operations.

e. **Directed CBRN Response; International Chemical, Biological, Radiological, and Nuclear Response (ICBRN-R); and CWMD.** During any phase of operations, the CCDR may need to support CBRN response/ICBRN-R tasks, including assisting HN forces as they conduct CBRN response operations. If the OE contains WMD and related storage or production facilities, then planning may need to include CWMD operations to control, defeat, degrade, disable, or dispose of the material, facilities/infrastructure, and weapons.

f. **Operational Contract Support.** The CBRN planner should identify units/organizations responsible for providing spaces, equipment, protective clothing, and decontamination/recovery for contractors authorized to accompany the force (CAAF). At a minimum, the CBRN planner should consider:

(1) Assessing and minimizing requirements for contracted support in or near a CBRN environment.

(2) Reviewing contractor qualifications or certifications required to support a CBRN requirement.

(3) Identifying medical support available and accessible to CAAF responding to a CBRN event.

(4) Ensuring education and training to CAAF regarding CBRN procedures, communications, and reporting.

(5) Implementing procedures for CAAF access to or restrictions from a CBRN-affected area.

(6) Designating authority to properly dispose of contaminated waste.

(7) Coordinating requirements and considerations with the operational contract support integration cell.

*See JP 4-10,* Operational Contract Support, *and Chairman of the Joint Chiefs of Staff (CJCS) Manual 4301.01,* Planning Operational Contract Support, *for additional information.*

*See JP 3-41,* Chemical, Biological, Radiological, and Nuclear Response, *for additional information on CBRN response and JP 3-40,* Countering Weapons of Mass Destruction, *for additional information on CWMD operations.*

g. **Operational Challenges.** In considering the challenges to sustained operations, the following areas merit special emphasis: intelligence support of JIPOE, deterring the threat's employment, reducing vulnerability to adversary CBRN capabilities, preventing enemy CBRN weapon employment, planning FP, conducting multinational operations, synchronizing operations, and assessing and managing risk. Information-related activities may be applied across these areas, combined or independently. Each of these areas is discussed in more detail below. Many of these areas can be nested under the CWMD constructs of "cooperate with and support partners;" "understand the OE, threats, and vulnerabilities;" "control (including subtasks of defeat, disable, and dispose) WMD threats;" and "safeguard the force and manage consequences."

(1) **Intelligence Support.** The intelligence community and other Joint Staff members advise the CCDR and subordinate JFCs of an adversary's possession of, access to, and capability to employ CBRN weapons or material and under what conditions that adversary is most likely to do so. This advice results from integrated operations and intelligence planning, including red team utilization, throughout a continuous JIPOE process to verify the adversary's willingness and intent to employ these weapons or materials. Tailored JIPOE products should address the capabilities and limitations of adversary CBRN weapons; delivery systems; technological advancements; command, control, and release procedures; medical disease threats; and the indicators of intent to employ CBRN weapons. Further, it should include information from the joint force surgeon, which assists and advises the JIPOE effort by identifying medical and disease threats in the OE. Additionally, the JIPOE process should assess the potential for sabotage of industrial and commercial TIM sources that are vulnerable to intentional release by an adversary or the unintentional release caused by an accident within the operational area. JFCs and supporting and subordinate commanders should include treaty, legal, and policy considerations relating to CBRN in their JIPOE process.

(a) The JIPOE process analyzes the OE to identify possible adversary COAs related to producing CBRN hazards and to support integrating CBRN threat considerations into joint planning, execution, and assessment. Tailored JIPOE products assess the potential for accidental or deliberate release of CBRN materials within the operational area and the adversary's potential proliferation or employment of CBRN weapons or materials, characterize the consequences of a CBRN-related incident, and support the joint force's CBRN defense effort.

1. JIPOE analysis regarding adversary CBRN capabilities and intent is a particularly important prerequisite for military success during execution of a joint operation, regardless of how the CBRN environment evolves. Tailored JIPOE products provide the CCDR awareness of the evolving capabilities and limitations of adversary CBRN weapons and hazard delivery systems; technological advancements; changes to their command, control, and release procedures; and the indicators of intent to employ CBRN weapons. The objective is to give the CCDR an understanding of the implications to the joint force of an actual or threatened CBRN contaminated environment to enable more effective decision making.

2. Red teams and wargames are closely associated with joint planning (primarily in COA analysis). Red teams enhance problem-solving efforts for complex operations like CWMD and civil-military operations such as domestic CBRN response and ICBRN-R. Both red teams and wargame are used during planning and mission execution to effectively assess decision points designed to deter or prevent adversary use of CBRN weapons or material and to optimize joint operations in a CBRN environment resulting from CBRN weapon use, industrial accidents, and sabotage or as a result of friendly actions.

*For additional information on red teams, see JP 5-0,* Joint Planning.

(b) **Intelligence, Surveillance, and Reconnaissance (ISR).** ISR is an activity that synchronizes and integrates the planning and operation of sensors; assets; and processing, exploitation, and dissemination systems in direct support of execution of current and future operations. As an integrated intelligence and operation function, collection requirements must be specified and ISR missions executed in order to satisfy CBRN operational or technical threat requirements. ISR activities provide commanders and staff the ability to understand adversary CBRN threat capabilities. Measurement and signature intelligence is conducted during both pre- and post-CBRN incident. Key to ISR visualization is an effective management process to graphically display current and future locations of ISR sensors, including CBRN reconnaissance and surveillance capabilities, their projected platform tracks, vulnerabilities to threat capabilities and meteorological and oceanographic phenomena, tasked collection targets, and products to provide a basis for dynamic redirection and time-sensitive decision making. This ability to redirect reconnaissance and surveillance capabilities allows the shift of planned or ongoing collection activities in response to changed or improved situational awareness or directive. The CCDR may also modify the commander's critical information requirements causing collection managers to reprioritize requirements.

*See JP 2-01,* Joint and National Intelligence Support to Military Operations, *for more information.*

1. **Intelligence.** Intelligence information, derived from the continuous collection and processing of information and data, is used to assess adversary CBRN capabilities, dispositions, intentions, and other potential sources of CBRN hazards (e.g., industrial facilities). The intelligence function develops and tracks this information. When the intelligence concerns adversary CBRN capabilities, dispositions, and intentions, the CBRN defense community is also responsible for ensuring CBRN technical requirements for information are satisfied.

2. **Surveillance.** The joint force conducts sustained, systematic, and continuous observation of an area for unforeseen hazard releases and monitoring of known hazard locations. Surveillance facilitates situational awareness and maintenance of an accurate, high-fidelity, real-time picture of the OE as changes occur. Surveillance involves standoff or point (including those remotely dispersed, unmanned, and unattended) means to detect the presence or absence of hazards beyond the immediate vicinity of a friendly force to permit maneuver, avoidance of hazard locations, operations in stable environments, and support planning.

3. **Reconnaissance.** Reconnaissance provides the CCDR with data about activities or conditions in a particular area of interest throughout the operational area. Effective reconnaissance enables the JFC to avoid contamination (e.g., affording safe passage) and preserve combat power by surveying an area or facility to provide detailed information on unforeseen hazards or monitoring an environment or facility for known hazards. Reconnaissance includes marking the hazardous area and supports sampling and hazard characterization capabilities.

*For detailed information on tactical execution considerations, refer to ATP 3-11.37/MCRP 10-10E.7(MCRP 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.

(c) **Medical Intelligence.** Medical intelligence is that category of intelligence resulting from collection, evaluation, analysis, and interpretation of foreign medical, bio-scientific, and environmental information that is of interest to strategic planning and to military medical planning and operations for the conservation of the fighting strength of friendly forces and the formation of assessments of foreign medical capabilities in both military and civilian sectors. Accurate and timely medical intelligence is a critical medical tool used to plan, execute, and sustain military operations. A supporting intelligence element should exist at some point in the medical unit's chain of command. This element, whether military or civilian, should be the primary source for the health services planner to access the necessary intelligence for the execution of health services operations. Medical surveillance consists of conducting disease surveillance to identify unusual patterns of disease emergence, as well as looking at the enemy's medical treatment capabilities and medical countermeasures (e.g., existing stock and items under development). If the enemy plans to deploy CBRN weapons, it is more than likely to ensure it can protect its own force. Therefore, identifying enemy capabilities to protect itself against CBRN threats could serve as an indicator/warning of the enemy's likelihood to use CBRN against the US. In addition to the ongoing disease surveillance activities to identify potential disease outbreaks, the intelligence community needs to evaluate the enemy's ability to deploy/employ medical assets as a method of determining real CBRN risks in the AOR. Intelligence support should be provided by local tactical intelligence sources, and PIRs for medical should be determined by the joint force surgeon and included in commander's PIRs.

(2) **Deterring Adversary Employment.** A fundamental premise of US military planning is that adversaries are most likely to be deterred from provocative action when US forces are sufficiently and visibly organized, trained, and equipped to defeat that action and fear a credible threat of undesired consequences. Deterring adversary use of CBRN weapons depends, to a significant degree, upon effective preparedness and operational readiness to deny the adversary any strategic advantage. Credible plans, education, and training, coupled with periodic exercises, and a clearly communicated commitment to hold an adversary and its leadership at risk in response to employment of WMD or use of CBRN material, are also important elements of deterrence. The adversary should perceive US capabilities and determination with certainty while remaining uncertain about the precise nature and timing of US countering actions. Synchronizing all information-related activities provides the commanders with the principle means to deter a potential or actual adversary from taking any CBRN provocative actions that threaten US national interests. Depending on the nature of the threat (especially a non-state actor), the ability to conduct counter-IED activities and to counter threat networks can be an important aspect of deterrence. However, not all non-state actors are significantly deterred by US force preparedness and capability.

(3) **Reducing Vulnerability to Adversary CBRN Capabilities.** Vulnerabilities should be examined through continuous comprehensive assessments and integrated with risk management decisions that encompass the full range of potential targets subject to CBRN attack. Commanders have multiple means to mitigate the consequences of identified risks and hazards to preserve combat power and minimize casualties. Such means include planning for branches and sequels, eliminating unique threat network nodes, and ensuring multiple units are synchronizing operations to prevent CBRN attacks. The protection working group serves as the primary advisor to the commander and staff for these issues.

(a) When US, HN, or other civilian populations and infrastructures are at risk from a CBRN attack, the JFC will, when directed, assist the appropriate military and civil authorities in mitigating the risk, as well as protection from and response to an attack. Such efforts are often undertaken through a CCDR's building partner capacity program. Of particular concern to the JFC in this regard are CBRN risks to civilian areas that may affect execution of the military operations.

(b) Assessments and resulting vulnerability reduction measures should also address the dangers posed by TIMs. Particular care should be taken in identifying the nature of such hazards, because in many cases, standard military CBRN IPE may not provide the necessary protection. In some instances, avoiding the hazard may be the most effective, or only, COA when specialized personal protective equipment (PPE) is not available or suitable given the OE. In all circumstances, the JFC should act to minimize immediate and long-term effects of toxic hazards, including low-level hazards, to health and mission objectives, including chronic exposure to low-level hazards.

(c) CBRN vulnerability assessments are essential to FP planning. They provide the commander a tool to determine the potential vulnerability of an installation, unit, activity, port, ship, residence, facility, or other site against CBRN threats and hazards. The CBRN vulnerability assessment identifies functions or activities that are vulnerable to threats and require attention from C2 authorities to address improvement to withstand, mitigate, or deter against the threat. When improvements cannot be made, a risk-based approach to defense and protection activities must be undertaken.

1. The CBRN vulnerability assessment compiles the other types of assessments discussed into an overall snapshot of the unit's ability to support or conduct an operation given the specific OE and unit capabilities.

2. The CBRN vulnerability assessment will:

a. Identify vulnerabilities.

b. Determine the likelihood CBRN threats or hazards will exploit a given vulnerability based on knowledge, technologies, resources, probability of detection, and payoff.

c. Predict the potential impact to the operational area if the vulnerability is exploited.

3. CBRN vulnerability assessments require a comparison of the threat with unit vulnerabilities to determine the efforts necessary to safely meet incident requirements. A vulnerability assessment also includes the integration of the commander's guidance through a risk management process to prioritize the implementation of vulnerability reduction measures.

4. Given the factors in the risk equation and the cost of implementing CBRN defense measures, a determination may be made that the risk potential of a given vulnerability is not worth the cost of correcting or implementing a measure.

*ATP 3-11.36/MCRP 10-10E.1(MCRP 3-37B)/NTTP 3-11.34/AFTTP(I) 3-2.70,* Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Aspects of Command and Control, *discusses CBRN vulnerability assessments in more detail.*

(4) **Preventing Adversary CBRN Weapons Employment.** In order to reduce the likelihood of having to plan for or operate in a CBRN environment, the JFC should not rely solely on efforts to reduce the force's vulnerability to CBRN attacks. JFCs should

make every effort within their authority to prevent the adversary from successfully acquiring and delivering CBRN weapons, using the full extent of actions allowed by the rules of engagement (ROE) and rules for the use of force, as applicable. These actions include multiple lines of effort and are further discussed in JP 3-40, *Countering Weapon of Mass Destruction.* However, understanding the consequences of execution prediction and assessment for WMD targets and TIM sites is essential during the joint targeting process.

*For more detailed information about preventing adversary CBRN weapons employment, see JP 3-01,* Countering Air and Missile Threats; *JP 3-03,* Joint Interdiction; *JP 3-40,* Countering Weapons of Mass Destruction; *JP 3-09.3,* Close Air Support; *JP 3-0,* Joint Operations; *JP 3-25,* Countering Threat Networks; *and JP 3-60,* Joint Targeting.

(5) **Planning FP.** Protecting the force consists of those actions taken to conserve the force by identifying CBRN threats and hazards and preventing or mitigating the effects of CBRN environments. CBRN-related protection includes measures taken to keep CBRN environments from having adverse effects on personnel, equipment, resources, or critical assets and facilities. Offensive and defensive measures are coordinated and synchronized to enable the effective employment of the joint force while degrading opportunities for the adversary. FP is an integral part of managing the impact of force entry in complex operating environments. CBRN protection must be provided throughout all phases of an operation, including surveillance/reconnaissance through the actual assault and then resupply and refit. From the enemy's viewpoint, contaminating ports, landing zones, drop zones, and beach landing areas with CBRN hazards buys time and space and is a combat multiplier. Planning and considering a mix of types of protective resources helps balance operational requirements with optimal CBRN protection and sustainment.

(a) Commanders implement protective measures appropriate to all anticipated threats, including terrorist threats and the use of CBRN weapons or other sources of CBRN hazards. This requires planning, preparation, and training to execute defenses to negate the effects of CBRN elements on personnel and materiel. Measures include IPE; receiving medical countermeasures, including vaccinations and other pre- and post-exposure prophylaxis measures as well as treatments, including force health protection prescription products such as chemical agent antidote auto-injectors; and COLPRO systems to provide protection in CBRN environments.

(b) As directed, the JFC's protection function may also extend beyond FP to encompass protection of US civilians; the forces, systems, and civil infrastructure of friendly nations; and other USG departments and agencies, international organizations, governmental organizations, and nongovernmental organizations (NGOs).

(c) Protection capabilities for military forces against CBRN hazards also apply domestically. Commander, US Northern Command, or the Commander, US Pacific Command, and subordinate commanders, when tasked by the Secretary of Defense (SecDef), can apply protection capabilities during homeland defense, domestic CBRN response for defense support of civil authorities, and for EP. DOD may be capable of preventing certain CBRN incidents during homeland defense, but DOD does not normally have resources to provide individual protection or COLPRO for the general population against CBRN elements resulting from a CBRN incident.

(d) **Force Health Protection.** Medical protection of the force against CBRN threats involves integrated preventive, surveillance, and clinical programs. The JFCs and subordinate and supporting commanders' plans should include pre-exposure medical countermeasures (i.e., vaccination and other prophylaxis measures); decontamination activities; diagnostic testing activities (including designation of field confirmatory and theater validation identification laboratories for medical and environmental specimens); post-exposure prophylaxis (e.g., certain vaccinations with post-exposure indications and antibiotics); and treatment (e.g., chemical agent antidotes and antibiotics or antivirals), including supportive care (e.g., use of mechanical ventilation), disease-containment strategies (i.e., restriction of movement [ROM], including isolation or quarantine), comprehensive health surveillance, and CBRN exposure data capture. These plans should take into account the capabilities and requirements of HNs, multinational and interagency partners, international organizations, NGOs, and essential civilian workers supporting US and multinational forces.

(e) CCDRs preserve their forces' fighting potential by minimizing the effects of hostile action by the enemy. One of the protection function tasks is the mitigation of effects of CBRN incidents through preparation, rehearsal, and timely incident response. The timely response to any CBRN incident includes the earliest possible detection and identification of the CBRN contaminants. These actions help limit both complications of the contamination and further spread of any communicable illnesses. Expedited shipment and processing of biological and chemical samples within the operational area are two crucial steps necessary for effective analysis and identification to provide the commander and command surgeon with critical information to support timely decisions regarding avoidance, protection, decontamination measures, and medical prophylaxis and treatment for affected units and personnel, if needed. The results can also support preliminary attribution (prove or disprove) to implicate or support trace analytics for the source of the identified CBRN material. The CCMD staff facilitates the expedited transport of CBRN samples and specimens within their AORs by ensuring procedures and adequate units and/or personnel are in place to provide proper technical escort from any land or maritime point of contamination to the closest in-theater laboratory with appropriate analytical capabilities.

(f) **Protective Equipment.** Sufficient equipment should be available to protect the uniformed force and mission-essential personnel. Individual and unit training for proper sizing, use, and care for IPE and, where appropriate, PPE is required to take full advantage of its capabilities. IPE is the personal clothing and equipment provided to all military personnel to protect them from CBRN hazards. More specialized protective equipment, such as level A protective suits worn together with self-contained breathing apparatus, that meets civilian certifications as required by the US Department of Labor Occupational Safety and Health Administration is considered PPE.

(g) **Emergency Management and CBRN Response Measures.** Adversaries challenge FP capabilities at home stations even before deployment, through the threat of using CBRN weapons. Joint installation commanders manage and maintain comprehensive, all-hazards installation emergency management programs on DOD installations worldwide. Per DODI 6055.17, *DOD Emergency Management (EM) Program,* all hazards include any incident, natural or man-made, that warrants action to protect the life, property, health, and safety of military members, dependents, and civilians at risk and minimize any disruptions of installation operations (including CBRN incidents). DOD maintains this capability for its installations and, as directed, supports and assists civil authorities in emergency management activities to mitigate, prevent, protect, respond to, and recover from natural or man-made CBRN incidents.

*DODI 6055.17,* DOD Emergency Management (EM) Program, *addresses requirements (including CBRN/hazardous materials) for responders within DOD.*

(6) **Conducting Multinational Operations**

(a) US military operations are routinely conducted with forces of other countries within the structure of an alliance or coalition. An adversary may employ CBRN weapons or material against non-US forces, especially those with little or no defense against these weapons, in an effort to weaken, divide, or destroy the multinational effort. When conducting combat operations, the JFC should consider the capabilities and limitations of all available forces to maximize their contributions and minimize their vulnerabilities. Peacetime activities with multinational partners, particularly multinational and interagency training and planning exercises, provide means of preparing for multinational combat operations in CBRN environments.

(b) With very few exceptions, multinational operations will involve the use of HN sovereign airspace and territory, bases or civilian airports, facilities, and personnel (including non-USG and contracted civilian workers supporting US and multinational forces). The CCDRs' combatant command campaign and contingency plans and HN considerations, including passive defense, are the subject of significant peacetime planning in which operational, legal, contractual, and personnel issues are addressed. Coordination of HN support activities will involve a number of interagency partners, as well as the US country team. Particular emphasis is placed on early warning and detection; actions to prepare US and indigenous military forces; and protection of threatened civilian populations, essential infrastructures, and facilities. Arrangements for custody and movement/disposal of captured CBRN materials and facilities should be arranged before operations commence. Allies may or may not take custody of various CBRN materials in areas under their control due to treaty obligations, training, and equipping or home government directions. The geographic combatant commander's (GCC's) staff should verify all plans and exercises are in alignment with HN agreements for providing assistance to the HN during CBRN incidents, especially where effects may hinder US military response.

(c) Targeting chemical, biological, or nuclear facilities as a part of multinational operations may be constrained by differing treaty obligations, multinational ROE coordination requirements, and reporting requirements. The staff judge advocate (SJA) and arms control advisor should be involved in the planning and targeting processes to identify applicable treaty obligations, multinational ROE considerations, and reporting requirements.

*For additional information on CBRN targeting, see JP 3-40,* Countering Weapons of Mass Destruction*. For additional guidance on offensive actions against WMD-related targets, see JP 3-05*, Special Operations; *JP 3-09,* Joint Fire Support; *JP 3-60,* Joint Targeting; *and DODD S-2060.04,* (U) DOD Support to the National Technical Nuclear Forensics (NTNF) Program.

(7) **Synchronization of Operations.** The objective of synchronizing operations is to maximize the combined effects of all friendly forces while degrading adversary capabilities. Synchronization entails the interrelated and time-phased execution of all aspects of operations and is enhanced by situational awareness and adaptability. In CBRN environments, the requirements for successful synchronization include, but are not limited to, the proper integration of, and sequencing among, intelligence collection capabilities, active and passive defense measures, offensive activities, CBRN response, and sustainment. The JFC's operation or campaign plan, C2 arrangements, and TTP should facilitate synchronization across all force functions and components. Installation commanders must also synchronize base-level operations among all tenant units to maintain readiness and continuity of operations in CBRN environments.

(8) **Risk Assessment and Management.** Implementing the full measure of CBRN passive defense should be a calculated decision made by the JFC. Providing full protection against CBRN threats and hazards can significantly degrade the operational capabilities of the joint force. The JFCs must balance the need to effectively implement CBRN passive defense against the logistical cost and risk of these actions to their objectives and mission and against the cost of having to recover force capabilities if passive measures are not enacted and an attack occurs. Use of risk assessment and management tools will enable JFCs to effectively execute a risk mitigation plan during operations in a CBRN environment.

(9) **Information Integration into Operations.** In CBRN environments, information plays a crucial role in creating effects in the information environment that deter and/or counter adversary efforts to employ WMD, create CBRN effects, or heighten the chaos attendant to their use. Effective integration of information also enhances the JFC's ability to respond to such incidents, disseminate accurate information in a timely manner, allay fears and misunderstanding, and build support where necessary to ensure desirable outcomes. Therefore, information considerations must be part of planning from the outset and considered throughout preparation, execution, and assessment.

g. CBRN planners and commanders must develop plans and implementation actions to counter adversary actions during peacetime and early in crises. These plans and activities require joint, multinational, and interagency coordination for activities that support CBRN awareness and understanding, protection of critical assets, and contamination mitigation measures.

(1) **CBRN Hazard Awareness and Understanding.** CBRN hazard awareness is the ability to exploit intelligence about CBRN threat dispositions and intentions and to determine the characteristics and parameters of CBRN hazards throughout the OE that impact decision making and CBRN defense activities. CBRN hazard understanding is the ability to individually and collectively comprehend the implications of the character, nature, or subtleties of information about CBRN hazards and their impact on the OE, mission, and force, in order to enable situational understanding (see Figure II-1). Planning the collection and exploitation of the CBRN threats and hazards information is essential for the JFC's situational awareness. When CBRN hazard awareness and understanding is combined with an understanding of the enemy, it can be used to enhance decision making and planning requirements.

(a) Considerations for hazard awareness include:

1. What CBRN threats may impact joint operations?

2. What are the adversary's cultural factors that might enable predictions about their motivation and COAs involving employment of WMD or CBRN hazards?

3. What industrial, medical, or research facilities may contain CBRN agents or TIMs that could be used by an adversary to cause a CBRN incident, through intentional or accidental release, requiring a CBRN response?

4. What friendly operations may be the source of collateral CBRN hazards?

5. What are the types and locations of CBRN hazards present in the operational area?

6. What are the characteristics of the CBRN hazards?

7. In what concentrations or amounts are the hazards present?

8. How are the hazards being brought into the operational area if they do not already exist there?

9. What are the predicted short-term and long-term effects of the CBRN hazards?

10. What are the environmental and climatology background data?

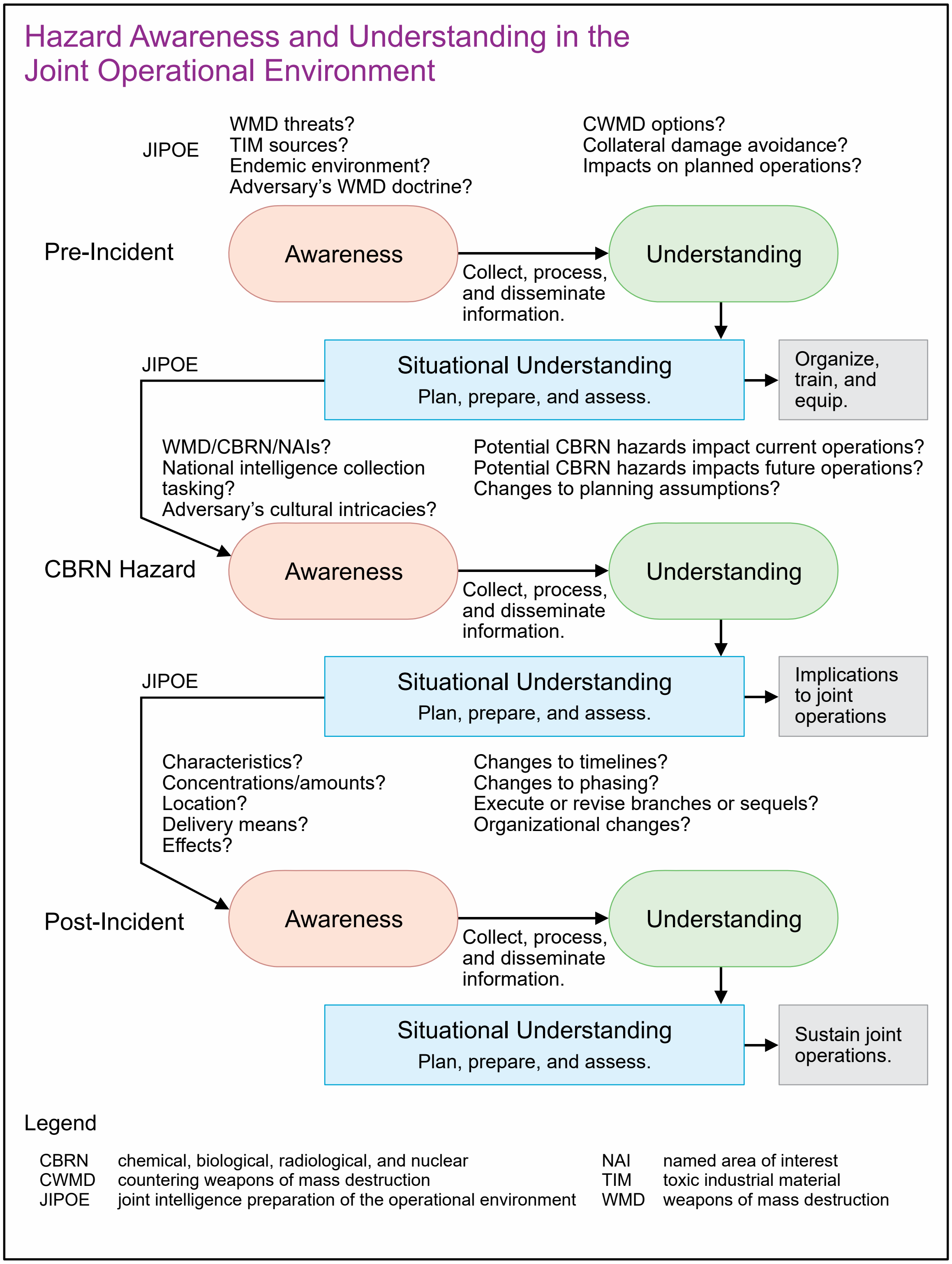


**Figure II-1. Hazard Awareness and Understanding in the Joint Operational Environment**

11. What naturally occurring diseases are endemic to the local area and is there baseline health surveillance data for those diseases?

(b) Considerations for hazard understanding:

1. What effects do the potential sources of CBRN hazards have on current operations?

2. What effects will the potential sources of CBRN hazards have on future operations?

3. What are reasonable expectations for completing assigned missions in a CBRN environment?

4. Do any planning assumptions have to be changed?

5. What approaches need to be changed to facilitate the development of viable problem solutions?

6. What changes are there to the strategic environment?

7. What changes are there to the operational and tactical environment?

8. What timelines will need to be changed?

9. What phasing changes will be required?

10. What branches or sequels need to be executed or redone?

11. What organizational changes may need to be enacted?

12. What does the CBRN threat or hazard indicate about the adversary?

13. What are the JFC's current and future CBRN defense capability shortfalls and what can be done to mitigate these shortfalls?

14. What number of casualties is the hazard likely to produce?

15. What medical treatments may be needed to reconstitute the operational forces?

(2) **Protection of Critical Assets.** Protection focuses on conserving the joint force's fighting potential in four primary ways: **active defensive measures** that protect the joint force, its information, its bases, necessary infrastructure, and lines of communications from an adversary's attack; **passive defensive measures** that make friendly forces, systems, and facilities difficult to locate, strike, and destroy; **application of technology and procedures** to reduce the risk of friendly fire; and **emergency management and response** to reduce the loss of personnel and capabilities due to enemy action, accidents, health threats, and natural disasters. Actions taken to protect the force

include those that reduce the vulnerability of critical resources, including personnel, facilities, equipment and supplies, and information to deter or neutralize incidents and their effects.

(a) Basic objectives for operations and campaigns include rapid and uninterrupted force preparation and deployment, comprehensive FP, and adherence to the law of war.

(b) Mission-oriented protective posture (MOPP) is a flexible system of protection against CBRN contamination in which personnel are required to wear only that protective clothing and equipment appropriate to the threat level and a work rate imposed by the mission, temperature, and humidity. Commanders may adjust the amount of MOPP gear required in their particular situations and still maintain combat effectiveness. Additionally, commanders can place all or part of their units in different MOPP levels (i.e., split-MOPP) or other variation within a given MOPP level.

(c) Separate MOPP systems exist for ship and land operations (see Figure II-2). JFCs should be familiar with both MOPP systems. Ship MOPP includes integrated detection, individual protection, COLPRO, and decontamination actions, while land MOPP focuses on individual protection.

*For more information on MOPP system flexibility, see ATP 3-11.32/MCRP 10-10E.8/NTTP 3-11.37,* Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological and Nuclear Passive Defense, *and NTTP/Coast Guard TTP 3-20.31,* Surface Ship Survivability.

(d) Sustaining operations in CBRN environments may require COLPRO equipment, which provides a toxic-free area for conducting some activities and performing life support functions such as rest, relief, and medical treatment. In planning for the use of COLPRO, an assessment of the capabilities of the available COLPRO systems should be included. Proper planning and coordination with CBRN subject matter experts (SMEs) will assist in the effective use of COLPRO.

(e) When COLPRO is not available, plans must be developed, exercised, and evaluated to move personnel to alternative toxic-free areas that are well away from the contaminated areas. The use of split-MOPP procedures may be appropriate in such situations. If evacuation is not possible, building occupants may be able to shelter in place to gain limited protection by closing all windows and doors; turning off ventilation systems; and moving to closed, inner rooms. If there is advance warning, occupants can increase protection by sealing windows, doors, and openings but must recognize the building or space may quickly become uninhabitable without cooling or ventilation.

(3) **Contamination Mitigation.** Contamination mitigation is the planning and actions taken to prepare for and recover from contamination associated with all CBRN hazards and to contain the spread of CBRN contamination and prevent the loss of assets.

## Joint Ship/Land Chemical, Biological, Radiological, and Nuclear Mission-Oriented Protective Posture Comparison

| Ship MOPP | | Land MOPP | |
|---|---|---|---|
| **Ship MOPP Level** | **Description** | **Land MOPP Level** | **Description** |
| MOPP 0 | • IPE onboard and inventoried; all personnel sized and assigned IPE. | MOPP 0 | • Carry mask; IPE available (within arm's reach). |
| MOPP 1 | • IPE issued to all personnel and available (within arm's reach). | MOPP 1 | • Don protective suit. |
| MOPP 2 | • Carry mask, other IPE available.<br>• Activate detectors.<br>• Set condition MODIFIED ZEBRA. | MOPP 2 | • Don protective boots. |
| MOPP 3 | • Don protective suit.<br>• Don protective boots.<br>• Set condition ZEBRA (ship hatch closure/secure measures).<br>• Activate intermittent washdown. | MOPP 3 | • Don protective mask.<br>• Secure hood. |
| MOPP 4 | • Don protective mask.<br>• Secure hood.<br>• Don protective gloves.<br>• Set condition CIRCLE WILLIAM (ship hatch closure/secure measures) as required.<br>• Activate continuous washdown. | MOPP 4 | • Don protective gloves. |

Legend

IPE individual protective equipment

MOPP mission-oriented protective posture

**Figure II-2. Joint Ship/Land Chemical, Biological, Radiological, and Nuclear Mission-Oriented Protective Posture Comparison**

Planners must ensure clear guidance for contamination mitigation is not confused with CBRN response and is integrated into appropriate planning products. Staffs utilize CBRN hazard awareness and understanding (see Figure II-1) to match CBRN mitigation measures to the hazard, determine necessary capabilities needed to limit the spread of contamination and neutralize the effects, to prioritize and coordinate mitigation actions and resources, and establish measures to assess mitigation efforts. A proactive approach to contamination mitigation is achieved through planning and preparation.

h. **Other Planning Considerations**

(1) **Information-Related Activities.** The integrated employment of information-related activities may reduce force vulnerability and help deter adversarial use of CBRN weapons. Public interest in and fear of CBRN-related developments may be intense and may affect US and multinational leadership decisions. National-level communications can create international and internal pressures to convince an adversary not to acquire or use CBRN weapons. Fully explaining the USG position on the potential US reaction in the event of an enemy use of CBRN materials on US or multinational forces could be very beneficial. A combination of information-related activities, including electronic warfare, cyberspace operations, military information support operations, military deception, and operations security, designed to influence, disrupt, corrupt, or usurp the adversary's decision-making process, can be vital to the success of the overall operation or campaign. To affect an adversary's intelligence collection and situational awareness, information-related activities may help prevent an adversary from acquiring information necessary to successfully target friendly forces and facilities using CBRN weapons.

(2) **Public Affairs.** The JFC should provide, as the situation requires and release authority exists, timely and accurate information to the public regarding actions taken in reaction to CBRN threats, hazards, or incidents. The JFC and the staff public affairs officer are the primary official military spokespersons for this purpose.

*For further guidance on communications related to CBRN incidents, see Presidential Policy Directive (PPD)-25,* (U) Guidelines for US Government Interagency Response to Terrorist Threats or Incidents in the US and Overseas.

*For further details on public affairs, see JP 3-61,* Public Affairs.

(3) **Legal Guidance.** The complexity of CBRN and associated law and policy require continuous involvement of the SJA, or appropriate legal advisor, for planning, control, and assessment of operations. Because of the global nature of some CBRN threats, this may include continuous consultation with interagency and multinational partners, HN governments, and international organizations to establish the necessary legal authorities, capabilities, and limitations associated with such organizations. The SJA can advise the JFC and staff of potential, associated legal issues (e.g., compliance with domestic environmental regulations, legal implications of CBRN planning, and targeting in a CBRN environment).

(a) **International Law.** The SJA will advise the JFC and staff on international law that may impose certain obligations upon the US and shape the planning of joint operations and campaigns associated with CBRN threats and environments. Certain legal requirements may generate constraints and restraints that shape CBRN planning efforts.

(b) **Conventions, Treaties, and Other International Agreements.** Arms control and nonproliferation treaties establish global norms opposing the proliferation of WMD, their precursors, means of delivery, and weapons manufacturing equipment. Such treaties define the international standards under which signatories may be held accountable and provide diplomatic tools and legal recourse to isolate and punish violators. International agreements may increase or limit US options with regard to logistical support, security assistance, and status of forces.

## 6. Preparation Considerations

a. During preparation, the focus is on deterring and preventing threats from taking actions that affect combat power. Since the force is most often vulnerable to surprise and attack during preparation, the implementation of hazard awareness and understanding activities, protection of critical assets, and contamination mitigation measures with ongoing preparation activities assists in the prevention of negative effects.

b. The fundamental elements for maintaining adequate preparedness require a clear understanding of the threats and operational requirements, both overseas and in the US. To support these requirements, the commanders' mission analyses identify specific, mission-essential tasks for individuals and organizations that facilitate operations in CBRN environments. DOD is also responsible for homeland defense against employment of WMD directly against the US and supporting homeland security against possible covert CBRN threats. Domestic military support, known as defense support of civil authorities, is subject to constitutional, statutory, and policy restrictions.

*For further planning considerations, see JP 3-28,* Defense Support of Civil Authorities, *and CJCSI 3125.01,* Defense Response to Chemical, Biological, Radiological, and Nuclear (CBRN) Incidents in the Homeland.

c. Complete intelligence collection and analysis for each specific threat assessment is seldom available. Changes in the perceived magnitude or severity of the threat when compared to friendly vulnerability and risk limitations often dictate adjustments or changes to the plan when those threat characteristics exceed friendly force limitations established in planning. During preparation, the staff continues to monitor and evaluate the overall situation and update the commander's critical information requirements, because variable threat and hazard assessments may generate new PIRs, while significant changes in friendly assets' capabilities or vulnerabilities could lead to new friendly force information requirements.

d. Commanders and staffs consider the following during preparation:

(1) Revise and refine the plan.

(2) Employ systems to detect CBRN threats and hazards and provide early warning of any hostile activities.

(3) Collect and analyze CBRN threat and hazard data.

(4) Monitor both adversary and joint force preparation activities and revise assessments.

(5) Request support to reinforce logistics preparations and replenishment.

(6) Assess joint force Service components training and readiness requirements.

(7) Expedite the procurement and availability of resources needed for protection against CBRN weapons.

(8) Synchronize efforts with USG departments and agencies and multinational partners.

(9) Monitor forces and facilities to ensure preparation to operate in CBRN environments.

e. As the staff monitors and evaluates the performance or effectiveness of the friendly COAs, intelligence assets collect information that may verify adversary COAs. As the nature of the threat evolves, risk to the force changes and may require a different CBRN protective posture or the implementation or cessation of specific CBRN measures and activities. The staff analyzes changes or variances that may require modifications to the priorities and obtains additional commander's guidance, when necessary.

(1) Specific activities to enhance hazard awareness understanding during preparation may focus on the collection and exploitation of information gained from CBRN reconnaissance and surveillance, as well as from health surveillance to develop and refine the common operational picture of the OE. Relevant information collections can help fill in information gaps, refine potential threats and hazards data into facts, validate assumptions, and finalize the plan.

(2) Multiple sources provide units with relevant information, which is processed, extracted, formatted, and forwarded. Commanders and their staffs evaluate the information to assess its impact on operations and protection. The assessment may lead to directives/orders to help protect against the effects of the assessed CBRN hazard. Commanders may direct an integrated series of protective measures (e.g., adjust MOPP) to decrease the level of risk (e.g., decrease threat of exposure), and the plan is revised as updated information is received. MOPP analysis of the appropriate levels of protection based on hazards, mission, environmental conditions, and time constraints will inform the commander's decision.

(3) Forces prepare for contamination mitigation activities by monitoring current operations, assessing resource readiness, preparing mitigation packages (structures and resources to include medical), and synchronizing the contamination mitigation capabilities

to ensure they are ready to respond. Some situations require unique application of decontamination principles, procedures, and methods. These considerations should take into account command, control, communications, and planning capabilities required for decontamination of strategically significant areas/terrain or facilities. Other factors requiring consideration include standing up/deactivating a task force, selecting and defining joint decontamination operations sites, and establishing the manning allocation of initial headquarters for such decontamination operations.

*For additional decontamination considerations, see Appendix F, "Contamination Mitigation Considerations."*

*For specific information on tactical decontamination operations and levels, see ATP 3-11.32/MCRP 10-10E.8/NTTP 3-11.37,* Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Passive Defense.

(a) **Patient Decontamination.** Patient decontamination reduces the threat of CBRN contamination to medical personnel, other patients, and the health care facility. Patient stabilization treatment to conduct decontamination should not be delayed unless it puts the patient at additional risk. Trained and qualified triage personnel determine priority of treatment and decontamination. Aeromedical evacuation capabilities for contaminated and contagious casualties are very limited. The medical movement of contaminated patients entering the strategic air evacuation system requires SecDef; CCDR; and Commander, United States Transportation Command (USTRANSCOM), concurrence in consultation with medical authorities.

(b) **Sensitive Equipment Decontamination.** Sensitive equipment decontamination considers the delicate nature of certain types of equipment (e.g., avionics and/or electrical, electronic, and environmental systems), aircraft and vehicle interiors, associated cargo, and some weapon systems. Due to the corrosive properties of most decontamination solutions, sensitive equipment decontamination options are limited. Best practices include employing contamination avoidance measures (to include COLPRO and standoff/point detection systems) to prevent or mitigate the effects to the interior contamination of vehicles, aircraft, and ships.

(c) **Aircraft Decontamination.** Aircraft pose unique decontamination challenges. Spot decontamination can be used as an immediate measure to mitigate unintentional transfer and spread contamination on aircraft that may require servicing between sorties, to support ingress and egress of aircraft by crews and passengers, or if performing pre- or post-flight inspections; however, clearance decontamination is required for unrestricted use of aircraft for international flight operations, transportation, and maintenance. Other alternatives include exposure of more aged and higher-hours platforms with a view toward rework or disposal that is less impactful to readiness or end strength. See Appendix F, "Contamination Mitigation Considerations," for additional information on aircraft decontamination considerations.

(d) **Sealift Decontamination.** The availability of clearance decontamination capabilities is necessary to ensure the unrestricted use of Military Sealift Command (MSC) ships for strategic sealift. To achieve this level of cleanliness, specialized teams with more sensitive detection equipment may be required. Near-term operational employment decisions can have long-term strategic consequences, because this level of decontamination is time-consuming and expensive, thus potentially reducing future unit availability. Considerations must include limited shipyard and contractor resource capabilities for conducting decontamination operations at this level. Therefore, the JFC should strive to limit the intentional CBRN exposure of MSC sealift ships to only those missions considered critical. JFC plans must take into account these challenges in considering employment of MSC ships to transport contaminated cargo or passengers or to operate in contaminated areas.

(e) **Fixed-Site Decontamination.** Fixed-site decontamination techniques focus on fixed facilities and mission support areas, such as communications systems, C2 facilities, intelligence facilities, supply depots, aerial and sea ports, medical facilities, and maintenance sites.

(f) **Cargo Decontamination.** Contaminated cargo must be packaged safely in accordance with hazardous materials procedures or decontaminated prior to transport. To minimize the spread of contamination and risks to personnel, the JFC will limit the retrograde of contaminated or formerly contaminated cargo to critical items that are preidentified in JFC plans, unless the cargo has been assessed to be safe or meets clearance standards. Every effort will be made to provide shipment traceability of contaminated or formerly contaminated cargo. Additionally, destination and transit countries may deny overflight and landing clearances to aircraft carrying contaminated cargo. US Presidential approval may be required for these shipments. Post-conflict redeployment of contaminated assets may require extensive decontamination measures (to include extended weathering) and the use of specialized teams and highly sensitive detection and monitoring equipment. In-place destruction/disposal of contaminated equipment may be necessary; detailed documentation pertaining to the in-place destruction of contaminated materiel will be retained by appropriate authorities.

(g) **Terrain Decontamination.** Absorption of CBRN materials by terrain surfaces may affect the tactical mission by restricting terrain (assuming the commander's guidance is to bypass contaminated areas) and result in delayed exposure. The decontamination of terrain speeds the weathering process, potentially opening critical terrain to use, and allows personnel to increase stay time in an area. Terrain decontamination requires extensive resources in terms of equipment, material, and time and must, therefore, be limited to areas of critical importance.

(h) **Decontamination of Human Remains.** Planning to operate in a CBRN environment necessitates planning for the decontamination of human remains.

## 7. Sustainment Considerations

a. Sustainment is the provision of logistics and personnel services to maintain operations through mission accomplishment and redeployment of the force. Sustainment provides the JFC the means to enable freedom of action and endurance and to extend operational reach. Sustainment determines the depth to which the joint force can conduct decisive operations, allowing the JFC to seize, retain, and exploit the initiative. For operations in a CBRN environment, unique sustainment considerations should include:

(1) Coordinating the resupply of CBRN defense and monitoring equipment. Some CBRN-related equipment is often commercial off-the-shelf items that may need special consideration for maintenance and replacement.

(2) Maintaining force health protection measures.

(3) Conducting contamination mitigation.

(4) Coordinating health services, medical readiness, mass casualty management, and mortuary affairs.

*For more information on health support services, refer to JP 4-02,* Joint Health Services.

b. Maintaining adequate logistics support is more difficult for operations in CBRN environments. Key considerations include the application of the joint logistics principles of sustainability, survivability, responsiveness, and flexibility to provide adequate CBRN-related equipment stocks and to support interoperability. The application of these principles in a CBRN environment is described as follows:

(1) **Sustainability.** Sustainability is the measure of the ability to maintain logistics support to all users throughout the theater for the duration of the operation. In CBRN environments, constant, long-term consumption of CBRN defense supplies requires careful planning; monitoring serviceability for items, such as IPE that have specific shelf lives (i.e., expiration dates); and anticipation of future requirements. In an active CBRN environment, water usage will dramatically increase both for human consumption and decontamination.

(2) **Survivability.** Theater logistics sites and units present an adversary with important and often high-value, fixed targets for CBRN attack. Protection planning must include both active and passive defense measures to minimize the risks from CBRN attacks while satisfying the needs of the joint force for uninterrupted logistics support.

(3) **Responsiveness.** The potential damage and environmental conditions caused by CBRN incidents may require relocation of bases and medical facilities, major redirection of supply flow, reallocation of transportation and engineering services, and short-notice transfer of replacement personnel or units from one part of the theater to

another. Plans should allow for surges in logistics requirements for CBRN defense consumables and equipment items to appropriate units.

(4) **Flexibility.** Work/rest cycles must be activated and implemented to the maximum practical extent allowed. Maintaining logistics flexibility in CBRN environments requires logistics units be capable of rapid alteration of work schedules. CBRN incidents can cause degradation of logistics activities due to having to operate in protective clothing and decontaminate supplies and equipment. Logistics plans need to include means for protective covering and sheltering of essential items against contamination.

(5) **CBRN Defense Equipment Stocks.** Logistic support for CBRN defense readiness includes providing adequate supplies and transportation of CBRN defense equipment, as well as assisting as necessary any CBRN defense organizations directly responsible for carrying out reconnaissance, decontamination, and supporting tasks.

(6) **Interoperability.** In operations outside the continental US, when the JFC will likely be working with HN and other forces, each member organization of a multinational operation is responsible for its own CBRN defense. The ability to exploit logistic interoperability (e.g., in equipment and supplies) can contribute to the effectiveness of the collective CBRN defense.

(7) **Training.** Individual and unit survival skills and the ability to perform mission-oriented tasks while in protective clothing are vital to theater logistic activities. Mission-essential tasks will be identified in theater plans and unit standard operating procedures, and regular training and certification should be conducted to establish individual and unit proficiency.

c. **Logistics Supportability Analysis.** The logistics supportability analysis provides a broad assessment of core logistics capabilities required to execute plans and define the total logistics requirement for execution of a concept of operations. Because of the potential impact of CBRN contamination on logistics support and support requirements, collaboration with CBRN experts is essential in this process. The CBRN staff can highlight potential deficiencies in supply forecasts (protective equipment, decontaminants, and filters) that may result from contamination; risks to the logistics support mission attributed to CBRN threats; and additional CBRN defense capability requirements that may result from exposure of logistics units, equipment, or facilities to CBRN contamination.

d. OPTEMPO, logistics, the health services, personnel services, and reconstitution efforts may be affected by the introduction of CBRN hazards and can present separate and distinct threats to personnel, units, equipment, and operations. The ability to assess the potential effects of CBRN weapons and hazards on the mission is a critical factor in deciding priorities for CBRN protection and efficiently allocating resources.

*See Appendix F, "Contamination Mitigation Considerations," for additional decontamination considerations.*

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# CHAPTER III
## EXECUTION

### 1. General

a. Joint operations require adaptability and flexibility during execution, particularly in CBRN environments. The application of operational art and operational design provides the operational approach and promotes unified action for planning and execution.

b. Execution applies the planning considerations described in Chapter II, "Planning," in support of joint operation plans. During execution, planning considerations for operating in CBRN environments support JFC decision making during all phases of an operation.

(1) During execution in a CBRN environment, the staff assesses how CBRN threats, hazards, and incidents have affected operations.

(2) Assessment recommendations concerning the impact of CBRN environments on joint operations help commanders adjust operations and the application of resources, determine when to develop and execute appropriate branches and sequels, and ensure current and future operations remain aligned with the mission and military end state (see Chapter IV, "Operation Assessment," for additional information). Execution continues until the mission is accomplished and/or termination criteria have been met.

c. Along with unity of command, centralized planning and direction and decentralized execution are key considerations in how JFCs organize and employ their forces. While

**OPERATION TOMODACHI—RADIATION HAZARDS**

**In 2011 a major earthquake struck off the northern coast of Japan resulting in a massive tsunami that crippled the Fukushima Daiichi Nuclear Power Station. The Department of Defense (DOD), along with several US Government departments and agencies, executed a response plan to support the government of Japan. DOD's primary concern was the potential massive radiation leak from the Fukushima Daiichi Nuclear Power Station. This concern led DOD to establish Operation TOMODACHI Registry (OTR), which would track the whole-body and thyroid radiation doses for the nearly 75,000 DOD-affiliated individuals who were on or near the mainland of Japan at the time of the event and the months following. OTR becomes a critical element in the overall response because of the hazard awareness and understanding (HAU) concept. Once radiation started escaping from the damaged nuclear power station, it became absolutely critical everyone involved in executing the US support response knew the extent of the radiation hazard. This illustrates the value of fusion, automation, and integration to enhance the joint chemical, biological, radiological, and nuclear HAU capability.**

**Various Sources**

JFCs may elect to centralize some functions, they should avoid reducing the versatility, responsiveness, and initiative of subordinate forces. JFCs should allow Service component and SOF organizations and capabilities to function generally as they were designed. However, the JFC should account for differences in Service or component capabilities in CBRN environments when synchronizing operations. Commanders should use situational leadership to maximize operational performance and overcome the ambiguities and uncertainties inherent in combat operations, especially when faced with a CBRN environment.

*For detailed information on tactical execution considerations, refer to FM 3-11/MCRP 10-10E.3(MCWP 3-37.1)/NWP 3-11/AFTTP 3-2.42,* Multi-Service Doctrine for Chemical, Biological, Radiological, and Nuclear Operations, *and ATP 3-05.11,* Army Special Operations Forces Chemical, Biological, Radiological, and Nuclear Operations.

## 2. Hazard Awareness and Understanding and Situational Awareness

a. The JFC and staff must share information and create the shared understanding, which is required to make informed and timely decisions amid massive quantities of operational data. Even a small or isolated CBRN incident may produce significant quantities of data that challenge decision makers if the capability to evolve from initial data gathering to full situational awareness does not exist. There is an evolution from a first bit of data provided by a CBRN sensor (or a group of sensors linked to provide a more complete picture of a large facility, city, or region) or another indicator of CBRN exposures (e.g., medical diagnosis) to full situational awareness of the implications of a CBRN incident based on shared information. The information concerning the causes of CBRN incidents and environments (hazard awareness) have to be properly processed, managed, and shared to create the necessary shared understanding (hazard understanding) that results in the wisdom essential to sound decision making. Sharing of CBRN hazard awareness and hazard understanding may be accomplished through antiterrorism or FP or by establishing CBRN working groups.

*For a more detailed discussion of creating shared understanding, see JP 3-0,* Joint Operations.

b. **CBRN Hazard Understanding.** CBRN hazard understanding is the dynamic individual and collective comprehension of the implications of emerging CBRN environments within the OE, facilitating the framing of problems and decision making during execution.

c. CBRN threat and hazard warnings and reporting play an instrumental role in achieving situational understanding. Awareness of a CBRN hazard results in warnings, alerts, and reports that provide hazard data which is key to decentralized operational decisions at all levels within the joint force. Awareness allows for the rapid warning and alerting of affected personnel who employ CBRN protective equipment and mitigation capabilities to negate the effects of the CBRN incident and help sustain operations. The

JFC processes this awareness of a CBRN incident to gain an understanding of its implications to joint operations.

*For more information on CBRN warning and reporting, refer to ATP 3-11.32/MCRP 10-10E.8/NTTP 3-11.37,* Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Passive Defense.

d. CBRN hazard awareness is achieved through the expert analysis of the information provided through the fusion of CBRN detectors and collected intelligence. The intelligence community collects and analyzes information about adversary CBRN capabilities and intentions, along with other potential sources of CBRN hazards. When the intelligence community has concerns about adversary CBRN capabilities, dispositions, and intentions, the CBRN defense community is responsible for ensuring CBRN technical information requirements are satisfied. As part of the JIPOE process, neutral and friendly activities that may be sources of potential CBRN hazards are also considered and analyzed. CBRN hazard awareness is also achieved through modeling and predicting a release of a CBRN hazard in the operating area. Modeling the release of a CBRN hazard allows friendly forces to anticipate the impacts of a CBRN release. A predictive model assists in understanding the hazards combined with the weather and terrain. This informs decision making regarding FP measures such as split-MOPP considerations and restrictions on movement during an operation.

e. CBRN hazard awareness leads to providing effective warning and reporting of threats to the force. See Chapter II, "Planning," subparagraph 5.f.(1), "Intelligence Support," for considerations for CBRN hazard awareness and understanding.

f. **Situational Understanding and Decision Making.** Applying decisions based on the shared understanding of the CBRN situation also requires understanding when to deploy and employ CBRN defensive capabilities such as IPE and COLPRO:

(1) **Deploy CBRN Defense and Protection Assets.** Deployment encompasses all activities from origin or home station through destination and specifically includes not only movement legs but also reception, staging, and onward movement/distribution. Examples of deployment decisions that might be needed:

(a) Where to deploy CBRN defense and protection assets?

(b) How much CBRN detection and identification equipment to deploy?

(c) When to deploy CBRN medical assets?

(d) What type of CBRN decontamination materials to deploy?

(e) Has CBRN response been tasked within the operational area, or should CBRN response be anticipated during the assigned mission?

(2) **Employ CBRN Defense and Protection Capabilities.** Examples of employment decisions that may need to be made:

(a) Employ CBRN contamination mitigation assets.

(b) Employ CBRN defense medical assets.

(c) Employ CBRN reconstruction and stabilization assets.

(d) If directed, employ CBRN response assets.

## 3. Protection

a. **General.** The introduction of WMD or CBRN hazards into a joint force's operational area necessitates specific actions to safeguard the mission and the force. Throughout the operation or campaign, the JFC employs active defense measures, such as air and missile defense and physical security, to defend against conventionally and asymmetrically delivered WMD. These capabilities deny an adversary the benefit to the use of CBRN threats and can influence their decision to employ them. These capabilities also represent benefits to allies and partners and can influence their support as well. The JFC employs CBRN defense capabilities (e.g., integration of IPE and other equipment to protect against WMD and CBRN or demonstrating to an adversary that personnel are trained) to reduce or negate vulnerabilities and minimize the effects of CBRN contamination. CBRN defense measures also protect US military interests, installations, and critical infrastructure. When WMD or CBRN hazards are encountered, the joint force focuses on controlling the effects of the release of the CBRN hazard, mitigating the threats, and then transitioning control to a competent authority for final disposition as the situation or mission dictates. These protection steps are undertaken whenever a joint force encounters a CBRN hazard and may be carried out incidental to the original mission or as a specified CWMD mission.

b. **Safeguard the Force and Manage Response.** The purpose of this activity is to allow the joint force and other mission-critical personnel to sustain effective operations and support US and foreign civil authorities and their populations by responding to a CBRN incident and mitigating the hazards and the effects of their use. When conducted on a small scale, safeguard the force and manage response tasks may constitute part or all of a crisis response or limited contingency operation. For major operations and campaigns, which balance offensive, defensive, and stability activities, this activity supports the joint force's defensive and stability actions. Within the construct of such activities, the joint force needs to be prepared for a variety of WMD or CBRN weapon situations, including an adversary's deliberate use, or other instances such as an inadvertent release, release due to joint force action, or actor of concern's employment of CBRN materials.

*For more information to safeguard the force and manage response, see JP 3-40,* Countering Weapons of Mass Destruction, *and JP 3-41,* Chemical, Biological, Radiological, and Nuclear Response, *respectively.*

## 4. Contamination Mitigation

a. **General.** Planning for contamination mitigation is discussed in Chapter II, "Planning." As part of execution, contamination mitigation enables joint forces to sustain operations in a contaminated environment without prolonged interruption of OPTEMPO. It also enables the quick restoration of essential capabilities or combat power required to accomplish the current mission and achieve operational objectives. In some cases, as a result of automatic agent defeating capabilities, no additional joint force or individual actions are required. Only if directed should the joint force conduct CBRN response in support of the civilian populations, to contribute to life saving and, as needed, maintain or restore essential services to support critical life supporting activities. Contamination mitigation includes planning, initiating, and continuing operations despite the potential for CBRN hazards through the conduct of contamination control and decontamination.

b. **Contamination Control.** The joint force quickly responds to contamination by initially mitigating the effects and performing only those actions required to allow continuation of the mission and, within mission constraints, save lives. A CBRN incident may contaminate essential operating areas, and local commanders need the capability to control the contamination of affected areas. Large, fixed sites (e.g., ports, airfields) with excess throughput capacity may allow split-MOPP operations implementation which provide the flexibility to shift operations to uncontaminated locations on the installation. At smaller facilities operating at full capacity, an incident could reduce throughput to a level below the JFC's requirements. Controlling contamination of equipment and operating surfaces at fixed sites is required to maintain operational capacity until decontamination can be undertaken.

c. **Decontamination.** The joint force conducts decontamination of personnel, equipment, operating surfaces, materials handling equipment (MHE), aircraft, vessels, and exposed military cargo to the extent required to sustain operations within contaminated environments and limit the spread of contamination throughout the OE. The OPTEMPO and mission will determine the level of decontamination required. The joint force should be prepared to conduct mass casualty decontamination operations.

d. **Recover from Contamination.** The joint force maintains access to resources and capabilities to mitigate any hazardous contamination to recover/maintain unit readiness for the required range of mission activities at acceptable contamination levels.

*For more information on decontamination activities and levels, see ATP 3-11.32/MCRP 10-10E.8/NTTP 3-11.37,* Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Passive Defense.

## 5. Sustainment Considerations

a. **General.** Operations will slow as tasks are performed by personnel encumbered by protective equipment or exposed to CBRN environments which may require abandonment or limited use of contaminated areas, transfer of missions to uncontaminated forces, or avoidance of contaminated terrain and routes. Additionally, the use of WMD or other CBRN incidents resulting in a major disruption of normal personnel and materiel replacement processes in the theater could severely hamper the commanders' capabilities for force generation and sustainment.

(1) Split-MOPP options could make available many forces that would otherwise have been unavailable due to unnecessary protective level constraints. Force reconstitution requirements may also dramatically increase over initial planning estimates. Even when sufficient protection has been afforded to individuals and units, continued operations in a CBRN environment could overburden reorganization and reconstitution capabilities, as well as the deployed military health system capabilities.

(2) Understanding the nature of CBRN contamination is central to JFC decisions that reduce the risk of casualties and cross-contamination and ensures the rapid resumption of operations after an incident. Coordinated reconnaissance, detection, identification, and marking is required. Personnel conduct self-assessment activities to detect possible contamination in their individual areas; however, military units trained and equipped to conduct CBRN reconnaissance are normally necessary to support JFC understanding of CBRN contamination in the OE.

*For more information, refer to ATP 3-11.37/MCRP10-10E.7(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.

b. **Logistics in CBRN Environments.** Logistics are particularly vulnerable to CBRN incidents. Movement of supplies and maintenance of equipment slows in CBRN environments. The resources needed for recovery from CBRN incidents can severely strain the theater logistic system and cause unanticipated effects on combat operations. Other logistics considerations may include:

(1) Increased water requirements for personnel and equipment decontamination operations.

(2) Large amounts of contaminated waste.

(3) Inventory shortages of low-density CBRN protective equipment may require unplanned movement of these critical supplies.

(4) Disruption of supply routes to avoid contaminated areas.

(5) Increased maintenance of contaminated equipment.

c. **Medical Logistics.** The threat of CBRN weapons against US military personnel constitutes a tremendous medical planning challenge. Planned medical countermeasures range from the routine management of medical materiel used for individual protection to planning responses for events that may produce catastrophic numbers of casualties. The level of investment in materiel and other countermeasures for anticipated response to a CBRN incident will depend upon the JFC's assessment of the threat and directives for planning and materiel readiness. Medical logistics considerations may include:

(1) Managing medical biological chemical defense materiel.

(2) Positioning and composition of CBRN response sets.

(3) Mitigating disruption of Class VIII distribution channels.

(4) Mitigating CBRN threats to medical units.

(5) Reconstituting medical logistics networks.

(6) Partnering with other USG departments and agencies.

(7) Deploying environmental laboratories to analyze suspected CBRN samples in the operational area.

*For more information, refer to JP 4-02,* Joint Health Services.

d. **Handling of Contaminated Materiel, Equipment, and Human Remains**

(1) **Materiel and Equipment.** The GCC is responsible for ensuring all materiel and equipment exposed to CBRN contamination is decontaminated to clearance level before it is returned to stock or retrograded from the theater. Thorough planning and Service TTP are used to protect individuals against low-level CBRN hazard exposure, conserve valuable assets, identify requirements for the return of equipment and personnel to the US, and maintain DOD life cycle control of previously contaminated equipment. Due to the limitations of decontamination technology in meeting all safety and health standards, some contaminated equipment may require extensive weathering to meet safety standards. In some cases, equipment may be so grossly contaminated that reuse or repair is not practical and in-theater destruction may occur.

(a) In accordance with current publications, contaminated materiel and equipment that cannot be decontaminated for operational use is marked, segregated, and disposed of or decontaminated after the cessation of hostilities. Theater plans and orders provide guidance and procedures for retrograde of contaminated materiel and prioritize selected items that, due to their essential nature and short supply, require immediate retrograde, repair, and subsequent return to the theater. For retrograde of equipment via mobility air forces airlift, cargo will be decontaminated to a clearance level sufficient to prevent aircraft contamination.

(b) The length of time nuclear and biological contaminants pose a health hazard is determined by their decay rates. The time required for the natural decay of radioactive material is a function of the half-life of the radionuclide and cannot be accelerated. If the residual radiation cannot be removed, commanders must employ the principles of time, distance, and shielding. Commanders should minimize the time personnel are exposed to the radiation source; maximize the distance between personnel and the radiation source; and place as much shielding material, such as walls or soil, between personnel and the radiation source as possible. Inhibit inhalation and ingestion routes of entry by using appropriate protective equipment for the radiological hazard. Biological agents generally decay to acceptable levels within hours after dissemination due to exposure to sunlight, relative humidity, wind speed, and temperature gradient. However, encapsulation or genetic engineering may protect agents from natural deterioration, increasing their persistency.

(c) Equipment retrograde and redeployment requires valuable lift assets that must be protected from contamination for future use for moving forces. Only critical retrograde cargo should be moved from a contaminated location onto uncontaminated aviation and maritime lift assets. Critical requirements are designated in theater plans. The intent to retrograde residually contaminated equipment must be thoroughly coordinated through the CJCS, DOD, and other relevant USG departments and agencies due to potential foreign and domestic risks and political/environmental sensitivities. The approval authority for landing contaminated aircraft at locations in areas outside of the US or its territories is coordinated through the Department of State (DOS) and the HN. Requests for approval to land such aircraft will be made through the appropriate CCMD, which, in turn, will seek DOS approval. Requests for landing contaminated aircraft within the continental US or territories is coordinated by the Headquarters US Air Force/Deputy Chief of Staff for Plans and Operations, who will, in turn, seek DOD approval. DOD must coordinate with applicable civilian authorities and will only issue guidance on contaminated aircraft movement after obtaining approval from the President or SecDef. CCDRs are responsible for cargo processing, to include packaging, technical escort, reception and staging, and foreign and interagency coordination; compliance with applicable US and international laws; compliance with treaties, conventions, and agreements to which the US is a party; and compliance with DOD policies on international and domestic CBRN response.

(2) **Human Remains.** The GCC has the responsibility to search, recover, tentatively identify, and deliver US human remains to the theater mortuary evacuation point. To complete this task, the JFC establishes a mortuary affairs contaminated remains mitigation site. This site is an operational element under the oversight of the joint mortuary affairs office (JMAO) and is manned by specialized mortuary affairs and CBRN personnel.

(a) In some circumstances, the JFC may need to authorize alternative procedures for the disposition of human remains. If human remains cannot be decontaminated to a safe level, decontamination capabilities are not available, or if there are other public health and safety concerns, contaminated human remains may have to be temporarily interred or stored in a manner that contains the CBRN hazard and the location should be properly marked to facilitate contamination avoidance. The JMAO directs and controls subsequent disinterment. Temporary interments require dedicated transportation assets to avoid the spread of contamination, engineer support to prepare the site, and security personnel to prevent unauthorized personnel from entering the interment area.

(b) If remains are contaminated, all efforts will be made to mitigate the contaminant and render safe for transport. For remains that cannot be decontaminated to a safe transportation level, protecting the health of Service members and the public must take precedence over rapid repatriation of remains. Temporary interment or temporary storage of remains is the recommended method of disposition until safe handling procedures and materials can be identified. Authority for temporary interment outside the US resides with the GCC. The appropriate JMAO directs and controls subsequent disinterment. Temporary interments require dedicated transportation assets to avoid the spread of contamination, engineer support to prepare the site, and security personnel to prevent unauthorized personnel from entering the interment area.

*For joint doctrine for handling contaminated human remains, see JP 4-06,* Mortuary Affairs.

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# CHAPTER IV
# OPERATION ASSESSMENT

## 1. Operation Assessment

In the context of planning and executing military operations, assessment is a continuous process that measures the overall effectiveness of employing joint force capabilities. Assessment involves deliberately comparing forecasts with actual events to determine the overall effectiveness of force employment. Specifically, an assessment process primarily helps the JFC and component commanders, and potentially other partners, determine progress toward accomplishing a task, creating a condition, or achieving an objective as the operation moves toward a desired end state. Assessment should not be confused with the intelligence function that provides intelligence assessments of the OE in the context of JIPOE. However, tailored JIPOE products, based on continuously updated intelligence requirements that include operation assessment indicators, can serve as major contributions to all levels of the assessment process of an operation or campaign. Assessments are applicable in all military operations. The JIPOE process supports assessment by helping the commander and staff decide what aspects of the OE to measure and how to measure them to determine progress toward accomplishing tasks and setting conditions necessary to achieve an objective. Based on their assessments, commanders direct adjustments, thus ensuring the operation remains focused on accomplishing the mission. Assessment of operations conducted in CBRN environments will increase the quantity and nature of variables that must be considered and analyzed to provide commanders with the most viable COAs. Planning and preparing for the assessment process must begin with the initial stage of joint planning, and during mission analysis, the initial set of mission success criteria normally becomes the basis for assessment. Assessment considerations help guide operational design because they can affect the sequence and type of actions along lines of operation and lines of effort.

## 2. Operation Assessment Process

The assessment process is directly tied to the commander's decision cycle throughout planning, preparation, and execution of operations. It entails three distinct tasks: continuously monitoring the situation and the progress of the operations; evaluating the operation against measures of effectiveness (MOEs) and measures of performance (MOPs) to determine progress relative to the mission, objectives, and end states; and developing recommendations and/or guidance for improvement.

a. Staffs help the commanders by monitoring the numerous aspects that can influence operations and providing the commander timely information needed for decisions. The assessment process approved by the commander helps the staff by identifying and monitoring key aspects of the operation the commander is interested in and where the commander wants to make decisions.

b. Normally, the operations directorate of a joint staff or the plans directorate of a joint staff, assisted by the intelligence directorate of a joint staff, is responsible for coordinating assessment activities. For subordinate commanders' staffs, this may be accomplished by equivalent elements within Service and/or joint functional components.

c. During planning, the staff analyzes threats, hazards, vulnerabilities, and capabilities to assist commanders in determining and refining priorities, task organization decisions, logistics and health services, intelligence collection requirements, resource allocation, and readiness requirements. The assessment process should identify activities required to maintain situational awareness, monitor and evaluate staff estimates and tasks, develop and monitor MOEs and MOPs, and identify potential variances that could require decisions.

d. During execution, the staff monitors and evaluates the progress of current operations to validate assumptions made in planning and to continually update changes to the situation. The staff also monitors the conduct of operations, looking for variances. When variances exceed threshold values developed or directed in planning, the staff may recommend an adjustment, such as an order to counter an unanticipated CBRN threat or hazard or to mitigate a developing vulnerability. They also track the status of assets and evaluate their effectiveness as they are employed.

e. The staff should monitor and evaluate the following aspects of the CBRN environment as part of the assessment process:

(1) Changes to CBRN threats and hazards.

(2) Changes in CBRN force vulnerabilities.

(3) Changes to unit capabilities.

(4) Validity of assumptions as they pertain to CBRN defense.

(5) Staff and commander estimates.

(6) CBRN environments and their conditions and changes.

(7) CBRN resource allocations.

(8) Increased risks.

(9) Supporting efforts.

*For additional information on the operation assessment process, see JP 5-0,* Joint Planning.

# APPENDIX A
## CHEMICAL HAZARD CONSIDERATIONS

### 1. General

Exposure to toxic chemicals can significantly influence the OPTEMPO and sustainment of forces. This appendix presents a brief overview of chemical agents and TICs and their effects.

### 2. Chemical Agents

a. Traditional chemical agents include agents in the categories of nerve, choking, blood, blister, and incapacitating. The terms "persistent" and "nonpersistent" generally describe the time an agent remains in an area. Persistent chemical agents present contamination hazards for unprotected personnel for more than 24 hours to several days or weeks. Conversely, a nonpersistent agent normally dissipates and/or loses its ability to cause casualties to unprotected personnel after considerably less time. The effects on personnel exposed to these hazards may be immediate or delayed. A summary of effects for persistent and nonpersistent chemical agents is shown in Figure A-1.

b. Figure A-2 indicates individual symptoms and effects, rate of action, and how chemical agents are normally disseminated.

c. Adversaries will seek to employ chemical agents under favorable weather conditions, if possible, to increase their effectiveness. Weather factors considered are wind, air stability, temperature, humidity, and precipitation. **Note: Adversaries may not wait for favorable weather conditions to employ chemical agents to create their desired effects.**

Chemical Agent Effects

| Persistency | Target of Choice | Target Effect |
|---|---|---|
| Nonpersistent<br>• Nerve<br>• Blood<br>• Choking | • Personnel | • Immediate<br>• Lethal |
| Persistent<br>• Nerve<br>• Blister | • Terrain<br>• Materiel<br>• Logistics<br>• Command and control facilities | • Reduced operations tempo or mission degradation<br>• Lethal or casualty producing |

**Figure A-1. Chemical Agent Effects**

## Chemical Warfare Agent Categories

| Types | Symptoms | Effects | Rate of Action | Release Form |
|---|---|---|---|---|
| Nerve | • difficulty breathing<br>• sweating<br>• drooling<br>• nausea<br>• vomiting<br>• convulsions<br>• dimming of vision<br>• headache<br>• (symptoms usually develop quickly) | • incapacitates at low concentrations<br>• death at high concentrations | • very rapid by inhalation or through the eyes<br>• slower through the skin | • aerosol<br>• vapor<br>• liquid |
| Blood<br><br>Choking | • difficulty breathing<br>• coma | • interference with respiration at cellular level or by interfering with oxygen transport | • rapid | • aerosol<br>• vapor |
| Blister | • symptoms range from immediate to delayed (agent dependent)<br>• searing of eyes<br>• stinging of skin<br>• powerful irritation of eyes, nose, and skin | • blisters skin and respiratory tract<br>• can cause temporary blindness<br>• some sting and form welts on the skin | • blisters from mustard may appear several hours after exposure<br>• Lewisite causes prompt burning, redness within 30 minutes; blister on first and second days<br>• phosgene oxime causes immediate, intense pain | • liquid<br>• particulate |

**Figure A-2. Chemical Warfare Agent Categories**

d. Adversaries may choose to deliver agents upwind of targets; in which case, stable or neutral conditions with low to medium winds of 5-13 kilometers per hour are the most favorable conditions. Marked turbulence, winds above 13 kilometers per hour, moderate to heavy rain, or an air stability category of "unstable" result in unfavorable conditions for chemical clouds. However, the adversary may be able to leverage these factors to effectively employ a persistent agent to contaminate water supplies or deny or clear terrain and material.

e. Most weather conditions do not affect the quantity of munitions needed for effective, initial liquid contamination. Once munitions have been delivered, however, weather conditions can impact the agent's effectiveness.

f. The National Countering Weapons of Mass Destruction Technical Reachback Enterprise, facilitated by the Defense Threat Reduction Agency (DTRA), can help to identify further information on the impact of the environment on chemical agent dispersion (see Appendix G, "Technical Chemical, Biological, Radiological, and Nuclear Forces," paragraph7.g., for DTRA Joint Operations Center contact information).

## 3. Toxic Industrial Chemicals

a. US forces frequently operate in environments in which TICs are present. A number of these chemicals could interfere in a significant manner across the range of military operations. Most TICs of immediate concern are released as vapors. These vapors exhibit the same dissemination characteristics as chemical warfare agents. The vapors tend to remain concentrated in natural low-lying areas such as valleys, ravines, or man-made underground structures downwind from the release point. High concentrations may remain in buildings, woods, or areas with low air circulation. Explosions may spread liquid hazards and vapors may condense to liquids in cold air.

b. Figure A-3 identifies recommended isolation and protective action distances associated with accidental releases of some selected TICs, as recommended by the *Emergency Response Guidebook* (ERG). Isolation and protective action distances listed in the ERG apply to a release of TICs. If the quantity of the TIC released is unknown, the distances for the large spills in the ERG should be utilized. Release of TICs is most dangerous at night. Generally, the downwind hazard area from a nighttime release is much greater because of cooler temperature and less wind than during the daytime.

Note: Distances in Figure A-3 are worst-case scenarios involving the instantaneous release of the entire contents of a package (e.g., as a result of terrorism, sabotage, or catastrophic accident). Figure A-3 distances were obtained by multiplying US Department of Transportation ERG distances by a factor of two.

c. The most important action in case of an industrial chemical release is **immediate evacuation from the hazard's path.** The greatest risk from a large-scale toxic chemical release occurs when personnel are unable to escape the immediate area and are overcome by vapors or blast effects. **Respirators (e.g., military-issued protective masks) and other protective equipment, including protective clothing, may provide only limited protection against TICs.** Unless there are indicators or other information that available protective equipment will not protect against the hazard, such equipment should be used during the immediate evacuation from the hazard area if more appropriate protective equipment is not available.

d. In planning for operations in areas that might include TICs, commanders at all levels should include consideration of these potential hazards as part of the JIPOE process.

## Industrial Chemical Site Minimum Downwind Hazard (Sample)

| Chemical* | Small Release (< 55 Gallon Drum) | | | Large Release (> 55 Gallons or Multiple Small Releases) | | |
|---|---|---|---|---|---|---|
| | Isolate All Directions (Meters) | Protect Downwind (Kilometers) | | Isolate All Directions (Meters) | Protect Downwind (Kilometers) | |
| | | Day | Night | | Day | Night |
| Ammonia | 60 | 0.2 | 0.2 | 120 | 1.2 | 4.4 |
| Chlorine | 60 | 0.4 | 2.4 | 480 | 2.4 | 7.4 |
| Nitric Acid | 60 | 0.2 | 0.2 | 120 | 1.2 | 2.4 |
| Phosgene | 180 | 1.8 | 8.2 | 1600 | 6.6 | 21+ |
| Sulfuric Acid | 120 | 0.8 | 2.0 | 660 | 5 | 13 |
| Hydrochloric Acid | As an immediate precautionary measure, isolate release in all directions for at least 50 meters for liquids and at least 25 meters for solids. | | | | | |
| Petrochemicals | | | | | | |
| Phosphoric Acid | | | | | | |

* Samples only. See the current version of the *Emergency Response Guidebook* for additional information.

**Figure A-3. Industrial Chemical Site Minimum Downwind Hazard (Sample)**

These hazards could occur from deliberate or accidental release from industrial sites, as well as storage and transport containers. Non-state actors have used IEDs to disperse TICs and other adversaries could be tempted to do the same. Particular emphasis should be placed on those TICs that produce acute effects when inhaled or that produce large amounts of toxic vapor when spilled in water. The findings from a comprehensive TIC assessment provide the risks presented by TIC in an OE.

*For detailed information on these and other TIC hazards, see the National Institute for Occupational Safety and Health* Pocket Guide to Chemical Hazards, *the US Department of Transportation Emergency Response Guide*, and the US National Library of Medicine Toxicology Data Network *at http://toxnet.nlm.nih.gov/.*

## 4. Nontraditional Agents

NTAs are chemicals and biochemicals researched or developed with potential application or intent as chemical warfare agents but which do not fall in the category of traditional chemical agents per the Chemical Weapons Convention. NTAs differ from traditional blister and nerve agents, on which the US previously focused its defensive efforts. There are multiple categories of NTAs. Each category of NTAs has its own set of distinguishing characteristics.

*For more information on NTAs and their characteristics, planning considerations, and mitigation, refer to Appendix E, "Nontraditional Agent Hazard Considerations."*

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# APPENDIX B
## BIOLOGICAL HAZARD CONSIDERATIONS

### 1. General

Militarily significant characteristics for biological aspects of operations include a normally vulnerable target population, contagious or toxic agents with highly lethal or incapacitating properties, agent availability or adaptability for scaled-up production, agent stability, and agent suitability for mass dispersion. Limiting factors include biological properties (e.g., virulence), environmental factors (e.g., ultraviolet light causing rapid decay), and dissemination methods (e.g., wet versus dry aerosol).

### 2. Technical Aspects

a. Biological agents are microorganisms capable of causing disease in humans, animals, and plants. Biological hazards are organisms, or substances derived from organisms, that pose a threat to human, plant, or animal health. These hazards include microorganisms, viruses, or toxins (from a biological source). Pathogens are disease-producing microorganisms (for example, bacteria, viruses, rickettsia, prions) that directly attack human, plant, or animal tissue and biological processes. Pathogens are further divided into noncontagious or contagious. When biological hazards are contagious, planning needs to account for possible ROM and evacuations. Toxins are nonliving, poisonous substances that are produced naturally by living organisms (e.g., plants, animals, insects, bacteria, fungi) but may also be synthetically manufactured. These hazards can originate from sources such as medical waste and biological environmental samples and/or clinical specimens. Advances in biotechnology, genetic engineering, and natural mutation may facilitate the development or emergence of deadlier biological agents. Biological warfare is the employment of biological agents to produce casualties in personnel, livestock, and animals or damage to plants and materiel or defense against such employment. Figure B-1 provides a list of selected biological agents and their disease characteristics.

(1) The ability to modify microbial agents at a molecular (gene) level has existed since the 1960s, when new genetic engineering techniques were introduced, but the enterprise tended to be slow and unpredictable. With today's techniques, infectious organisms can be modified to become more infectious and resistant to current prophylaxis and treatment options or to exhibit novel disease characteristics. The current level of sophistication for many biological agents is low, but there is enormous potential—based on advances in modern molecular biology and drug delivery technology—for making more sophisticated agents. Biological agents may emerge in two likely categories: man-made manipulations of classic biological agents and newly discovered or emerging infectious diseases. An example of a recent new pathogen (though not necessarily an ideal biological agent) is *Streptococcus pneumoniae* S23F, a naturally occurring strain of bacteria resistant to at least six of the more commonly used antibiotics.

## Pathogens, Viruses, and Toxins of Military Significance

| Disease (Etiological Agent) | Exposure Routes | Untreated Mortality (%) | Incubation Period | Medical Treatment | Communicability (Human to Human) |
|---|---|---|---|---|---|
| **Bacteria and Rickettsia** | | | | | |
| Anthrax (*Bacillus anthracis* (spores)) | I, C, In | I: ≥ 99<br>C: 5-20<br>In: 25-75 | 1-6 days | Vaccine<br>Antibiotics | No |
| Plague (*Yersinia pestis*) | I, V | I: ≥ 99<br>V: 60 | 1-6 days | Antibiotics | High |
| Q Fever (*Cociella burnetti*) | I, C | < 1 | 2-10 days | Antibiotics<br>Investigative vaccine | No |
| Tularemia (*Francisella tularensis*) | I, C, V, In | I: 30-60<br>C,V,In: 10-25 | 3-5 days<br>(1-21 days) | Antibiotics<br>Investigative vaccine | No |
| **Viruses** | | | | | |
| Smallpox (Variola major) | I | 30 | 7-17 days | Vaccine | High |
| Viral Equine Encephalitis | | | | | |
| Venezuelan<br>Eastern<br>Western | I, V | I: 35, V: 10<br>I: >75, V: 50-75<br>I: 40, V: 10 | 2-6 days<br>5-15 days<br>4-10 days | Investigative vaccine<br>Antiviral drugs | No |
| Viral Hemorrhagic Fever | | | | | |
| Ebola<br>Marburg<br>Lassa<br>Crimean-Congo | I, C. V | 50<br>25-90<br>15-50<br>10-40 | 2-21 days<br>5-10 days<br>6-21 days<br>5-6 days | Investigative vaccine<br>Antiviral drugs | Moderate<br>Moderate<br>Moderate<br>Low |
| Zika Virus Disease (Zika Virus) | V,C | <1 | 3-12 days | Supportive Care | Low (body fluids) |
| **Toxins** | | | | | |
| Botulism (*Botulinum* neurotoxin) | I, In | I: >60<br>In: 10-50 | I: 6-36 hours<br>In: 18-36 hours | Antitoxin | No |
| Ricin Intoxication (ricin toxin from *Ricinus communis*) | I, In | I: >50<br>In: < 30 | I: 5-6 hours<br>In: 12-36 hours | Supportive Care | No |
| SEB Intoxication (*Staphylococcal* Enterotoxin B) | I, C, In | < 1 | 1-24 hours | Supportive Care | No |
| T2 Mycotoxin Intoxication (*Trichothecene* Mycotoxin) | I, C, In | 10-60 | Minutes-hours | Supportive Care | No (dermal transfer) |

NOTE: A vector refers to an arthropod or mammal that carries and transmits a pathogen.

Legend

C cutaneous
I inhalation
In ingestion
V vector

**Figure B-1. Pathogens, Viruses, and Toxins of Military Significance**

(2) The types of modified biological agents that could potentially be produced through genetic engineering methodologies are listed below. Each of these techniques

seeks to capitalize on the extreme lethality, virulence, or infectivity of biological agents and exploit this potential by developing methods to deliver agents more efficiently and to gain control of the agent on the battlefield.

(a) Benign microorganisms genetically altered to produce a toxin or bioregulator (naturally occurring organic compounds that regulate diverse cellular processes in multiple organ systems, such as heart rate).

(b) Microorganisms resistant to antibiotics, standard vaccines, antivirals, and therapeutics.

(c) Microorganisms with enhanced aerosol and environmental stability.

(d) Immunologically altered microorganisms able to defeat standard detection, identification, and diagnostic methods.

(e) Combinations of the above four types with improved delivery systems.

b. **TIBs.** TIBs include infectious agents, as well as other biological hazards. The risk can be direct through infection or indirect through damage to the environment. TIBs are often generated as infectious waste, such as on sharp-edged medical instruments commonly known as “sharps” (e.g., needles, syringes, and lancets), material contaminated by bodily fluids, and as biological clinical specimens (e.g., biopsies or diseases for research).

## 3. Operational Considerations

a. **Dissemination.** Biological agents may be dispersed or deposited as aerosols, liquid droplets, or dry powders. In general, agents dispersed as dry powder are more viable than those dispersed as wet aerosols. Biological agents can also be transmitted directly by arthropod vectors or by an infected individual. An arthropod is an invertebrate animal having an exoskeleton. Infected arthropod vectors are useful for penetrating the skin.

b. **Persistency.** The longevity of biological agents is greatly dependent on their viability (ability to cause disease). Examples of viability are shown in Figure B-2.

c. **Environmental Conditions.** Environmental conditions may also affect the viability of biological material (see Figure B-3). These conditions include: solar (ultraviolet) radiation, relative humidity, wind speed, and temperature gradient. Ultraviolet light decreases the viability of most aerosol disseminated biological agents. However, encapsulation through man-made processes, natural sporulation, or arthropod vectors may protect biological agents from the impacts of the environment and increase agent viability.

d. **Trigger Events.** With current technology, it is possible a biological attack will occur before local commanders are aware it has taken place. Commanders, in conjunction with their medical staffs, must attempt to distinguish between an epidemic of natural origin, a biological attack, or the release of/exposure to TIBs. Trigger events can assist

## Examples of Biological Material Viability

| Disease (Etiological Agent) | Likely Dissemination Method | Exposure Route | Infectivity | Untreated Mortality | Environmental Stability |
|---|---|---|---|---|---|
| **Bacteria and Rickettsia** | | | | | |
| Inhalation Anthrax (*Bacillus anthracis* (spores)) | • Aerosol | Inhalation | Moderate | High | Very stable |
| Pneumonic Plague (*Yersinia pestis*) | • Aerosol<br>• Arthropod | Inhalation<br>Bite | High | Very High | Unstable |
| Q Fever (*Cociella burnetti*) | • Aerosol<br>• Liquid | Inhalation<br>Ingestion | High | Low | Stable |
| Tularemia (*Francisella tularensis*) | • Aerosol<br>• Arthropod<br>• Liquid | Inhalation<br>Bite<br>Ingestion | High | Moderate | Stable |
| **Viruses** | | | | | |
| Smallpox (*Variola* major) | • Aerosol | Inhalation<br>Dermal | Moderate | High | Stable |
| Viral Encephalitis (Eastern, Western, and Venezuelan Equine Encephalitis Virus) | • Aerosol | Inhalation | High | • Eastern - High<br>• Western - High<br>• Venezuelan - High | Stable |
| Viral Hemorrhagic Fever (Ebola, Marburg, Lassa, Crimean-Congo, others) | • Aerosol | Inhalation | High | • Ebola - High<br>• Marburg - Moderate<br>• Lassa - Low<br>• Crimean-Congo - Moderate | Unstable |
| **Toxins** | | | | | |
| Botulism (*Botulinum* neurotoxin) | • Aerosol<br>• Liquid | Inhalation<br>Ingestion | Not Applicable | High | Stable |
| Ricin Intoxication (ricin toxin from *Ricinus communis*) | • Aerosol | Inhalation | Not Applicable | Moderate | Stable |
| SEB Intoxication (*Staphylococcal* Enterotoxin B) | • Aerosol<br>• Liquid | Inhalation<br>Ingestion | Not Applicable | Low | Stable |

**Figure B-2. Examples of Biological Material Viability**

commanders and the medical staff by providing an indication a biological incident is likely to occur, may have occurred, or has occurred and will prompt commanders to initiate response measures. Possible triggers signaling a biological event include: evidence of atypical disease and death of livestock and populations; reports of suspicious disease clusters; alarming of biological monitoring sensors; intelligence indicators of concerning modes of enemy protective posture, treatment capability, and medical equipment employability; sentinel cases; or rare diseases.

## Weather Effects on Biological Agent Dissemination

| | Weather Condition | Biological Warfare Agent Cloud Performance | Operational Considerations |
|---|---|---|---|
| Favorable | Stable or inversion conditions | Agent clouds travel downwind for long distances before they spread laterally.<br><br>High humidity and light rains generally favor wet agent dissemination. | Agent clouds tend to dissipate uniformly and remain cohesive as they travel downwind.<br><br>Clouds lie low to the ground and may not rise high enough to cover the tops of buildings and/or other tall objects. |
| Marginal | Neutral conditions | Agent clouds tend to dissipate quickly. | More agent required for the same results as under stable conditions.<br><br>Desired results may not be achieved. |
| Unfavorable | Unstable or lapse conditions | Agent clouds rise rapidly and do not travel downwind any appreciable distance.<br><br>Cold temperatures affect wet agent dissemination. | Agent clouds tend to break up and become diffused.<br><br>Little operational benefit from off-target dissemination. |

**Figure B-3. Weather Effects on Biological Agent Dissemination**

*See DODI 6200.03,* Public Health Emergency Management Within the Department of Defense, *for further description of roles, responsibilities, and qualifications of medical staff.*

(1) An intelligence warning trigger event occurs when a commander receives convincing information (unanalyzed) or intelligence (analyzed information) indicating a biological incident (naturally occurring, accidental, or intentional) is imminent. Information and intelligence from multiple sources (e.g., the general public, military intelligence, and national intelligence institutions in the HN) can provide advance warning of a biological event.

(2) Weapons trigger events refer to attacks by a weapon system(s), such as missile(s), artillery, or observed attacks employing other delivery means such as an aerosol

sprayer device. Where intelligence has assessed a biological weapon capability, it is reasonable to initially react to weapons events as if they could contain biological agents.

(3) A detector alarm trigger event refers to the discovery of a biological event via a positive result from a detection device, such as positive identification of environmental samples (e.g., water, food), indicating a biological agent is present. Detectors are not an absolute method of indicating the presence of biological agents due to the sensitivity threshold limitations of the devices and the possibility of false negatives/positives. Positive results via detector, followed up with laboratory analysis, may permit discovery of a biological hazard prior to the onset of symptoms.

(4) A sentinel casualty trigger refers to the medical community's detection of a biological agent or infectious disease hazard by assessing trends in medical symptoms among personnel or diagnosis of an index case. Response actions based on a sentinel casualty may begin well into the disease progression cycle. This information may be made available via the news media, the Centers for Disease Control and Prevention, the Armed Forces Health Surveillance Branch, the Service's public health centers, the World Health Organization, the National Center for Medical Intelligence, or state and local public health departments.

e. **Additional Attack Indicators.** In addition to the trigger events listed in the subparagraphs for 3.d., "Trigger Events," the surrounding environment can also provide indication of a biological attack. Particular attention should be given to the following:

(1) Increased numbers of sick or dead animals, often of different species. Some biological agents are capable of infecting/intoxicating a wide range of hosts.

(2) Unusual entomological parameters (dead insects).

(3) Unusual death or wilting of plants in a certain area.

f. **Sources and Requirements for Weaponization.** Very little distinguishes a vaccine or pharmaceutical plant from a biological production facility. Nearly all the equipment, technology, and materials needed for biological agent production are dual use. On a smaller scale, the same type of equipment is found in research facilities and universities as well. However, the means of production is directly tied to the means of dissemination. Far less technical production capability is required to produce a biological agent to disseminate in an improvised weapon, such as an IED, or letter than it is for a ballistic missile.

## 4. Biological Defense

Biological defense comprises the methods, plans, and procedures involved in establishing and executing defensive measures against biological attack. In striking contrast to protection against chemical, radiological, and nuclear weapons, there exists the potential to minimize the effects of biological agents. The combined use of medical surveillance, identification, medical countermeasures, physical protection, and ROM provides the basis of biological defense.

a. **Medical Surveillance.** In some cases, humans may be the only biodetector. Early clinical findings may be nonspecific or atypical of the natural disease. Medical personnel may be unable to differentiate natural disease from biological attacks. Considerable time may elapse following a biological attack before the extent of the exposure is known. To enable identification of a biological attack, ongoing, systematic collection and analysis of health data are essential. Following a biological attack, the disease pattern may have characteristics that differ from those of a naturally occurring epidemic. The following are examples:

(1) In contrast to naturally occurring epidemics (excluding food-borne outbreaks) in which disease incidence increases over a period of weeks or months, or an area's endemic diseases, which has a persistent and fairly stable number of infections over time, the epidemic curve for most large, artificially induced outbreaks is compressed, peaking within a few hours or days.

(2) In contrast to the peaks and troughs evident in most natural disease outbreaks, a steady and increasing stream of patients may be seen (comparable to that during an accidental food poisoning outbreak).

(3) An understanding of disease ecology and epidemiology can be extremely useful in distinguishing natural outbreaks from those induced by a biological attack. For example, diseases that are naturally vector-borne will have environmental parameters that predispose to naturally occurring outbreaks. Appearance of disease in the absence of these parameters would be highly suggestive of a biological attack. Epidemiology is the branch of medicine that deals with the study of the causes, distribution, and control of disease in populations.

(4) The military health system must maintain routine disease surveillance and syndromic surveillance in AORs with a high probability of biological attack; emergence of an atypical pattern mandates immediate notification of higher authority. The simultaneous appearance of outbreaks in different geographical locations should alert to the possibility of a biological attack. In addition, multiple biological agents may be used simultaneously in a biological attack, or chemical and biological agents may be combined in a single attack to complicate diagnosis.

(5) A large number of casualties within a period of two to three days (suggesting an attack with a microorganism) or within hours (suggesting an attack with a toxin) would epidemiologically indicate a massive single source.

(6) A large number of clinical cases among exposed individuals.

(7) An illness type highly unusual for the geographic area (e.g., Venezuelan equine encephalitis in Europe).

(8) An illness occurring in an unnatural epidemiological setting, where environmental parameters are not conducive to natural transmission (e.g., Venezuelan equine encephalitis in the absence of antecedent disease in horses or in the absence of vector mosquitoes).

(9) An unusually high prevalence of respiratory involvement in diseases that, when acquired in nature, generally cause a non-pulmonary syndrome—the signature of aerosol exposure (e.g., inhalational anthrax).

(10) Casualty distribution aligned with recent wind direction.

(11) Lower attack rates among those working indoors, especially in areas with filtered air or closed ventilation systems, than in those exposed outdoors. The reverse is true when the attack is made by using ventilation systems to disseminate biological agents indoors.

(12) Large numbers of rapidly fatal cases, with few recognizable signs and symptoms, resulting from exposure to multiple lethal doses near the dissemination source.

b. **Identification**

(1) There are four levels of identification associated with CBRN hazards—presumptive, field confirmatory, theater validation, and definitive. The higher the level of identification, the higher confidence the commander has that a CBRN incident has occurred.

(a) **Presumptive identification** is the employment of technologies with limited specificity and sensitivity by conventional forces in a field environment to determine the presence of a CBRN hazard with a low level of confidence and the degree of certainty necessary to support immediate tactical decisions.

(b) **Field confirmatory identification** is the employment of technologies with increased specificity and sensitivity by technical forces in a field environment to identify CBRN hazards with a moderate level of confidence and the degree of certainty necessary to support follow-on tactical decisions.

(c) **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 CBRN hazard with a high level of confidence and the degree of certainty necessary to support operational-level decisions.

(d) **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 CBRN hazard with the highest level of confidence and degree of certainty necessary to support strategic-level decisions.

(2) Identification of biological agents is essential to determine appropriate operational and medical countermeasure responses that may be taken by the JFC and public health officials.

(a) Presumptive identification of the biological agent in the operational area will influence initial responses. Biological agent categories can generally be described as:

1. Communicable diseases, such as pneumonic plague, smallpox, influenza, and many others, that are able to be transmitted from person to person.

2. Noncommunicable diseases, such as anthrax, that can contaminate an area and infect personnel but are not able to be transmitted from person to person.

3. Noncommunicable biological agents, such as toxins and many other bacterial pathogens, that primarily only cause effects in directly exposed personnel.

(b) Field confirmatory identification is obtained using devices/materials/technologies available to specially trained personnel and units in a field environment that includes collections and analyses of samples to substantiate the presence and type of a biological substance at a given 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.

(c) Theater validation identification qualifies a biological sample if using the accepted quality assurance measures. It provides additional critical information to support timely and effective decisions regarding avoidance, protection, decontamination measures, 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.

c. **Medical Countermeasures**

(1) **Immunoprophylaxis**

(a) **Active Immunoprophylaxis.** Vaccination is an important practical means of providing continuous protection against biological hazards prior to, as well as during, hostile actions. Vaccines against a number of potential biological agents are available. Many of these vaccines were developed for the protection of laboratory workers or individuals working where the target diseases are endemic.

1. During a biological agent attack, the number of infectious or toxin units to which an individual is exposed may be greater than in the case of natural exposure.

Exposure by inhalation may represent an unnatural route of infection with many biological agents. The efficacy afforded by most vaccines is based on route of exposure and presentation of disease. Vaccines, which are generally considered to be effective under natural circumstances, may not provide a similar degree of protection to individuals exposed to aerosolized or genetically altered agents.

2. An appropriate immunization policy is essential. Vaccines are biological agent-specific and do not provide immediate protection. Not all vaccines can be administered simultaneously; therefore, to prevent the logistic problems caused by in-theater vaccination, prior immunization is essential.

3. If an in-theater vaccination program is required, the possibility of adverse reactions from vaccination and the concomitant degradation of operational efficiency should be taken into account.

(b) **Passive Immunoprophylaxis.** For some biological agents, the only available medical countermeasures might be specific antisera. Under certain conditions, passive immunoprophylaxis with immunoglobulin products might be considered. Use may be limited by lack of adequate sources and quantities of material, limited duration of protection, and the risk of serum sickness associated with antisera of animal origin. However, recent scientific advances in products for immunoprophylaxis (for example, human monoclonal antibodies, despeciated equine or ovine antisera) are making this option technically more attractive.

(2) **Chemoprophylaxis**

(a) Chemoprophylaxis using appropriate drugs (e.g., antibacterials, antibiotics, antivirals) may offer additional protection in the event of a biological incident. If an attack is felt to be imminent (i.e., intelligence indicator), or is known to have occurred (i.e., weapon or a sentinel casualty), command-directed chemoprophylaxis would be appropriate for all personnel in the area. However, it is impractical and wasteful to place everyone located in a potential target area on prolonged, routine antimicrobial prophylaxis in the absence of such a threat condition. Chemoprophylaxis/in-theater use of antibiotics or pharmaceuticals may be a Food and Drug Administration (FDA) off-label use.

(b) For bacterial agents, antibiotics should be administered as soon as possible following exposure. Initiation of chemoprophylaxis during the incubation period is always worthwhile. However, the earlier the antibiotic is given, the greater is the chance of preventing disease. In some cases (e.g., inhalational anthrax), post-exposure vaccination must be given in addition to antibiotics to personnel previously unvaccinated to prevent late onset of disease when antibiotics are withdrawn.

(c) Consideration should be given to the possibility of the interaction between drugs in multi-drug regimens that address the multiple elements of force health protection. Medical personnel must ensure consistent observation of personnel receiving chemoprophylaxis to identify and treat harmful interactions or side effects.

d. **Physical Protection**

(1) **IPE/PPE**

(a) **Respiratory Protection.** Respiratory protection is essential in the presence of any biological inhalation hazard. Currently, fielded field protective masks equipped with standard filters provide a high degree of protection but increase the physiological burden for the force when worn as respiratory protection during missions over extended periods of time spanning weeks to months. Other forms of protection (e.g., self-contained breathing apparatus) are available and may be fielded to meet particular conditions. Surgical masks may be worn as part of a layered approach (i.e., while indoors resting) to reduce the physiological burden of wearing a full-face respirator. Low-grade dust masks or warming layers pulled over the face are not sufficient to protect against aerosol attacks. Personnel using military and/or commercial protective equipment (e.g., military protective masks, commercial respirators, military and commercial protective clothing) shall be required to follow Service-specific IPE/PPE requirements.

(b) **Dermal Protection.** Intact skin provides an excellent barrier against biological agents; however, any skin abrasions or inflammation must be covered. In some instances it may be necessary to protect the mucous membranes of the eye. IPE clothing employed against CBRN agents will protect against skin contamination with biological agents, although standard uniform clothing affords a certain degree of protection against dermal exposure to the surfaces covered.

(c) **Casualties.** Casualties unable to continue wearing IPE in a biological-agent contaminated area should be held and/or transported using containment measures to protect the casualty against biological agent exposure. Contagious patients should be held and/or transported using a barrier system to prevent disease transmission.

(2) **COLPRO**

(a) A COLPRO shelter is a dedicated, hardened or unhardened shelter equipped with a CBRN air filtration unit. This shelter provides an overpressure environment to allow medical treatment personnel to work inside with minimal IPE/PPE or without the need for additional IPE/PPE. Contaminated patients, staff, and equipment/materials must be decontaminated prior to entering a COLPRO shelter to maintain its integrity.

(b) COLPRO is the most effective method for protecting clean patients, medical personnel, and the medical treatment facility (MTF) during the primary biological attack. Patients whose illness is thought to be the result of a biological attack or those who are thought to have a transmissible disease will necessarily be cared for using barrier protection techniques. The environment within COLPRO may promote cross-infection between casualties and staff and it may be appropriate to care for these patients outside COLPRO.

*For more information on individual, patient, and caregiver protection, refer to ATP 4-02.7/MCRP 3-40A.6(MCRP 4-11.1F)/NTTP 4-02.7/AFTTP 3-42.3,* Multi-Service Tactics, Techniques, and Procedures for Health Service Support in a Chemical, Biological, Radiological, and Nuclear Environment.

e. **ROM**

(1) To prevent the spread of an infectious disease or contagious illness, public health authorities use different techniques. ROM (including isolation, and quarantine enforcement actions) is generally within the jurisdiction of the state and local authorities and, when overseas, HN authorities. Enforcement actions by DOD personnel will likely be restricted by the Posse Comitatus Act and/or DOD policy unless an alternative statutory or constitutional authority exists (e.g., Presidential invocation of the Insurrection Act). In areas outside of the US, enforcement actions by DOD personnel are conditioned by applicable treaties, agreements, and/or other arrangements with foreign governments and allied forces. Implementation of these actions at non-US installations and field activities shall require formal agreements with HN authorities as well as multinational forces.

(2) ROM refers to the controlling the movement of or contact with potentially infected persons to stop the spread of contagious disease. In the case of military personnel, restrictions, isolation, quarantine, or any other measure necessary to prevent or limit transmitting a communicable disease may be implemented. In the case of persons other than military personnel, restrictions may include limiting ingress to, egress from, or movement on a military installation.

(a) Isolation is a form of ROM that refers to the separation of persons who have a specific infectious illness from a healthy population. Isolation allows for the target delivery of specialized medical care to people who are ill, while protecting healthy people from getting sick. Infected people in isolation may be cared for in their homes, in hospitals, or in designated MTFs. DODI 6200.03, *Public Health Emergency Management Within the Department of Defense,* addresses requirements for managing the impact of public health emergencies caused by all hazards incidents.

(b) Quarantine is a second form of ROM that refers to separating and restricting the movement of persons who, while not yet ill and have not shown signs and symptoms of the disease, have been exposed to an infectious agent and therefore may become infectious. Quarantine involves the confinement and active, continued medical surveillance of an individual who is suspected of having been exposed to an infectious agent until determined that they are free of infection. Quarantine is medically very effective in protecting the public from disease.

(c) Other restrictions could be determined based on the potential exposure of members of the US Armed Forces as a result of a directed response to a biological hazard outbreak. In the case of the Ebola virus disease outbreak, DOD instituted a system of controlled monitoring. Controlled monitoring is the process by which trained healthcare professionals or appropriately trained DOD personnel directly observe Service members and volunteering DOD civilian employees, monitor their twice-daily temperature checks, and evaluate daily for symptoms consistent with the Ebola virus disease in a controlled monitoring area established by the installation commander. During controlled monitoring in this area, Service members and volunteering DOD civilian employees are prohibited from having physical contact with family members and the general population.

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# APPENDIX C
## RADIOLOGICAL HAZARD CONSIDERATIONS

### 1. General

a. Radiation is ever-present, and there is a background of natural radiation everywhere in our environment. It comes from space (e.g., cosmic rays) and from naturally occurring radioactive materials contained in the earth (e.g., uranium) and in living things (e.g., potassium-40). The source of radiation may be natural or man-made. Man-made sources are created by processing natural radioactive material or by neutron bombardment and/or accelerators and include machine-generated radiation. Naturally occurring radioactive sources can complicate detection and quantification of man-made radiation and the interpretation of radiation measurements for identifying and marking a potential hazard area, making radiation risk management challenging. It should also be noted that many common radioactive materials also present a chemical toxicity hazard; this hazard may actually exceed that of the radiation.

b. Radiation hazards may arise from the presence of large amounts of natural radioactivity (high background); unintentional, improper use of radioactive material; intentional use of radioactive material to kill or injure personnel; area denial purposes; or nuclear weapons detonation and fallout. Radiation threats differ from chemical and biological threats because radiation cannot be "neutralized" or "sterilized" and is not contagious. Further, exposure to radiation does not require direct physical contact.

c. Radiation should be differentiated from the radioactive material itself. Radiation is the energy emitted in the form of electromagnetic energy or as subatomic particles and, as such, can interact at some distance from the radioactive material itself. Radioactivity is a physical property of energetically unstable atoms. Radioactive material is a substance emitting radiation. A radionuclide is an element that has excess energy, making it unstable (i.e., radioactive); there can be multiple radionuclides for the same element. Each radionuclide has a unique characteristic half-life. Half-life describes the rate at which a specific radioactive material decays or changes from one nuclide to another nuclide that may in turn be radioactive or stable. Half-life can vary from a fraction of a second to many years, but once a material is stable, there is no longer an associated radiation emission.

d. There are many variables that influence the human health impact of radiation exposure. A whole body exposure to penetrating radiation may result in immediate effects if delivered in large amounts over a short period of time; cancer may develop years later or no adverse medical conditions at all. The effects of radiation exposure are usually enhanced if there are other concurrent injuries. There are medical countermeasures and treatments that can be employed to moderate the effects of the radiation exposure.

e. The Services are specifically responsible for establishing radiation safety policy and guidance for handling military radioactive material commodities, such as depleted uranium munitions, and for developing and enforcing exposure standards that protect personnel against external and internal exposure. In the operational area, the commander, in consultation with the staff, is responsible for managing risk for those within the command.

f. There are a variety of instruments that exist at various echelons designed to detect radiation. At the unit level, there are handheld devices (e.g., radiation detection, indication, and computation equipment) and dosimetry. Dosimeters are used to measure exposure to ionizing radiation, at the unit or individual level. Specialized units may have more advanced handheld devices, as well as laboratory grade equipment. Definitive quantitative measurements of air, water, and soils can be performed at Service laboratories specializing in environmental radiation measurements. Background radiation must always be a consideration in the employment of radiation detection devices.

g. There are a number of methods to mitigate radiation hazards. The most straightforward and effective way is to avoid areas with radiation levels. Radiation hazards should be assessed in the context of all other hazards (e.g., minefields, active engagement with the enemy, chemical or biological hazards). If avoidance is not an option, then time, distance, and shielding should be used to limit exposure. Reduce the time of exposure, maximize the distance between the source and personnel, and utilize shielding material to reduce exposure. Individual protection and COLPRO can be used to preclude skin contamination and internal contamination via inhalation, ingestion, or injection. Decontamination methods can be used to limit exposure and potential cross-contamination. Finally, medical countermeasures can be used to limit the internal uptake of radionuclides and enhance the excretion of internal contaminants. Medical treatments are also used to lessen the effects of external exposure.

h. A risk management tool to track and limit radiation exposures has been developed. Radiation exposure status (RES) is used to track unit exposure level, while the OEG is the commander's primary administrative control used to limit radiation exposure to personnel for a given mission.

## 2. The Radiological Hazard

a. **Introduction**

(1) In addition to direct exposure to radiation and fallout from a nuclear detonation, there are many other potential sources of radiation. These sources can be broken down into four broad categories: natural, industrial, medical, and military commodities. TIR refers to any radiological material manufactured, used, transported, stored, and disposed in industrial, medical, or military processes. Radiation is emitted in the form of neutrons, alpha particles, beta particles, gamma rays, or X-rays. Once radioactive material is introduced into the environment, it may be found in air, soil, and water, or as contamination on any object.

(2) Radioactive materials, to include fissile material, may be used by an aggressor in one or more of the following ways: as a nuclear device, an improvised nuclear device (IND), an RDD, or as a radiological exposure device (RED).

(3) The health effects of exposure to radiation and radioactive materials can be deterministic or stochastic.

(a) **Deterministic effects** are those in which the severity of the effect increases with dose above some threshold, below which there is no apparent effect, and only happens at relatively high doses. Large doses in a short time period may cause a combination of deterministic effects termed acute radiation syndrome. The higher the dose, the faster these effects occur and the more severe the syndrome.

(b) **Stochastic effects** have a delayed onset and have an increasing chance of occurrence with increasing dose. All doses of radiation have the potential to cause an increase in an individual's risk of cancer. Since the probability of the effect (i.e., cancer risk) increases with dose, it is termed stochastic or nondeterministic. Note the severity of nondeterministic effects is unaffected by increasing dose (i.e., an individual either has cancer or does not, and there is no threshold). Occupational radiation safety programs and regulations are designed to preclude deterministic effects and limit stochastic effects to an acceptable level. Figure C-1 summarizes the overall effects of prompt radiation exposure as a function of dose for healthy, young adults with no other injuries. The threshold for deterministic effects will be lower for personnel with combined injuries. Medical intervention can limit some effects and increase survivability.

b. **Sources of Radiation (see Figure C-2)**

(1) Nuclear detonation and fallout.

(2) Natural sources of radiation include those of both terrestrial and cosmic origin. Terrestrial radionuclides found in the Earth's crust include uranium and thorium decay chains, among others. The Earth is exposed to cosmic radiation. These are the main contributors to background radiation, along with worldwide fallout from above ground nuclear weapons testing.

(3) Industrial sources of radiation include cargo inspection systems, industrial X-ray machines, accelerators, sterilizers for food and medical instruments, well hole loggers, and moisture density gauges. Nuclear weapons production and the nuclear fuel cycle, including mining and milling, fuel production, reactor operations, reprocessing, and waste, also falls in this category.

(4) Medical sources of radiation again include machine-generated radiation from medical accelerators, X-ray, and computed tomography (CT) machines for diagnosis and treatment of disease and injury.

(5) Military commodities encompass all radioactive materials used in military equipment. There are many radionuclides to be found on or in military equipment. The most common use is as a luminous agent (to make things glow in the dark).

c. **Mechanisms of Radiation Production**

## Effects of Prompt Radiation Exposure

| Acute Dose Centigray (cGy) Free-in-Air (See Note 1) | Threshold Effects Within 1 Day (See Notes 2, 3) | Probability of Death Within 30 Days | Probability of Nausea/ Vomiting Within 6 Hours | Percentage Expected to Require Hospitalizations | Probability of Death from Excess Cancer (40 Years After Exposure) (See Note 4) |
|---|---|---|---|---|---|
| 25 | None expected | < 1% | < 1% | < 1% | < 1% |
| 75 | Mild<br>– Nausea<br>– Vomiting<br>– Headache | < 1% | < 10% | < 1% | 1-2% |
| 125 | • Lymphocyte count drop<br>• Fever | < 1% | < 25% | < 10% | 2-4% |
| 410 | • Moderate vomiting<br>• Diarrhea<br>• Fatigue | ≥ 50% | 75% | 100% | 10-15% |
| 1000 | Performance degraded | ≥ 99% | 100% | 100% | Not applicable |
| 3000 | Combat ineffective | 100% | 100% | 100% | Not applicable |
| 8000 | • Disorientation<br>• Death | | | | |

rad = radiation absorbed dose

1 rad = 1 cGy

100 rad = 1 Gray

NOTES:

1. Assumes a low linear energy transfer radiation dose (e.g., X-ray, gamma).
2. The probability of death is without medical treatment and for healthy adults.
3. Burns and/or trauma in combination with radiation injury increases mortality. Personnel with such injuries combined with radiation doses exceeding 100 cGy will likely require prompt medical evaluation. Personnel with combined injuries with doses in excess of 600 cGy are unlikely to survive regardless of medical intervention.
4. US citizens have approximately 41% chance of getting cancer over lifetime, averaging between 37% and 41% based upon race and ethnicity.

**Figure C-1. Effects of Prompt Radiation Exposure**

(1) The most commonly encountered means of radiation production is machine generation. In medicine, exposure to radiation occurs during X-ray, CT, and particle-accelerator-related treatments. Machine-generated radiation is also used in industrial X-ray machines and in inspection devices for baggage, cargo, and, most recently, passengers. In research, electron microscopes and X-ray diffraction equipment produce radiation. Machine-generated radiation equipment requires electrical power to produce radiation and is only hazardous when powered and activated, although there may be residual radioactive activation products formed in building materials in the vicinity of high-energy accelerators.

## Sources of Radiation

### Radionuclides

| Name | Symbol | Source/Use |
|---|---|---|
| Potassium-40 | K-40 | Terrestrial |
| Phosphorus-32 | P-32 | Atmospheric |
| Carbon-14 | C-14 | Atmospheric |
| Tritium | H-3 | Atmospheric, military |
| Cobalt-60 | Co-60 | Industrial, medical, military |
| Cesium-137 | Cs-137 | Industrial, military |
| Iridium-192 | Ir-192 | Industrial, medical |
| Uranium | U-234, U-235, and U-238 | Industrial |
| Depleted uranium | U-238 | Industrial, military |
| Plutonium | Pu-238, Pu-239, and Pu-240 | Industrial |
| Radium-226 | Ra-226 | Industrial, military |
| Radon-222 | Rn-222 | Industrial |
| Iodine-131 | I-131 | Industrial, medical |
| Strontium-90 | Sr-90 | Industrial |
| Molybdenum-99 | Mo-99 | Medical |
| Technetium-99 | Tc-99m | Medical |
| Mxenon-133 | Xe-133 | Medical |
| Fluorine-18 | F-18 | Medical |
| Thallium-201 | Tl-201 | Medical |
| Nickel-63 | Ni-63 | Military |
| Americium-241 | Am-241 | Military |
| Promethium-147 | Pm-147 | Military |
| Thorium-232 | Th-232 | Military |

**Figure C-2. Sources of Radiation**

(2) Radioactive material produces radiation by the physical process of radioactive decay. Radioactive decay occurs when an energetically unstable nuclei (parent nuclide) emits energy or radiation as it becomes a (progeny) nuclide that may be either radioactive or stable. The decay process is governed by a physical constant unique to that particular parent nuclide called half-life. An example is the isotope of uranium with an atomic mass of 238 (or U-238): U-238 decays into Th-234 [thorium 234] via alpha decay with a half-life of 4.5 billion years. The long half-life of U-238 is the reason it is found in the Earth's crust. U-238 has been in the Earth's crust since the formation of the Earth, about one of its half-lives ago. Radioactive material remains a hazard until the material decays into an

inconsequential quantity (the rule of thumb is about seven half-lives of the nuclide), although there may be radioactive progeny that also need to be considered during the risk management process. Since decay is a physical process at an atomic scale, it cannot be altered via inactivation or decomposition like chemical and biological hazards can. Further, some radiation types can be a hazard at some distance from the source radioactive material. Decontamination can be done by physically removing exterior radioactive particles, but they remain a hazard in the waste stream. Radioactive material, once internalized, can remain in the body of exposed personnel for the lifetime of the individual or until it decays away. IPE masks and suits help prevent particulate internal exposure via inhalation, ingestion, or absorption through the skin or a wound. It must be noted, however, IPE does not protect against all forms of external radiation exposure. IPE will keep alpha and beta particles from touching an individual; a protective mask (i.e., respirator) will protect from inhalation of radioactive material. Neither of these offers protection from gamma or X-ray radiation. Protection is discussed in further detail in following sections.

(3) Radiation may be produced by fission of certain radionuclides, such as U-235 [isotope of uranium with an atomic mass of 235] and Pu-239 [isotope of plutonium with an atomic mass of 239], which are used to make nuclear fuel and nuclear weapons. Fission involves the splitting of atoms into two fission fragments and the emission of radiation in the form of one or more neutrons and gamma rays. Spontaneous fission can occur, but fission is more likely initiated by a neutron being absorbed within the parent nuclide. Fissionable nuclides typically have relatively long half-lives and undergo radioactive decay via alpha decay. Once an atom splits and emits neutrons, the neutrons will then interact with the surrounding medium. If more fissionable material is present, some of the neutrons may be absorbed and fission more atoms. When this cycle repeats, it is called a chain reaction. Not all fissionable materials can sustain a chain reaction. For example, U-238 atoms can fission with high energy neutrons but cannot sustain a chain reaction. Fissile material is fissionable material that is able to undergo a self-sustaining chain reaction with neutrons of any energy. If a chain reaction occurs, it can potentially lead to a nuclear detonation that releases large amounts of energy. The amount of fissile material in a specific configuration required to generate a chain reaction is called the critical mass. Two initially subcritical masses, when brought together, can emit lethal amounts of radiation and possibly detonate. Separation of subcritical masses is imperative.

d. **Types of Radiation**

(1) Neutrons originate in the nucleus of an atom, have a substantial mass (~1 atomic mass unit [amu]), and no charge. They are penetrating (may act at long distances) and have variable health effects depending upon their energy. They are difficult to detect and require specialized equipment not commonly found in the field. Hydrogenous materials, such as water or plastics, make good shielding against neutrons.

(2) Alpha particles are large (~4 amu), charged (+2), helium nuclei. They are produced by heavy unstable nuclei with too low of a neutron to proton ratio. Because of their relatively large size and positive charge, they have a very short range (a few centimeters in air, a few microns in tissue) and deposit a great amount of energy in a

relatively short path length. Alpha particles are difficult to detect in the field due to their short range and limited ability to penetrate into the volume of a detector. Alpha particles are easily shielded by a piece of paper or human skin. Therefore, health effects of an alpha exposure occur only when the alpha emitters are inhaled, ingested, injected, or enter the body through an open wound or the lens of the eyes. Alpha particles inside the body can be exceedingly dangerous.

(3) Beta particles are electrons or positrons that are ejected from the nucleus of an unstable atom. Positrons are subatomic particles with the same mass as an electron but positively charged. Beta particles have a mass of about 0.0005 amu and a charge of -1 for electrons and +1 for positrons. They deposit much less energy per unit path length than an alpha particle and have greater range (meters in air, millimeters in tissue). Typically, they are relatively easy to detect with commonly fielded, handheld, radiation detection equipment. There are notable exceptions to this general rule: both carbon-14 and tritium are difficult to detect due to the very low energy of the beta particle, illustrating that just because radiation is not detected, does not mean there is not any present. Note that skin contamination with beta emitters can cause burns. Plexiglas or aluminum are good shielding materials for beta emitters.

(4) Gamma and X-rays are electromagnetic energy, have no charge, and are very penetrating. However, they have different points of origin. Gamma rays originate in the nucleus of the atom, while X-rays originate from an electron change in energy. Their energy spectra overlap, but X-rays are generally lower in energy than gamma rays. They are easy to detect with handheld, field-detection systems. Most radionuclides will have some relatively abundant gamma and/or X-ray associated with their alpha or beta decay, allowing them to be detected with typical handheld instrumentation. Dense materials such as steel or lead are typically used as shielding for gamma and X-rays.

e. **Employment.** The previous discussion has outlined radiological sources that are in legitimate use throughout the world, but there are means to use these sources as weapons. Radiological material can be offensively employed in nuclear weapons, INDs, REDs, and RDDs. Attacking and destroying facilities where radioactive material is used and/or stored (e.g., nuclear reactors) may lead to distribution of radioactive material in the environment. The efficacy of radiological weapons, other than nuclear weapons, at inflicting casualties, is not high. They are, however, well suited to creating fear and as area denial weapons.

(1) A relatively small number of countries have nuclear weapons capability because they are technically difficult and expensive to produce. Nuclear devices produced by nuclear capable countries can be difficult to detonate without proper equipment and security codes. This makes them unlikely candidates for use on the battlefield in less than total war with a nuclear capable enemy. If used at the optimum height of burst, a nuclear weapon would generate prompt radiation and an EMP, causing extensive damage to electronic equipment, conventional damage, and injury but, likely, very little fallout.

(2) A non-state actor could produce an IND from illegally obtained fissile material, such as enriched uranium or plutonium. While there are significant technical

hurdles to overcome to produce an IND, with the right expertise, it is possible. An IND would likely be a low-yield nuclear device detonated on the ground delivering prompt radiation exposure and conventional damage and injury, as well as significant fallout.

(3) An RED is a penetrating radiation source (gamma and/or neutron) that is placed or buried where people will become exposed to the radiation emitted. An RED is relatively easily employed, but obtaining the material might be difficult. If a relatively strong source of penetrating radiation could be obtained, it could be emplaced in a public location, such as a park or public building, in such a way as to maximize the probability and time of exposure to those nearby. If the source were big enough and the time of exposure long enough, exposure could lead to acute effects such as nausea, diarrhea, erythema (reddening of the skin), and even clinical illness and death.

(4) An RDD is a device, other than a nuclear explosive device, designed to disseminate radioactive material to cause destruction, damage, or injury. This can be done by using a conventional explosive bundled with radioactive material known as a dirty bomb. The explosive itself would likely cause most of the direct damage and injury, but the radioactive contamination may deny use of the area and complicate incident management and health services support. Mitigation of the effects of the contamination would consume significant resources. Additionally, it may not be routine for seemingly conventional attack responses, such as IEDs or other improvised weapon attacks, to utilize radiation detection equipment to confirm the presence of radioactive material, delaying recognition of the RDD event and further complicating effective response and risk management. The radiation itself may not pose an immediate health threat, but contamination control measures and protective measures (IPE, PPE) should be implemented to reduce risk of future health implications (see Figure C-1).

## 3. Radiological Threat Management

a. **Responsibilities.** The commander manages risk on behalf of all personnel under the commander's authority. It is DOD policy to reduce exposure to ionizing radiation associated with DOD operations to a level as low as reasonably achievable (ALARA) consistent with operational risk management. Complying with the principle of ALARA must be done in the context of managing risk from all sources. Commanders must balance risk management with the requirement of completing the military mission.

(1) **Operational Commanders**

(a) Set the OEG.

(b) Establish guidance for the use of radioprotectants; consult with command surgeon.

(c) Review radiological risk throughout mission; revise guidance if necessary.

(2) **Staffs**

(a) Conduct radiological risk management.

(b) Provide risk estimate and mitigation recommendations to the commander.

(c) Implement medical surveillance program.

(d) Recommend guidance for the use of radioprotectants and radiotherapeutics.

(e) Collect/archive cumulative dose information.

(f) Prepare radiological risk updates as mission progresses; recommend additional mitigation measures and/or revised guidance if circumstances dictate.

b. **Detection and Measurement**

(1) **Handheld Radiation Detection Equipment**

(a) Only in very peculiar circumstances will an individual be able to sense radiation without the aid of some detection device, and there are no universal radiation detection systems that are appropriate for every type of radiation detection scenario. Each system has its advantages and disadvantages. The selection of the appropriate radiation detection system is dependent upon many variables, including the type of radiation (alpha, beta, gamma, neutron) that is of interest, the environmental media or circumstances (air, water, soil, surface, volume, or ambient), the type of measurement that is needed (e.g., removable contamination, cumulative dose, dose rate, exposure, exposure rate, or counts per minute), and the need to determine radionuclide identity. Detection equipment generally provides indication well before radiation levels present a health hazard.

**A negative response on a given piece of radiation detection equipment does not necessarily indicate radiation and/or radioactive materials are not present. The detection limits of each type of detector must be considered.**

(b) The most commonly available and most useful radiation detection instruments are capable of measuring ambient and surface dose and dose rate from gamma and beta emitting nuclides. CBRN specialists, bioenvironmental engineers, industrial hygiene specialists, and health physicists are able to detect and measure gamma rays, and alpha and beta particles using specialized probes. Available through a radiation safety officer, there may be specialized instruments in theater that can provide nuclide identification capability for gamma-emitting nuclides. Some dosimeters are neutron sensitive.

(2) **Personnel Radiation Dosimetry.** Field dosimetry systems are fielded to those units that have a requirement to track the radiation dose of their personnel. A difference should be noted between real-time reading dosimeters (such as an electronic personal dosimeter or a color-changing dosimeter) and those that require separate equipment and extra time to read. An unforeseen requirement for dosimetry may arise that necessitates establishing a dosimetry program or augmenting the program already in place. In this eventuality, the following Service agencies can be contacted for guidance and support:

(a) US Army Dosimetry Center
ATTN: AMSAM-TMD-SD, Building 5417
Redstone Arsenal, AL 35898-5000
Phone: 256-876-1786
Fax: 256-876-3816

(b) US Air Force Radiation Dosimetry Laboratory
2510 5th Street, Area B, Building 0840
Wright-Patterson Air Force Base, OH 45433-7212
Phone: 937-938-3764/1-888-232-3764
E-mail: esoh.service.center@us.af.mil

(c) Naval Dosimetry Center
Walter Reed National Military Medical Center
8901 Wisconsin Avenue
Bethesda, MD 20889-5614
Phone: 301-295-5410
Fax: 301-295-5981

(3) **Laboratory Grade Capabilities.** Laboratory capability in a field environment is likely to be very limited or nonexistent. This level of measurement is usually reserved for environmental samples that are taken in the field and then sent to a laboratory outside the theater of operations. This capability can be accessed through the following Service contacts:

(a) US Army Public Health Center Laboratory Sciences Portfolio
USAPHC
ATTN: MCHB-TS-L
5158 Blackhawk Road
Aberdeen Proving Ground, MD 21010-5403
Phone: 410-436-3639
DSN: 584-3639

(b) US Air Force School of Aerospace Medicine
2510 5th Street, Building 840
Wright-Patterson Air Force Base, OH 45433-7913
Phone: 937-938-2716
DSN: 798-2716

(c) Environmental, Safety, and Occupational Health (ESOH) Service Center
esoh.service.center@us.af.mil
Toll Free: 1-888-232-ESOH (3764)
Phone: 937-938-3764
DSN: 798-3764

*Field radiation detection, measurement, and survey techniques are detailed in ATP 3-11.37/MCRP 10-10E.7(MCRP 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.

c. **Radiological Contamination Mitigation**

(1) **Principles of Radiation Protection**

(a) If radiation is encountered and the mission requires potential exposure, radiation protection is achieved through time, distance, and shielding. Minimizing time of exposure in an elevated radiation environment minimizes dose. Mission permitting, practice tasks will have to be performed in a radiological environment before execution so they can be performed more quickly. Rotate personnel in and out of the radiological environment so no single individual is excessively exposed. Sometimes forgoing the use of IPE that might slow operations can shorten time of exposure and minimize dose.

(b) Maximizing personnel distance from the source will minimize dose. Distance has an inverse square relationship to radiation exposure or dose, meaning that if the distance from the source is increased by a factor of X, the dose is decreased by a factor of $X^2$ (e.g., double the distance, quarter the dose). Individuals should also be cognizant of their geometry in relationship to the source so they can position themselves at the maximum distance from the source, consistent with mission accomplishment. If the source is contamination on the ground and is fairly uniformly distributed, standing or sitting some distance above the ground in a vehicle or elevated platform will also minimize dose, as well as act as a shield.

(c) Shielding is simply placing material between personnel and a source. The reduction of the dose depends on the type of radiation being emitted and the shielding material, as well as its density and thickness. Thicker is always better but may be limited by weight and availability. Lead and other dense materials work well for gamma and X-ray emitters. Lower density means greater thickness is required for the same shielding value. Lower-density material such as plexiglas or aluminum should be used to shield against beta emitters. Beta interaction with high-density materials like lead can lead to significant X-ray production, possibly increasing dose. Neutrons can be shielded with materials that have a lot of hydrogen atoms, like plastics and water. Generally, it is not necessary to shield for alpha particles. Concrete, earth, and sand bags can work well as field-expedient shielding material for all sources. In addition, vehicles will provide shielding, with armored vehicles generally providing more shielding than light vehicles.

Note that IPE does not provide shielding for the most part, but it can limit contamination and internal uptake of radioactive material, thereby limiting dose.

(2) **Avoidance.** Avoiding sources of radiation is obviously the most effective means of limiting radiation risk but may increase other risks (e.g., choosing to go around a contaminated area might subject a unit to the physical risk of a mine field or increased likelihood of ambush).

(3) **Personal Protection and COLPRO.** Utilization of IPE and COLPRO can control contamination and limit internalization of radioactive material, which is particularly important for alpha emitters. Some COLPRO systems may also have some shielding value, although this is not the case with IPE.

(4) **Decontamination.** Radioactive contamination is generally associated with particulates, although there are some materials that will be found as gasses or vapors. No special decontamination solution is required for radioactive material, since the hazard cannot be reduced by chemical or physical destruction. Waste material generated as a result of decontamination should be controlled and disposed of in accordance with appropriate command TTP and/or HN disposal procedures.

*Passive defense measures are discussed in detail in ATP 3-11.32/MCRP 10-10E.8/NTTP 3-11.37,* Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Passive Defense.

(5) **Medical Countermeasures and Treatment.** There is one drug that can be given as a pre-exposure prophylaxis to limit the effects of radiation exposure; however, others are in development. Anti-emetics will keep personnel from vomiting following radiation exposure. Potassium iodide, a fission product found in fallout from a nuclear detonation or reactor accident, can limit the uptake of radioiodine. There are medical products currently in development for use as prophylaxis (radioprotectants) that may potentially be available in the future, which would act to lessen the biological damage caused by the radiation. Post-exposure, there are a number of drugs that can be given to remove radioactive material from the body. Two different diethylenetriaminepentaacetic acid (DTPA) products are FDA-approved; these are chelators that can be used but only under medical monitoring since they can be poisonous if the dose is not carefully controlled. Ethylenediaminetetraacetic acid (EDTA) is another chelator similar to DTPA that may be used to treat internal contamination. However, EDTA is only FDA-approved for use in the treatment of lead poisoning. Prussian blue can be administered to treat internal contamination by Cs-137 [Celisum-137], another common fission fragment, as well as radioactive thallium and non-radioactive thallium. Furthermore, Neupogen® and Neulasta® are FDA-approved to treat a sub-syndrome of acute radiation syndrome.

*Medical countermeasures and treatment are discussed in detail in ATP 4-02.83/MCRP 3-40A.2(MCRP 4-11.1B)/Navy Tactical Reference Publication (NTRP) 4-02.21/Air Force Manual (AFMAN) 44-161(I),* Multi-Service Tactics, Techniques, and Procedures for Treatment of Nuclear and Radiological Casualties.

d. **Risk Management**

(1) The commander's decision to expose personnel to ionizing radiation should be balanced with mission requirements and all other risks. In combat, it may be necessary to exceed RES categories of radiation exposure due to mission requirements or as a consequence of enemy action. The risk management process is to identify hazards, characterize the risks to the greatest extent possible, and apply mitigation measures to try to eliminate or minimize the risks. The objective is to achieve the lowest-possible overall risk consistent with mission accomplishment.

(2) The staff planner should be aware that risk mitigation measures applied to reduce risk associated with one hazard may increase risk to another hazard. As part of the risk management process, applying radiation safety mitigation measures should act in concert with other risk mitigation measures to minimize the overall risk. The highest risk of significant casualties will usually occur from the conventional weapons threat. Increasing conventional risk to achieve the objective of ALARA may result in an increased total risk with higher probability of mission failure.

(3) Complete risk management requires the following:

(a) **Information.** The staff should work to collect the best available information on all the identified hazards. The risk assessment begins with accurate information on the nature of all hazards present in the operational area, to include intelligence assessments, measurements, visual observations, and modeling.

(b) **Justification.** During operational decision making, commanders should consider immediate, operationally significant health effects, as well as long-term consequences of radiation exposure (e.g., cancer), in addition to all other health risks. The importance of the mission should drive acceptability of risk.

(c) **Optimization.** After a risk has been justified, the commander should optimize the plan to minimize the potential effects of all risks that are involved, in the context of the mission. The operational implications of risk mitigation measures should be carefully considered. Optimization balances potential reduction in operational effectiveness inherent in instituting some risk mitigation measures with the potential return in the reduction of risk. For example, use of IPE slows operations but provides protection against internalization of radioactive materials.

(4) The dose contributed by ingestion or inhalation of radioactive material (known as internal dose), partial body irradiations from gamma rays, and skin irradiations from beta particles is difficult to accurately assess in the field. However, such individual doses can be estimated by appropriately trained staff for operational purposes. Depending upon the type of radioactive material and its dispersed form, the combined internal and external dose equivalent may be much larger than the external exposure recorded on a dosimeter. Consequently, respiratory and skin protection must be considered whenever the

hazard analysis establishes a potential risk in which the internal exposure, or skin exposure, will cause the commander's OEG to be exceeded. Implementation of respiratory and skin protection controls will be subject to common sense tests of being reasonably achievable and practical for the situation.

## 4. Operational Radiological Risk Management Tools

a. **RES**

(1) RES provides a convenient method to track dose and associated operational impact of exposure. RES is an estimate, indicated by the categorization symbols RES-0 through RES-3 (see Figure C-3), which may be applied to a unit, subunit, or, by exception, to an individual. As indicated, RES-1 has multiple levels, each indicating specific recommended actions. RES categories RES-0 through RES-1E are for military operations other than war. RES categories RES-0 through RES-3 are for military combat operations, where all risks are assumed to be greater. Since RES is directly related to effects of tactical interest, it can be used for estimating the effectiveness of units (or, in exceptional cases, of individuals) and is considered during operational planning to select units or individuals with appropriate capabilities or skills to ensure mission accomplishment that results in the lowest RES after the mission is completed.

(2) Tracking RES includes keeping and maintaining RES records. RES levels are based on average total cumulative dose received by a unit from exposure to penetrating radiation. The total cumulative dose is most accurately determined by using a dosimeter (see paragraph 3.b.(2), "Personnel Radiation Dosimetry"). If a dosimeter is not used, then the dose can be estimated based on radiation monitoring data and total exposure time. Special advisors (see paragraph 6, "Service Resources") should be consulted for acceptable, alternative methods of assessing these exposures. Figure C-3 defines the RES categories as a function of dose received by the unit and describes the precautions required for units in each of the RES categories. All individuals of the unit or subunit are assigned the same RES based on the determined dose. If personnel are reassigned, the unit RES is determined by the average dose of the individuals assigned. All personnel who have received radiation exposure during operations should be evaluated by medical personnel and appropriate entries documented in their individual medical record in accordance with multi-Service TTP and NATO Standardization Agreement (STANAG) 2473, *Commander's Guide to Radiation Exposures in Non-Article 5 Crisis Response Operations*. The Service dosimetry centers are the primary location for all exposure and dose information processing. Each Service maintains a repository of individual dose information. In some cases, dosimetry results may be forwarded from the individual Service dosimetry centers to the Defense Occupational and Environmental Health Readiness System surveillance data portal.

b. **Assessing Radiation Hazards**

(1) Determining if the radiological hazards can be controlled depends on whether they are sufficiently characterized and appropriate controls are in place or can be put in place and sufficient resources exist to protect personnel to a level of risk comparable to

## Radiation Exposure Status Categories

| Total Cumulative Dose (See Notes 1 & 2) | Radiation Exposure Status (RES) Category | Recommended Actions (Continue Actions from the Previous RES Categories as RES Increases) |
|---|---|---|
| Military Operations Other than War | | |
| 0 – 0.05 cGy | RES-0 | • Routine monitoring for early warning of hazard |
| 0.05 – 0.5 cGy | RES-1A | • Record individual/unit dose readings |
| 0.5 – 5 cGy | RES-1B | • Initiate radiation survey and continue monitoring |
| 5 – 10 cGy | RES-1C | • Update survey and continue monitoring<br>• Continue dose control measures<br>• Execute PRIORITY tasks only (see note 3) |
| 10 – 25 cGy | RES-1D | • Execute CRITICAL tasks only (see note 4) |
| 25 – 75 cGy (see note 5) | RES-1E | • Monitor for acute radiation syndrome symptoms |
| RES Categories Continue for Military Operations During Combat | | |
| 75 – 125 cGy (see note 5) | RES-2 | • Any further exposure exceeds moderate operational risk |
| > 125 cGy (see note 5) | RES-3 | • All further exposure will exceed the emergency operational risk |

1 rad = 1 radiation absorbed dose = 1 centigray (cGy)

NOTES:

1. Radiation measurements can be in centisievert (cSv) or millisievert (mSv). However, due to the fact that the military may only have the capability to measure centigray (cGy) or milligray (mGy), the radiation guidance tables are presented in units of cGy for convenience. For whole body gamma irradiation, 10 mGy = 1 cGy = cSv = 10 mSv.
2. All doses should be kept as low as reasonably achievable. This will reduce individual Service member risk as well as retain maximum operational flexibility for future employment of exposed Service members.
3. Examples of priority tasks are those that contain risk, avert danger to persons, or allow the mission to continue without major revisions in the operational plan.
4. Examples of critical tasks are those that save lives or allow continued support that is deemed essential by the operational commander to conduct the mission.
5. Although an upper bound for RES 1E is provided in the table, it is conceivable that doses to personnel could exceed this amount. A low incidence of acute radiation sickness can be expected as whole body doses start to exceed 75 cGy. Personnel exceeding the RES 1E level should be considered for medical evaluation and evacuation upon any signs or symptoms related to acute radiation sickness (e.g., nausea, vomiting, anorexia, fatigue).
6. When an operational mission duration spans more than one calendar year and it does not exceed the annual occupational dose limit, the RES Category will be reset to RES 0 on 1 January. All radiation exposure data records are still required to be maintained by the service dosimetry centers.

**Figure C-3. Radiation Exposure Status Categories**

occupational standards. Under such conditions, commanders should apply the same standards of ionizing radiation protection as would apply to any routine practice involving ionizing radiation exposure and radioactive material as specified in DODI 6055.08, *Occupational Ionizing Radiation Protection Program.* Commanders may require dose limits specified in DODI 6055.08 be exceeded in emergency situations and during combat or wartime military operations.

(2) A sufficiently characterized radiological hazard will normally include an evaluation of the environment by a radiation SME such as a health physicist or radiation specialist. Characterization normally includes identifying the radionuclide(s) (or ionizing radiation type, radiation energy, and half-life of the source), quantifying the dose rate, and determining how the dose rate will change over time. Commanders should consult with available expertise and use available resources to characterize the environment to the best of their ability. Reachback and staff augmentation is available from several sources within each Service and DTRA, Joint Task Force-Civil Support, and the Armed Forces Radiobiology Research Institute.

(3) In contrast, environments are uncontrolled when they are uncharacterized and/or limited resources exist to reduce personnel exposure to ionizing radiation. Under such circumstances, commanders should apply operational risk management to protect personnel to the greatest extent possible. Requirements under these conditions include ensuring exposures are both justified and ALARA, as well as applying OEG instead of dose limits.

c. **Determine the Radiological Risk**

(1) To assess the risk in a radiological environment, estimate the potential dose and dose rate from radiological sources that may be encountered during the mission. This will determine the severity of the radiological threat. Next, determine the likelihood of encountering this radiological threat. This will determine the probability of exposure. Figures C-4 and C-5 provide severity and probability descriptions.

(2) Once the severity and the probability of the hazard are determined, Figure C-6 correlates the two to determine the level of risk associated with the hazard.

d. **Setting an OEG**

(1) The OEG is set for each platoon or equivalent unit and for each mission. The OEG should be based on the importance of the mission and the acceptable tolerance to ionizing radiation effects in comparison to other risks associated with the mission. During the risk management process, an approach is begun by selecting a conservatively low OEG. As an example, use Figure C-7 to determine OEG and assess the impact to the mission. If there is no foreseeable impact on the mission, then the low OEG should be appropriate. If not, raise the guidance to a less conservative (i.e., higher) OEG and repeat the process. Note that the risks should be monitored and reassessed as needed throughout the mission, allowing the OEG to be modified as necessary to keep risks as low as practical.

(2) The recommended levels for the exposure guidance given in Figure C-7 are low enough that the primary risk is limited to an increased risk of long-term health effects except for a critical mission with an extremely high acceptable risk. This table is intended to guide commanders and their staffs in determining an appropriate OEG.

## Severity of Radiological Threat

| Level of Severity | Mission Impact | Associated Potential Dose and Dose Rate |
|---|---|---|
| Catastrophic | • Expected loss of ability to accomplish mission | • Total dose > 450 centigray<br>• Encounter source/environment with dose rate > 200 centigray per hour |
| Critical | • Expected significant degradation of mission capabilities in terms of the required mission standard<br>• Inability to accomplish all parts of the mission<br>• Inability to accomplish the mission to standard if hazards occur during the mission | • Total dose > 200 centigray<br>• Encounter source/environment with dose rate > 10 centigray per hour |
| Marginal | • Expected degraded mission capabilities in terms of the required mission standard; mission capability will be reduced if hazards occur during the mission | • Total dose > 75 centigray<br>• Encounter source/environment with dose rate > 0.5 centigrays per hour |
| Negligible | • Expected effect will have little or no impact on accomplishing the mission | • Total dose > 25 centigray<br>• Encounter source/environment with dose rate > 0.01 centigray per hour |

1 rad = 1 radiation absorbed dose = 1 centigray (cGy)

**Figure C-4. Severity of Radiological Threat**

(3) **Critical** missions are those missions that are essential to the overall success of a higher headquarters' operation, emergency lifesaving missions, or the equivalent.

(4) **Priority** missions are those missions that avert danger to persons, prevent damage from spreading, or support the organization's mission-essential task list.

(5) **Routine** missions are all other missions that are not designated as priority or critical missions.

(6) In all cases, if following the OEG introduces additional risks and/or hazards otherwise avoidable, a reassessment of the OEG is warranted. It is not reasonable to set the OEG so low it introduces other more severe and/or unnecessary risks. For example, if the OEG is set so a route is not usable because of the possibility of exceeding the OEG and other routes introduce the potential for unnecessary adversary engagement or other significant danger. Commanders should reassess the risks and the importance of the mission, consider additional dose reduction mitigation measures, and/or increase the OEG.

## Probability of Radiological Threat

| Probability of Event | Impact on Personnel |
|---|---|
| Frequent – 1 in 500 | • Expected to occur several times or continuously over the duration of a specific mission |
| Likely – 1 in 1,000 | • Expected to occur during a specific mission or at a high rate but intermittently |
| Occasional – 1 in 10,000 | • May occur as often as not during a specific mission<br>• Occurs sporadically |
| Seldom – 1 in 100,000 | • Not expected to occur during a mission<br>• Occurs rarely as isolated incidents |
| Unlikely | • Occurrence not impossible but can assume will not occur during a mission<br>• Occurs very rarely |

**Figure C-5. Probability of Radiological Threat**

e. Commanders should establish an OEG for the following situations:

(1) All missions with the potential for ionizing radiation exposure.

(2) Units conducting radiological decontamination for personnel or equipment.

(3) Units conducting immediate or operational decontamination.

(a) Unlike chemical or biological agents, radiation will not be neutralized by decontamination. Decontamination will only move the hazard from one surface (bodies, vehicles, etc.) to another (the containment). Removed contaminated clothing and waste water may themselves, under certain conditions, become radiation hazards. Therefore, contaminated clothing and waste water should be treated as radioactive hazards. Waste water must be controlled to prevent further spread of contamination.

(b) An appropriate OEG should be set for units conducting thorough decontamination operations (i.e., consider the decontamination operation a separate mission with its own OEG).

(4) Radiological risk management applies to patient movement missions and health care providers; however, medical treatment or lifesaving measures take precedence over decontamination efforts.

## Level of Radiological Risk

| Severity \ Probability | Frequent | Likely | Occasional | Seldom | Unlikely |
|---|---|---|---|---|---|
| Catastrophic | Extremely High | Extremely High | High | High | Moderate |
| Critical | Extremely High | High | High | Moderate | Low |
| Marginal | High | Moderate | Moderate | Low | Low |
| Negligible | Moderate | Low | Low | Low | Low |

**Figure C-6. Level of Radiological Risk**

## Recommended Operational Exposure Guidance Levels

| Acceptable Risk Level \ Mission Importance | Critical | Priority | Routine |
|---|---|---|---|
| Extremely High | 125 centigray | 75 centigray | 25 centigray |
| High | 75 centigray | 25 centigray | 5 centigray |
| Moderate | 25 centigray | 5 centigray | 0.5 centigray |
| Low | 5 centigray | 2.5 centigray | 0.5 centigray |

1 rad = 1 radiation absorbed dose = 1 centigray (cGy)

NOTE:
The commander has the authority to select any operational exposure guidance deemed appropriate, including exceeding 125 centigray, if the circumstances warrant it.

**Figure C-7. Recommended Operational Exposure Guidance Levels**

(a) Mission OEG should be established for medical missions; however, careful consideration must be given before evacuation or treatment for a contaminated individual to avoid exceeding the OEG for evacuation crews and/or health care personnel. It is highly unlikely a contaminated patient will create a significant radiation hazard for health care providers. In most cases, removing the outer layer of clothing will eliminate most of the radioactive contamination and general medical precautions are sufficient to protect medical personnel from the radiological hazard.

(b) Treatment of radioactively contaminated casualties triaged as "immediate" should not be delayed for decontamination beyond removal of the outer layer of clothing. Decontamination can be safely delayed until immediate lifesaving actions have been accomplished and the delay/interference of decontamination will not threaten any personnel.

(5) Radiological risk management applies to all ground, air, and sea transportation missions. Risk to the transportation personnel, crew, and the mission requirements are factored into the decision process when setting the OEG. If transporting radioactive material, both the cargo and any other potential ionizing radiation exposure should be evaluated in the risk management process. For radioactively contaminated cargo, the decontamination requirement should be evaluated as part of the risk management process. Depending on the cargo and the mission, the OEG for the crew and transportation personnel may make decontamination unnecessary. Planning for intertheater transportation missions must consider the radiological control requirements at the destination. An intermediate intratheater stop may be required to conform to HN and international transportation requirements. Consult the memorandum from the Under Secretary of Defense for Policy, *Radiological Clearance Criteria Guidelines for Platforms and Materiel,* dated 16 December 2011, before transporting radiologically contaminated materiel out of theater.

f. **Determining Decontamination Requirements**

(1) Immediate or operational decontamination should be completed to reduce the possibility that residual contamination exceeds the OEG. Once the mission is completed or before beginning a new mission, thorough decontamination may be necessary to avoid additional exposure and/or exceed any newly established OEG and to keep exposure ALARA.

(2) Title 49, Code of Federal Regulations, parts 172 and 173, and Nuclear Regulatory Commission Regulatory Guide 1.86, *Termination of Operating Licenses for Nuclear Reactors,* provide guidance during peacetime environments for movement, disposal, and release of radiologically contaminated equipment and buildings for unrestricted use within the US.

(3) Under most conditions, up to 10 times background, typically averaging ~2 micro-Gray/hour, is an acceptable OE.

## 5. Additional Exposure Guidance

a. Internal uptake of radioactive material can contribute a significant dose to an individual, possibly impacting the risk management process. Internal uptake can be precluded by the use of IPE or COLPRO, but this mitigation measure is not always practical or may not be the most effective approach in reducing total risk. Internal dose assessment should be performed by a trained expert (see paragraph 6, "Service Resources"), with the following general considerations:

(1) Exposure can be assessed from nasal swabs (if done within one hour post exposure for certain radionuclides).

(2) Assessed via bioassay (blood, urine, feces, sputum) as soon as possible. Bioassay is the determination of the relative strength of a substance (as a drug) by comparing its effect on a test organism with that of a standard preparation. This normally requires special analysis by a qualified laboratory facility (see paragraph 3.b.[3], "Laboratory Grade Capabilities").

b. Priority should be given to nuclide identification. Alpha and beta emitting radionuclides are particularly hazardous if they are internalized.

(1) Affects internal dose assessment and treatment.

(2) Determines long-term IPE (MOPP)-level guidance.

c. **Protection of Civilians and Dependents.**

(1) General criteria for implementing protective actions:

(a) Threshold (i.e., acute) health effects should be avoided.

(b) The risk of delayed effects should not exceed a level that is judged to be adequately protective of health in emergency situations.

(c) The risk from a protective action should not exceed the risk associated with the dose that is to be avoided.

(2) Local commanders need to coordinate with local authorities, in accordance with status-of-forces agreements and locally published guidance, to establish appropriate guidance for the protection of dependents and civilians.

(3) For additional information on intervention levels for the protection of the public during domestic and foreign situations see:

(a) The *National Response Framework* for domestic response guidance and information.

(b) NATO STANAGs, International Atomic Energy Agency safety series documents, and ICBRN-R doctrine.

## 6. Service Resources

In addition to the Service resources already identified for personnel dosimetry and radioanalytical laboratory services, each Service has uniformed and civilian radiation safety experts (health physicists) and dedicated radiation safety agencies. Service-specific identification and contact information follows:

a. US Army
Expert: Nuclear Medical Science Officer
Agency: USAPHC Health Physics Program
Address: USAPHC
ATTN: MCHB-PH-HPH
5158 Blackhawk Road
Aberdeen Proving Ground, MD 21010-5403
E-mail: chppm-hpp-webrequest@amedd.army.mil
Phone: 410-436-8396
DSN: 584-8396

b. US Navy
Expert: Radiological Health Officer
Agency: Navy and Marine Corps Public Health Center
Address: 620 John Paul Jones Circle, Suite 1100
Portsmouth, VA 23708-2103
Phone: 757-953-0765 (Radiological Component Manager)
DSN: 377-0765

c. US Air Force
Expert: Bioenvironmental Engineer
Agency: US Air Force School of Aerospace Medicine
Address: 2510 5th Street, Building 840
Wright-Patterson AFB, OH 45433-7913
E-mail: esoh.service.center@us.af.mil
Phone: 937-938-3764/1-888-232-3764
DSN: 798-3764

# APPENDIX D
# NUCLEAR HAZARD CONSIDERATIONS

## 1. General

The international security environment encompasses threats from potential adversaries armed with nuclear weapons. This appendix summarizes common effects produced by nuclear weapons, high-energy radiation, and radiological materials to assist CCDRs and subordinate commanders to plan for and conduct operations in nuclear environments. The effects of radiation exposure described in Appendix C, "Radiological Hazard Considerations," also apply to the residual radiation including fallout from a nuclear explosion.

## 2. Characteristics of Nuclear Weapons

a. The nature and intensity of the effects of a nuclear detonation depend upon the characteristics of the weapon, the target, the means of employment, and the height of burst. The most significant characteristics of a nuclear weapon are its type and yield.

b. **Types of Nuclear Weapons.** Nuclear weapons release enormous amounts of energy liberated from the fission or fusion of atomic nuclei.

(1) Fission-based weapons utilize specific isotopes of heavy elements, such as uranium or plutonium, as the fissile fuel for the fission reactions. Fission-based weapons are often configured as gun-type weapons. Because these weapons require a relatively lower level of technological sophistication, they are more likely to be developed or used by underdeveloped nations or terrorist groups.

(2) Fusion-based weapons exploit the energy released when the nuclei of light elements, such as isotopes of hydrogen, combine to form a heavier nuclei and are often referred to as hydrogen bombs or H-bombs. Fusion-based weapons require very high temperatures to enable fusion reactions and may also be referred to as thermonuclear weapons. Since fusion-based weapons require much greater technological sophistication and are more efficient, more technologically mature nations are likely to adopt this weapon type.

c. **Yield.** The term *yield* is used to describe the amount of explosive energy released when a nuclear weapon is detonated. A nuclear weapon's yield is measured in units of tons of TNT [trinitrotoluene] that would produce an equivalent explosion. Fission-based weapons are capable of producing yields up to a few hundred kilotons. Thermonuclear weapons can produce yields in excess of 1 megaton.

## 3. Nuclear Weapons Effects

a. The effects of a nuclear weapon are largely determined by the medium in which it detonates. A nuclear weapon may be detonated in space, in the air at a high or low altitude, on the surface, below the surface, or under water. Data in this appendix focuses on air bursts.

b. When detonated, a typical nuclear weapon will release its energy as overpressure (positive and negative pressure waves), thermal radiation, ionizing radiation (alpha and beta particles, gamma rays, X-rays, and neutrons), and EMP. Figure D-1 depicts the relative proportions of the radiation products of an air burst nuclear explosion. When the detonation occurs in the atmosphere, the primary radiation products interact with the surrounding air molecules and are absorbed by matter and scattered as they radiate from the point of detonation. The secondary radiation products, referred to as residual radiation or fallout, produce the preponderance of the radiation hazard and casualties beyond the immediate point of detonation. All of these interactions lead to the five significant effects of a nuclear weapon detonated in the air: blast, thermal radiation, ionizing radiation, fallout, and EMP.

*For additional technical data, including nuclear weapon employment effects data, contact the US Army Nuclear and Countering Weapons of Mass Destruction Agency.*

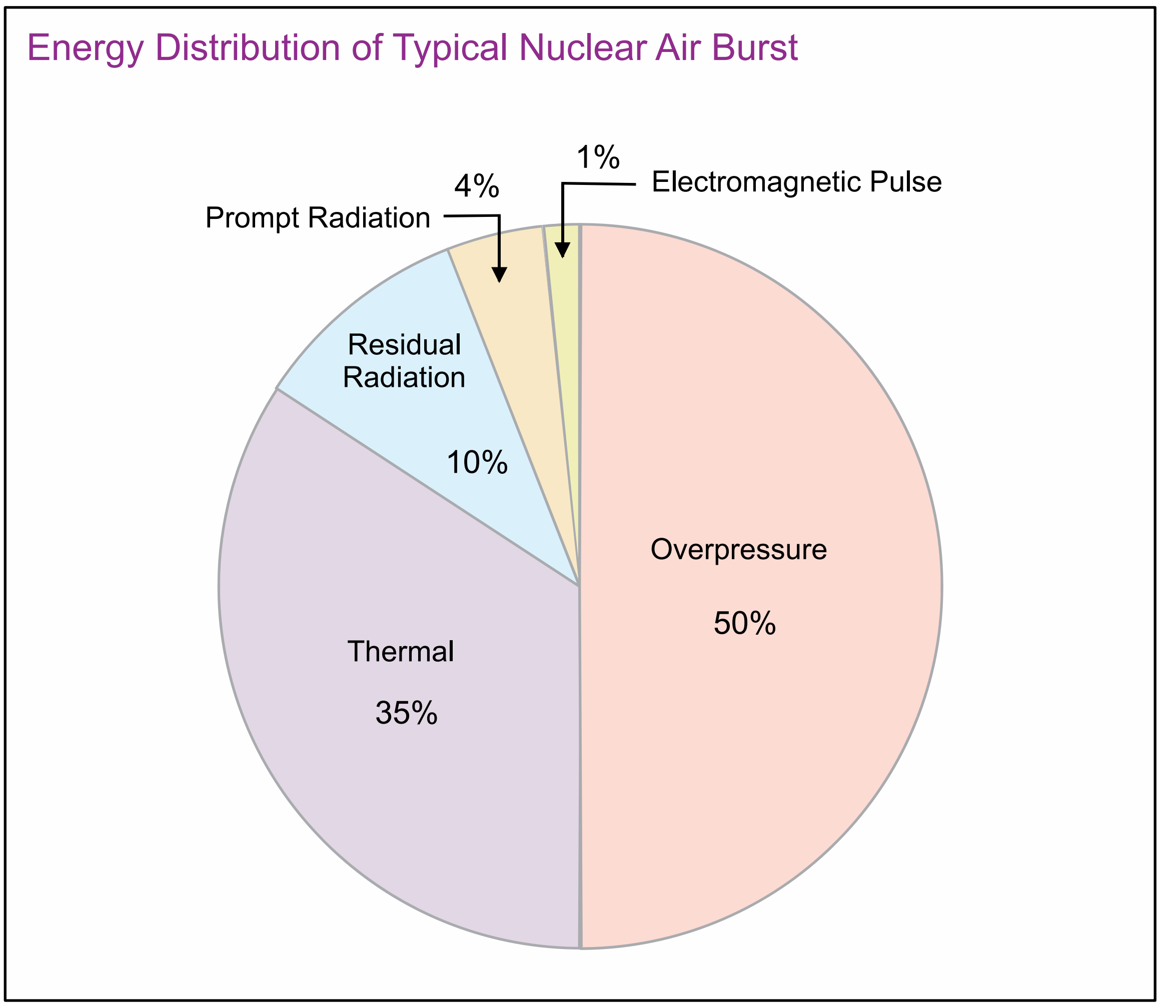


**Figure D-1. Energy Distribution of Typical Nuclear Air Burst**

c. **Overpressure.** A low-altitude nuclear air burst generates overpressure (and resulting negative pressure waves) and severe winds. These pressure waves produce casualties and damage through crushing, bending, tumbling, and breaking. Many of the casualties will be injured from flying debris such as broken glass and rubble. Depending upon a weapon's yield and detonation location, the pressure waves from a nuclear weapon is capable of destroying most of the infrastructure of a major city, including rendering roads impassable; disrupting water, sewer, gas, electrical, and phone lines; and destroying medical facilities. Commanders must anticipate these challenges when operating in a nuclear environment.

d. **Thermal Radiation.** The effect of the enormous amount of heat and light released by a nuclear detonation, in certain circumstances, may be more damaging than the blast. The thermal radiation from a multimegaton weapon can ignite wood, paper, rubber, plastics, and other materials many kilometers away from the detonation point. Because thermal radiation travels at the speed of light, flammable objects within the thermal range and line of sight of the blast will ignite immediately. Even a 10 kiloton weapon is capable of igniting flammable objects within several hundred meters of its detonation point. Additionally, thermal radiation will cause burns of various degrees to people in the line of sight of the explosion. Severe burn victims generally require intensive and sophisticated medical treatment, which may quickly overwhelm available medical support. Leaders must be aware of, and take steps to mitigate, thermal radiation effects while operating in a nuclear environment.

e. **Ionizing Radiation.** Ionizing radiation produced from a nuclear detonation is generally split into two categories, prompt radiation and residual radiation.

(1) Prompt radiation (X-rays, gamma rays, and neutrons) is generally produced within the first minute of a detonation and is emitted directly from the nuclear reactions characteristic to the type of weapon employed.

(2) Residual radiation is produced from the environmental material, unfissioned weapon debris, and radioactive fission products swept up into a debris cloud after the nuclear detonation occurs. This debris cloud will move with prevailing winds and will rain down to the ground as fallout depositing radioactivity over hundreds to thousands of kilometers around the detonation point. The resulting fallout produces residual radiation in the form of gamma, beta, and alpha particles and therefore becomes a significant hazard to personnel and materiel.

(3) Acute radiation doses from prompt or residual radiation can cause biological harm, leading to severe illness or death. Additionally, intense ionizing radiation can damage objects, including optical, mechanical, and electronic components, by altering their physical properties. Gamma rays and neutrons have a long range in the air and are highly penetrating. Consequently, even people inside of buildings and behind solid objects will receive some radiation dose.

f. **Fallout.** Fallout is the residual radiation product distributed into the atmosphere by a nuclear detonation. High-altitude bursts produce essentially no local fallout. For many weapon designs, low-altitude bursts in which the fireball does not touch the ground will very often produce little, in some cases negligible, amounts of fallout. All nuclear detonations close enough to the surface for the fireball to touch the ground produce very large amounts of radioactive debris that will be drawn up into the atmosphere and be deposited locally and dispersed downwind. Although fallout initially decays quickly, some areas could remain hazardous for years. Radiological surveys will be needed to identify and characterize such areas. Localized fallout may severely limit military operations within a contaminated area. Civilian and military facilities and resources will most likely be overwhelmed by the requirements for fallout casualty decontamination, processing, and treatment. Additionally, decontamination, identification, and interment of remains are formidable challenges for commanders to overcome.

g. **EMP.** Nuclear-generated EMP is a potential threat to all electronics and electrical systems. Its magnitude, duration, and range are dependent upon the height of burst and weapon yield. EMP is generally described as high-altitude electromagnetic pulse (HEMP) and low-altitude electromagnetic pulse (LEMP).

(1) HEMP is a high-altitude detonation of particular concern and can briefly cover many thousands of square kilometers of the Earth's surface with an electromagnetic field capable of damaging or upsetting both mobile and fixed electrical systems.

(2) LEMP is generated by a low-altitude or ground-burst nuclear detonation. LEMP has a higher signal amplitude than HEMP but rapidly drops off in terms of strength as one moves away from the detonation point. This form of EMP is of primary concern to electrical-based systems connected to long cables and will generate large electrical current pulses that can damage or destroy critical electronic components attached to the cables.

h. **Combined Effects.** Although each nuclear weapon effect is addressed separately, the planner should consider possible synergism of their combined effects on structures, equipment, and personnel. Structures may be burned, crushed, knocked down, and/or contaminated. Equipment may be disabled or destroyed by the combined effects of EMP, thermal blast, and ionizing radiation. Personnel may experience the effects of ionizing radiation in conjunction with conventional injury, and while each effect considered separately may not be sufficient to cause death, taken together, they could cause lethal damage.

## 4. Protective Actions

a. Protective actions taken before an attack are most effective for survivability of personnel and equipment. Mitigation can include, for example, wearing one or two layers of loose, light-colored clothing that can reduce burns; use of bunkers, reverse slopes, depressions, culverts, and caves; and dispersion. Education and training of leaders, staffs, and individuals on nuclear weapons effects and the principles of operations in CBRN environments can significantly enhance operational effectiveness in the event of nuclear attack.

*For more details on individual and collective protective actions, see ATP 3-11.32/MCRP 10-10E.8/NTTP 3-11.37,* Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Passive Defense.

b. Commanders operating in radiological and nuclear environments must minimize and control the exposure of personnel to radiation. As described in Appendix C, "Radiological Hazard Considerations," an OEG must be established for all military operations.

*See Appendix C, "Radiological Hazard Considerations," for further information on setting the OEG, RES categories, military radiation exposure states, and risk criteria.* Also see ATP 4-02.83/MCRP 3-40A.2(MCRP 4-11.1F)/NTRP 4-02.21/AFMAN 44-161(I), *Multi-Service Tactics, Techniques, and Procedures for Treatment of Nuclear and Radiological Casualties.*

c. **EMP.** While some military equipment is hardened against the effects of EMP, many military systems and commercial-off-the-shelf items are not. The cost of retroactively hardening a system is often prohibitively expensive. Preventive measures include keeping cable runs as short as possible and not elevated, keeping enclosures shut, and ensuring any unused equipment is turned off and unplugged. When warnings are issued, penetration by EMP into equipment can be minimized by immediately shutting down electronic equipment (such as radios, computers, and generators) and disconnecting radio antennas and power cables.

d. Nuclear environments are unique in that they are transient but some equipment and systems may be required to operate through the event. It is important during system acquisition to analyze nuclear hardness needs and establish appropriate requirements early in the process. If a system is nuclear hardened, a robust hardness maintenance and hardness surveillance program should be established and supported by commanders.

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# APPENDIX E
## NONTRADITIONAL AGENT HAZARD CONSIDERATIONS

This appendix is a classified supplement provided under separate cover. The classified appendix expands information related to nontraditional agent environments.

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# APPENDIX F
## CONTAMINATION MITIGATION CONSIDERATIONS

### 1. General

The hazards associated with CBRN incidents can force US forces into protective equipment, thereby degrading their ability to perform individual and collective tasks. CCMD staffs plan, prepare for, and provide support to contamination mitigation operations and for redeployment of platforms and material to home stations once hostilities cease. Contamination mitigation includes the planning and initiation of actions that will enable the force to continue operations despite threats and hazards from CBRN material through the conduct of contamination control and medical countermeasures that allow for quick recovery.

### 2. Terminology

a. **Forms of Contamination (Figure F-1).** CBRN contamination is the deposition on, or absorption of, CBRN materials by personnel, materiel, structures, and terrain. US forces may encounter CBRN contamination through direct attack, movement through contaminated areas, the unwitting use of contaminated facilities, or the movement of vapor clouds.

b. **Levels of Decontamination (Figure F-2).** The levels of decontamination are immediate, operational, thorough, and clearance. Immediate and operational decontamination operations are typically conducted at the tactical level to sustain combat operations. Thorough decontamination is normally done within the rear area. Clearance

Forms of Chemical, Biological, Radiological, and Nuclear Contamination

| Form of Contamination | Description |
|---|---|
| Vapor | Can be generated by generators or bursting munitions. Vapor in an open or outdoor area will generally disperse rapidly. |
| Liquid | Liquid droplets can range from thick and sticky to the consistency of water. Liquids can also be disseminated as an aerosol. |
| Aerosol | Is a liquid or solid composed of finely divided particles suspended in a gaseous medium. Examples of common aerosols are mist, fog, and smoke. They behave much like vapors. |
| Solids | Forms of contamination include radioactive particles, biological spores, and dusty agents. A dusty agent is a solid agent that can be disseminated as an aerosol. |

**Figure F-1. Forms of Chemical, Biological, Radiological, and Nuclear Contamination**

## Levels of Chemical, Biological, Radiological, and Nuclear Decontamination

| Level of Decontamination | Description |
|---|---|
| Immediate Decontamination | Immediate decontamination carried out by individuals immediately upon becoming contaminated to save lives, minimize casualties, and limit the spread or transfer of contamination. |
| Operational Decontamination | Decontamination carried out by an individual and/or a unit, restricted to specific parts of operationally essential equipment, materiel, and/or working areas, in order to minimize contact and transfer hazards and to sustain operations. |
| Thorough Decontamination | This is accomplished by units (with or without external support) to reduce contamination on personnel, equipment, materiel, and/or working areas equal to natural background or to the lowest possible levels, to permit the partial or total removal of individual protective equipment and to maintain operations with minimum degradation. |
| Clearance Decontamination | The final level of decontamination that provides the decontamination of equipment and personnel to a level that allows unrestricted transportation, maintenance, employment, and disposal. |

**Figure F-2. Levels of Chemical, Biological, Radiological, and Nuclear Decontamination**

decontamination operations are normally conducted post-hostilities using theater or higher-level assets to stabilize transition of contaminated forces for redeployment.

c. **Methods of Decontamination (Figure F-3).** Decontamination is accomplished by neutralization, physical removal, and weathering.

*For further guidance, see ATP 3-11.32/MCRP 10-10E.8/NTTP 3-11.37,* Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Passive Defense.

## 3. Considerations for Decontamination Operations

a. **Capabilities.** CCDRs and their staffs should consider their decontamination equipment capability and the detection threshold levels of their sensors during planning, as necessary. This planning requirement includes identification of in-theater capabilities to include aerial ports of debarkation (APODs) and seaports of debarkation (SPODs). ATP 3-11.32/MCRP 10-10E.8/NTTP 3-11.37, *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Passive Defense,* identifies these capabilities.

b. **Treaties and Regulations.** GCCs should review applicable treaties, laws, regulations, and agreements pertaining to their AOR, as well as understand and consider foreign government concerns for the movement of contaminated platforms and materiel.

## Methods of Chemical, Biological, Radiological, and Nuclear Decontamination

| Methods of Decontamination | Description |
|---|---|
| Neutralization | Is the most widely used method of decontamination, particularly for chemical warfare agents. Neutralization is the reaction of the contaminating agent with other chemicals to render the agent less toxic or nontoxic. |
| Physical Removal | Is the relocation of the contamination from one mission-critical surface to another less important location. Physical removal generally leaves the contamination in toxic form. It often involves the subsequent neutralization of the contamination. |
| Weathering | Involves such processes as evaporation and irradiation to remove or destroy the contaminant. The contaminated item is exposed to natural elements (e.g., sun, wind, heat, precipitation) to dilute or destroy the contaminant to the point of reduced or negligible hazard. |

**Figure F-3. Methods of Chemical, Biological, Radiological, and Nuclear Decontamination**

CCDRs identify relevant governmental and nongovernmental HN, international, and US entities that may affect operational decision making in moving platforms and materiel. CCDRs use this information to develop policies, standards, plans, and concepts of operation to sustain operations and restore operational capability to platforms and materiel that have been contaminated.

c. **Personnel Decontamination.** When a CBRN incident occurs, a decontamination operation may be required. Not all contaminated personnel may require medical attention. Those contaminated personnel that require medical attention may fall into one of the following categories:

(1) **Casualties.** Casualties consist of injured personnel that do not necessarily need treatment or admittance to an MTF. These personnel may require self-aid or buddy aid assistance or may just need to go through the decontamination process.

(2) **Patients.** These personnel will require medical treatment, life or limb-saving care, or evacuation to the next role of care. It is important these patients go through patient decontamination before they are admitted to the MTF. However, in some CBRN incidents, little or no decontamination may be necessary to process a patient, especially if lifesaving measures are time critical. If transport is deemed essential, all efforts must be made to prevent the spread of contamination. In these cases, prior approval must be given by the CCDR; Commander, USTRANSCOM; and SecDef in consultation with DOD medical authorities.

*For further guidance on casualty and patient decontamination, see ATP 4-02.7/MCRP 3-40A.6(MCRP 4-11.1F)/NTTP 4-02.7/AFTTP 3-42.3,* Multi-Service Tactics, Techniques, and Procedures for Health Service Support in a Chemical, Biological, Radiological, and Nuclear Environment; *current USTRANSCOM policies; and JP 4-02,* Joint Health Services.

d. **Logistics.** While decontamination logistic considerations are normally addressed by the Services, whenever possible, theater-level bulk reserves/stocks should be planned to facilitate resupply.

*For more information on logistics, see JP 4-0,* Joint Logistics. *For more information on decontamination operations, see ATP 3-11.32/MCRP 10-10E.8/NTTP 3-11.37,* Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Passive Defense.

e. **Guidelines for Formerly Contaminated Platforms and Materiel**

(1) Formerly contaminated platforms and materiel that undergo thorough decontamination may be used to meet mission requirements but under restricted use. They remain under USG control and are restricted to DOD-controlled facilities, unless cleared by partner nations (for locations outside the US).

(2) When mission requirements allow, formerly contaminated platforms and materiel are decontaminated to clearance criteria (unrestricted operations). These measures ensure formerly contaminated platforms and materiel do not present a health risk. Platforms and materiel that are not decontaminated to clearance criteria and approved for transit should not depart the theater of operations without authorization from USTRANSCOM and in coordination with the affected CCDR and SecDef. DOS is the approval authority for platforms porting in areas outside the US in coordination with those countries at which the platforms are porting. The approval authority for porting locations within the US is SecDef after obtaining the President's approval, in consultation with appropriate federal and state agencies. Clearance standards for DOD, national, and international agencies may vary. Consult appropriate authority.

(3) CCDRs use clearance criteria guidelines established by the Office of the Under Secretary of Defense for Policy and current national/international guidelines. When more than one standard is presented, the more conservative approach should be taken. Complete elimination of CBRN contaminants from platforms and materiel may not be possible due to limitations in currently fielded technologies and procedures. Furthermore, chemical agents absorb into porous materials such as rubber, plastic, and cloth and may become an "off-gasing" or contact hazard even after decontamination operations are complete.

(4) Documentation of the certified clearance level decontamination should be maintained and tracked in the appropriate maintenance records physically maintained for the platforms and/or materiel.

f. **Clearance Approval Process.** Figure F-4 illustrates the step-by-step process leading to approval to reoccupy the platform or use/transport materiel. Clearance criteria are the processes and measured levels by which decontamination efforts are considered acceptable for the restoration to routine use of a platform and materiel by unprotected personnel. By achieving clearance decontamination, unprotected civilians may conduct routine maintenance, fueling, inspections, loading/unloading, or similar activities. Passengers may include members of the non-DOD general population following clearance decontamination. The assumptions are as follows:

(1) The JFC or GCC has the capabilities required to identify the presence of a CBRN contamination hazard and to determine whether the hazard has been effectively mitigated;

(2) DOD will have the policy, standards, and protocols required to assess and characterize contamination;

(3) The source, type, and amount of contamination have been characterized;

(4) The hazard has been reduced to an acceptable exposure level;

(5) The asset will be used by unprotected persons, except for depot-level maintenance activities; and

(6) DOD policy guidelines for chemical, biological, or radiological clearance for platforms and materiel are followed.

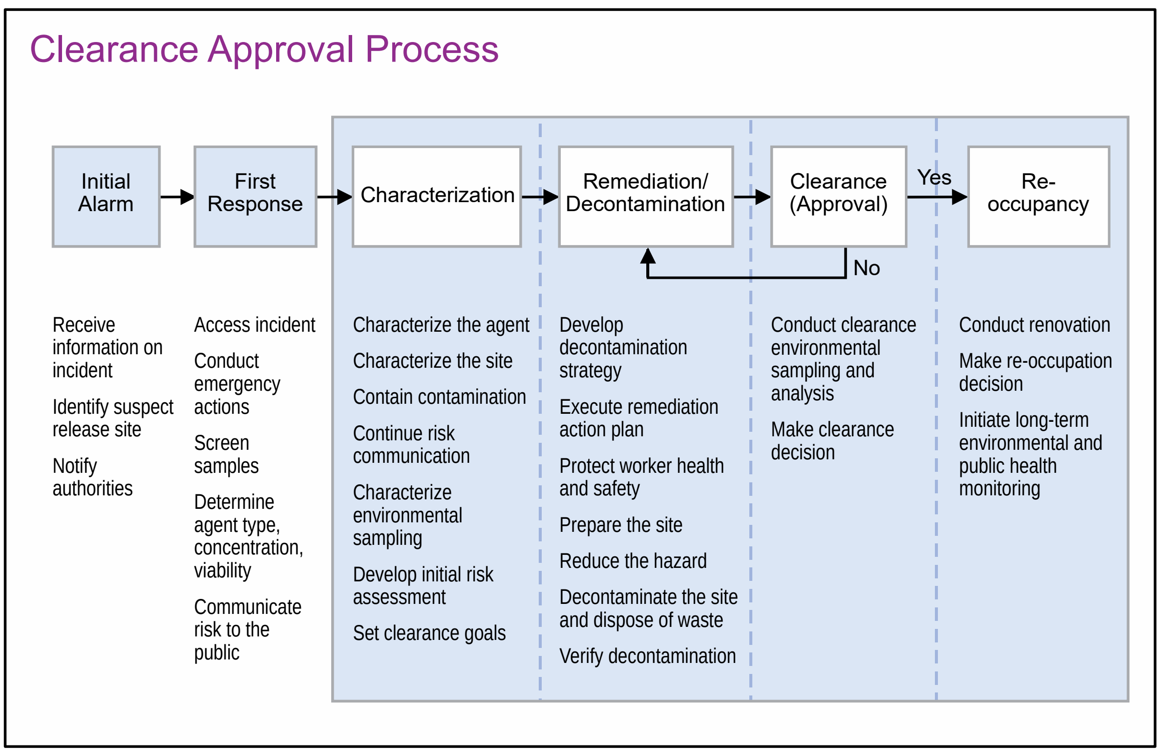


**Figure F-4. Clearance Approval Process**

## 4. Additional Sustainment Considerations

a. Operations will slow as tasks are performed by personnel encumbered by protective equipment or exposed to CBRN hazard effects. Hazards may require abandonment or limited use of contaminated areas, transfer of missions to uncontaminated forces, or avoidance of planned terrain and routes. Additionally, CBRN use or contamination resulting in a major disruption of normal personnel and materiel replacement processes in the theater could severely hamper the component commanders' capabilities for force generation and sustainment.

(1) Theater sustainment capabilities must be protected. CBRN contamination at an essential port of embarkation or port of debarkation or other critical logistic facility can significantly affect execution. Measures to prevent and mitigate the effects of CBRN contamination must focus on maintaining support to combat operations and rapidly restoring the degraded capabilities. Preventing and mitigating the effects of CBRN hazards on equipment and supplies include the use of protective coatings and coverings. Under some circumstances it may be necessary to use alternative facilities.

(2) Protecting forces from the effects of a CBRN environment is logistically taxing. Resupply requirements for protective clothing, medical supplies (e.g., antidotes, antibiotics, and antivirals), and sustainment supplies for quarantine/isolation facilities will be time-sensitive. Low-density CBRN protective equipment may require movement within the theater. Personnel and equipment decontamination requires a great amount of water, which becomes contaminated in the process. These and other resources needed for recovery from CBRN incidents can severely strain the theater logistic system and have unanticipated effects on combat operations.

(3) **Logistic Planning Considerations for Fixed Sites.** Ports, airfields, and related fixed sites are choke points vulnerable to CBRN incidents and potentially high-value targets. Combat forces are vulnerable to CBRN incidents during entry operations and during movement to areas of military operations. Common fixed-site defense measures can reduce their vulnerability.

(a) **Considerations for APODs.** While each APOD is unique, a few general considerations are important. When considering CBRN threats, the installation's overall size, with respect to the mission and its operational capacity and flexibility, will affect the commander's options for decontamination and avoidance. However, conducting successful attacks against APODs presents significant challenges to the adversary. If installation leadership and personnel are properly prepared to survive the attack and sustain operations, CBRN attacks may not cause significant long-term degradation of throughput capacity, unless the attack is nuclear or involves a biological agent that remains undetected until it has spread through a significant portion of critical personnel and/or equipment. This is especially true at large APODs where critical assets and much of the storage areas and MHE could easily escape contamination. Operations in these cases may be limited more by the effects of the attacks on the local work force and nearby civilian population. In most cases, it will be possible to continue operations at a contaminated APOD. While CBRN incidents may result in contamination of some operating surfaces, the size of the hazard area may be small compared to the size of the installation. The capability to quickly shift operations to those areas and facilities on the installation that were not contaminated is key to sustaining throughput operations.

1. If necessary, contaminated aircraft must be decontaminated to the level required by DOD and the HN, and acceptable to the International Civil Aviation Organization, before returning to the air mobility flow. The GCC is responsible for establishing control of contaminated aircraft in the AOR and at designated decontamination sites, as well as for procedures to address overflight requirements and destination base/country landing rights for previously contaminated aircraft.

2. In CBRN environments, there are limitations on the employment of aircraft. Some aircraft will not be able to land at or depart from contaminated areas regardless of an aerial port's CBRN preparedness. Of particular importance are the Civil Reserve Air Fleet, civilian, and other aircraft under contract to support military operations. CCMD plans must provide for replacing these aircraft with other airlift assets or conducting transload operations from bases outside the immediate threat area. These replacement aircraft would have to operate from transload airbases to shuttle the affected cargo and passengers to the theater. If that is not feasible, alternative means (e.g., sea, rail, or wheeled transport) must be made available.

3. The availability of alternative aerial ports to accomplish the transload of personnel and materiel from intertheater to intratheater airlift can minimize potential deployment interruptions by adversary CBRN use. The supported CCDR, in coordination with Commander, USTRANSCOM, is responsible for designating transload aerial ports. All means of active and passive contamination avoidance measures will minimize the level of contamination and will prevent further cross-contamination during operations.

(b) **Considerations for Seaports of Embarkation.** JFC plans must take into account MSC ships exposed to contamination. Contaminated ships will require decontamination support and certification acceptable to civil authorities to load additional cargo at uncontaminated US or foreign commercial port facilities.

(c) **Considerations for SPODs.** In large-scale operations, US equipment and material normally enter the theater on sealift ships and offload at SPODs. The vital importance of these seaports to US power projection makes them an attractive target for CBRN incidents. However, conducting successful attacks against SPODs presents significant challenges to the adversary. If port managers and operators are properly prepared to survive the attack and sustain operations, CBRN attacks may not cause significant long-term degradation of military logistic capacity. This is especially true at large ports where many piers, storage areas, and much of the MHE may escape contamination. Operations in these cases may be limited more by the effects of the attacks on the local work force and nearby civilian populations.

1. Though similarities concerning the impact of CBRN attack on SPOD and APOD operations exist, there are differences.

2. Each port provides unique capabilities and has different vulnerabilities in CBRN environments, but contamination avoidance is an essential element of sustaining operations. In normal circumstances, a port is but one node of a complex, theater-wide logistic network. Plans should include options for redirecting incoming ships when possible from contaminated ports to those that are uncontaminated. However, when alternative ports with adequate capacity and berths to handle large cargo ships are not available, it may be necessary to continue operations at contaminated ports. In considering alternative ports, planners must take into account the requirements for unit equipment to arrive in proximity to the marshalling areas for unit personnel, ammunition, and sustainment supplies to ensure coherent reception, staging, onward movement, and integration for affected units.

3. In some cases, it will be possible to continue operations at a contaminated port. While CBRN incidents may result in contamination of some operating surfaces, the size of the contaminated area may be small compared to the size of the port. The capability to shift operations to those areas and facilities within the port that escaped contamination is key to sustaining throughput operations. Proper preparation can significantly reduce the impact of CBRN incidents on a SPOD.

b. Specific sustaining considerations include:

(1) Decontaminating critical areas or facilities.

(2) Determining the disposition of contaminated equipment, facilities, and human remains.

(3) Coordinating salvage and decontamination of materials.

(4) Providing C2 of restoration operations.

(5) Integrating CBRN incident restoration operations.

(6) Providing restoration country assistance teams.

(7) Establishing reporting procedures for restoration requirements.

(8) Providing operational guidance to contaminated forces.

(9) Assessing the operational impact of restoration activities, to include assessing the linkage of restoration and the operational risk assessment.

(10) Supporting restoration of SOF operations.

(11) Establishing contamination control.

(12) Working with HN.

(a) Supplying or pre-positioning protective consumable, expendable, and replacement CBRN equipment.

(b) Employing protective measures to minimize the effects of CBRN incidents.

(c) Integrating multinational and US protective measures and assets.

(d) Establishing appropriate CBRN medical protection measures.

(e) Providing COLPRO for C2, medical operations, and workforce rest and relief.

(f) Implementing effective ROM, to include social distancing, isolation, and quarantine as appropriate, to limit exposure following a CBRN incident.

(g) Coordinating the disposal of contaminated waste water storage, removal and transport, and disposition from decontamination operations in accordance with HN guidelines.

(h) Identifying HN decontamination capabilities.

(i) Establishing contaminated patient treatment capability and capacity.

(j) Establishing contamination containment and clean up support.

(k) Providing support in communications and assistance with security, crowd control, and traffic regulating.

(l) Monitoring of wind/weather patterns.

(m) Establishing hospitals that will accept patients with potential exposure to CBRN hazard.

(n) Providing en route care capabilities.

(o) Providing patient evacuation support.

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# APPENDIX G
## TECHNICAL CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR FORCES

1. This appendix introduces technical CBRN force capabilities and some planning considerations for their use during operations in support of operational- and strategic-level objectives where CBRN hazards exist.

2. It is imperative the JFC and those responsible for apportioning forces and developing support plans not only understand the unique capabilities but also the limitations of technical CBRN forces within their operational areas prior to a CBRN or CWMD incident or mission.

3. Technical CBRN forces include specialized capabilities that are organized, equipped, and trained to conduct CBRN operations beyond the tactical level and in support of operational and strategic objectives to counter WMD. Technical CBRN forces are generally low-density and high-demand assets requiring significant mission prioritization to meet the commander's requirements. They possess advanced capabilities to identify CBRN threats and hazards with a high degree of confidence, providing evidence collection for attribution and the employment of medical countermeasures. Technical CBRN forces operate across the range of military operations and are able to integrate with joint, interagency, and multinational partners. Below is a list of DOD's technical CBRN forces and the references for additional information on them:

a. Chemical reconnaissance detachment (for more information, see ATP 3-11.24, *Technical Chemical, Biological, Radiological, Nuclear, and Explosives Force Employment*).

b. Chemical decontamination detachment (for more information, see ATP 3-11.24).

c. Decontamination and reconnaissance teams (for more information, see ATP 3-11.24).

d. WMD coordination teams (for more information, see ATP 3-11.24).

e. Nuclear disablement teams (for more information, see ATP 3-11.24).

f. Weapons of mass destruction-civil support teams (WMD-CSTs) (for more information, see ATP 3-11.24).

g. CBRNE response teams (for more information, see ATP 3-11.24).

h. CBRNE analytical and remediation activity (for more information, see ATP 3-11.24).

i. Laboratory support (for more information, see ATP 3-11.24, *Technical Chemical, Biological, Radiological, Nuclear, and Explosives Force Employment,* as well as ATP 3-11.37/MCRP 10-10E.7(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*).

j. Chemical-Biological Incident Response Force (for more information, see ATP 3-11.36/MCRP 10-10E.1(MCRP 3-37B)/NTTP 3-11.34/AFTTP 3-2.70, *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Aspects of Command and Control*).

k. US Air Force CBRN/emergency management hazard assessment team and installation management team for military operations in a CBRN, major accident response, or natural disaster environment. (For more information, see AFMAN 10-2503, *Operations in a Chemical, Biological, Radiological, Nuclear, and High-Yield Explosive [CBRNE] Environment, and* ATP 3-11.36/MCRP 10-10E.1(MCRP 3-37B)/NTTP 3-11.34/AFTTP 3-2.70).

l. US Air Force CBRN/emergency management superintendent and air operations center manager for operations at the installation, warfighting headquarters, combined/joint task force or major command level (for more information, see AFMAN 10-2503 *and* ATP 3-11.36/MCRP 10-10E.1(MCRP 3-37B)/NTTP 3-11.34/AFTTP 3-2.70*).*

m. US Army Nuclear and Countering Weapons of Mass Destruction Agency nuclear employment augmentation teams and CWMD planning assistance teams (for more information, see Army Regulation 10-16, *US Army Nuclear and Combating Weapons of Mass Destruction Agency*).

4. The US Marine Corps provides a naval force uniquely capable of transitioning ready-to-fight combat forces from sea to the shore to achieve CWMD objectives. The Marine air-ground task force (MAGTF) provides the JFC with adaptive force packages with enhanced CBRN dismounted reconnaissance and surveillance capabilities to support CWMD activities. The scalability of the MAGTF makes Marine Corps forces suitable to integrate with SOF and naval forces conducting CWMD activities. Marine Corps Tactical Publication (MCTP) 10-10E, *MAGTF Nuclear, Biological, and Chemical Defense Operations,* provides additional capability and limitation information.

5. DOD has identified forces for the homeland CBRN response mission. These forces are collectively referred to as the CBRN Response Enterprise and are comprised of both National Guard and federal forces. Under state control, these National Guard forces consist of WMD-CSTs, CBRNE-enhanced response force packages, and homeland response forces. Under federal control, forces consist of the Defense CBRN Response Force with Joint Task Force-Civil Support as its core and are backfilled with two additional C2 CBRN response elements.

6. Although SOF train for operations in CBRN environments, they cannot fully operate under CBRN threat conditions without the assistance of conventional forces. For example, while SOF have organic CBRN decontamination, reconnaissance, and sensitive site exploitation capability, they lack the capacity to conduct long-term sustainment and reconstitution operations without large-scale logistical resupply.

*For more detailed information on SOF capabilities and limitations, see JP 3-05,* Special Operations.

7. DTRA provides the following support either on-site or via reachback.

a. Reachback support teams offer both residential and mobile training team opportunities for users to train on and receive modeling and simulation software.

b. CBRN military advisory teams provide technical and scientific SMEs, planners, and hazard prediction modeling support to JFCs and mission partners or their delegated representatives in response to catastrophic incidents involving WMD in the US and abroad, when requested.

c. Planning teams assist JFCs or other mission partners with CWMD planning and analysis.

d. Liaison officer augmentation teams that augment existing DTRA liaison officers at supported organizations.

e. A joint mission assurance assessment team conducts "risk-based" assessments of an installation's ability to mitigate threats from all hazards and threats.

f. DTRA Technical Support Groups train, advise, equip, assist, and employ CWMD support to CCDRs and, upon SecDef approval, to other USG departments and agencies.

g. Additionally, DTRA is the single-source point of contact for technical reachback requests for information via its National Countering Weapons of Mass Destruction Technical Reachback Enterprise, a CWMD support element that provides time-sensitive access to a broad range of CBRN SMEs in a collaborative environment supporting modeling and simulation and technical analysis for planning, execution/response, and assessment.

DTRA Joint Operations Center, 24/7 Contact
Phone: 1-877-240-1187 or 703-767-2000 or 703-767-2003
DSN: 427-2000, 427-2003, 427-2116
E-mail: dtra-scc-joc@mail.mil/dtra-scc-joc@mail.smil.mil
Web site: https://opscenter.dtra.mil (use CAC log-in with e-mail certificate); tech help at DSN 427-2116

8. United States Coast Guard (USCG) forces conduct operations under USCG authorities or under DOD C2 when allocated to CCDRs. Select USCG deployable specialized forces with advanced CBRN technical capabilities may deploy to support GCCs. These specialized forces include maritime security response teams and the National Strike Force (NSF). The maritime security response teams may operate in an opposed environment, while NSF forces operate in a permissive environment. In addition, NSF forces may serve as, or support, the designated federal on-scene coordinator for a hazardous material incident.

9. **Explosive Ordnance Disposal (EOD).** Joint EOD forces enable access to areas denied by explosive and CBRN hazards. EOD forces operate across the joint force during domestic CBRN response and ICBRN-R. All EOD forces are trained to provide initial response to a WMD incident. Certain elements within the EOD force are able to provide specific capabilities to render-safe. EOD forces are critical components of handling and exploitation of captured or discovered enemy CBRN munitions and devices, FP measures, and defense of critical infrastructure.

*For more information on EOD forces and roles, see JP 3-42,* Joint Explosive Ordnance Disposal.

# APPENDIX H
## OPERATIONS IN CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR ENVIRONMENTS POINTS OF CONTACT

**Joint Staff/J7/Doctrine Division**

| | |
|---|---|
| Web Site: | http://www.jcs.mil/doctrine/ |
| Email: | js.pentagon.j7.jedd-support@mail.mil |
| Comm: | 1-703-692-7273 (DSN 222) |

**Joint Staff Doctrine Sponsor/J8/JRO-CBRND**

| | |
|---|---|
| Comm: | 1-703-571-3059 (DSN 671) |
| NIPR: | js.pentagon.j8.list.dd-fp-jro-mil@mail.mil |

**United States CBRN School/MSCOE Doctrine / Lead Agent**

| | |
|---|---|
| Comm: | 573-563-7364 (DSN 676) |
| NIPR: | usarmy.leonardwood.mscoe.list.cdidcodddcbrndoc-ownrs@mail.mil |

**United States Army Nuclear & Countering Weapons of Mass Destruction Agency**

| | |
|---|---|
| | Mailing Address: HQDA G-3/5/7, CWMD Proliferation Policy Division 5915 16th Street, Bldg 238 Ft. Belvoir, VA 22060-5589 |
| Comm: | 703-545-0718 |
| NIPR: | usarmy.pentagon.hqda-dcs-g-3-5-7.list.aoc-g34-appcoc@mail.mil |

**United States Marine Corps Special Operations Command (MARSOC)**

| | |
|---|---|
| Mailing Address: | U.S. Marine Corps Forces, Special Operations Command (MARSOC)<br>G7 Doctrine<br>PSC Box 20116<br>Camp Lejeune, North Carolina 28542-0116 |
| Web Site: | http://www.marsoc.marines.mil/ |
| Comm: | 910-440-0255 |

**Naval Warfare Development Command (NWDC)**

| | |
|---|---|
| | CBRN Defense and METOC Doctrine |
| Mailing Address: | Doctrine, Lessons Learned and Analysis Department<br>Naval Special Warfare Command Norfolk, Virginia |
| Comm: | 1-757-341-4199 (DSN: 341) |
| Web: | https://www.nwdc.navy.mil/SitePages/doctrine.aspx |

**Air Force**

| | |
|---|---|
| Mailing Address: | LeMay Center for Doctrine Development & Education<br>LeMay Center/DDJ |

401 Chennault Circle
Maxwell AFB, AL 36112-6428
Comm: 334-953-7601
NIPR: afddec.ddj@us.af.mil

# APPENDIX J
## REFERENCES

The development of JP 3-11 is based upon the following primary references:

### 1. General

a. Homeland Security Presidential Directive (HSPD)-18, *Medical Countermeasures Against Weapons of Mass Destruction.*

b. HSPD-22, *(U) Domestic Chemical Defense.*

c. National Security Presidential Directive (NSPD)-33/HSPD-10, *(U) National Policy for Biodefense*.

d. NSPD-46/HSPD-15, *(U) US Policy and Strategy in the War on Terror[ism]*.

e. PPD-8, *National Preparedness.*

f. PPD-25, *(U) Guidelines for US Government Interagency Response to Terrorist Threats or Incidents in the US and Overseas.*

g. PPD-42, *(U) Preventing and Countering Weapons of Mass Destruction Proliferation, Terrorism, and Use.*

h. *National Security Strategy.*

i. *(U) National Defense Strategy of the United States of America.*

j. *(U) National Military Strategy.*

k. *National Response Framework, Third Edition*.

l. *National Strategy for Biosurveillance.*

m. *National Strategy for Countering Biological Threats.*

n. *National Strategy for Homeland Security*.

o. *Strategy for Homeland Defense and Defense Support of Civil Authorities.*

p. *Department of Defense Strategy for Countering Weapons of Mass Destruction.*

q. Memorandum from the Under Secretary of Defense for Policy, Subject: *Radiological Clearance Criteria Guideline for Platforms and Materiel,* Change 1, 2012.

r. Memorandum from the Under Secretary of Defense, Subject: *Chemical Clearance Guideline for Platforms and Materiel,* 26 August 2014.

s. Memorandum from the Under Secretary of Defense, Subject: *Biological Clearance Guideline for Platforms and Materiel,* 27 September 2016.

t. *Department of Transportation Emergency Response Guidebook 2016.*

## 2. Department of Defense Publications

a. DODD 3025.18, *Defense Support of Civil Authorities (DSCA).*

b. DODD 3150.08, *DOD Response to Nuclear and Radiological Incidents.*

c. DODD 5100.46, *Foreign Disaster Relief (FDR).*

d. DODD 5240.01, *DOD Intelligence Activities.*

e. DODD 6490.02E, *Comprehensive Health Surveillance.*

f. DODI 2000.12, *DOD Antiterrorism (AT) Program.*

g. DODI 2000.21, *DOD Support to International Chemical, Biological, Radiological, and Nuclear (CBRN) Incidents.*

h. DODI 3020.52, *DOD Installation Chemical, Biological, Radiological, Nuclear, and High-Yield Explosive (CBRNE) Preparedness Standards.*

i. DODI 6055.01, *DOD Safety and Occupational Health (SOH) Program.*

j. DODI 6055.08, *Occupational Ionizing Radiation Protection Program.*

k. DODI 6055.17, *DOD Emergency Management (EM) Program.*

l. DODI 6200.03, *Public Health Emergency Management Within the Department of Defense.*

m. DODI 6440.03, *DOD Laboratory Network (DLN).*

n. DODI 6490.03, *Deployment Health.*

o. *Department of Defense Foreign Clearance Manual* (https://www.fcg.pentagon.mil).

p. Armed Forces Radiobiology Research Institute, *Medical Management of Radiological Casualties*, 3rd edition.

## 3. Chairman of the Joint Chiefs of Staff Publications

a. CJCS Concept Plan 0500, *Military Assistance to Domestic Consequence Management Operations in Response to a Chemical, Biological, Radiological, Nuclear, or High-Yield Explosives Situation*.

b. CJCS Guide 3215, *(U) CJCS Guide to Non-traditional Agents.*

c. CJCSI 2030.01D, *Chemical Weapons Convention Implementation and Compliance Policy Guidance*.

d. CJCSI 2700.01F, *Rationalization, Standardization, and Interoperability (RSI) Activities*.

e. CJCSI 3125.01D, *Defense Response to Chemical, Biological, Radiological, and Nuclear (CBRN) Incidents in the Homeland.*

f. CJCSI 3214.01E, *Defense Support for Chemical, Biological, Radiological, and Nuclear Incidents on Foreign Territory.*

g. CJCSI 3431.01D, *Joint Nuclear Accident and Incident Response Team*.

h. CJCS Manual 3122.01A, *Joint Operation Planning and Execution System (JOPES) Volume I, Planning Policies and Procedures*.

i. CJCS Manual 3130.03, *Adaptive Planning and Execution (APEX) Planning Formats and Guidance*.

j. JP 1, *Doctrine for the Armed Forces of the United States*.

k. JP 1-0, *Joint Personnel Support*.

l. JP 2-0, *Joint Intelligence*.

m. JP 2-01.3, *Joint Intelligence Preparation of the Operational Environment*.

n. JP 3-0, *Joint Operations*.

o. JP 3-05, *Special Operations.*

p. JP 3-06, *Joint Urban Operations.*

q. JP 3-08, *Interorganizational Cooperation*.

r. JP 3-10, *Joint Security Operations in Theater*.

s. JP 3-13, *Information Operations*.

t. JP 3-15.1, *Counter-Improvised Explosive Device Activities.*

u. JP 3-27, *Homeland Defense*.

v. JP 3-28, *Defense Support of Civil Authorities*.

w. JP 3-29, *Foreign Humanitarian Assistance*.

x. JP 3-33, *Joint Task Force Headquarters*.

y. JP 3-35, *Deployment and Redeployment Operations*.

z. JP 3-40, *Countering Weapons of Mass Destruction*.

aa. JP 3-41, *Chemical, Biological, Radiological, and Nuclear Response*.

bb. JP 3-42, *Joint Explosive Ordnance Disposal.*

cc. JP 3-61, *Public Affairs.*

dd. JP 4-0, *Joint Logistics*.

ee. JP 4-02, *Joint Health Services.*

ff. JP 4-06, *Mortuary Affairs*.

gg. JP 5-0, *Joint Planning*.

hh. JP 6-0, *Joint Communications System*.

**4. Multi-Service Publications**

a. ATP 3-11.23/MCTP 10-10H(MCWP 3-37.7)/NTTP 3-11.35/AFTTP 3-2.71, *Multi-Service Tactics, Techniques, and Procedures for Weapons of Mass Destruction Elimination Operations.*

b. ATP 3-11.32/MCTP 10-10E.8/NTTP 3-11.37, *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Passive Defense.*

c. ATP 3-11.36/MCRP 10-10E.1(MCRP 3-37B)/NTTP 3-11.34/AFTTP(I) 3-2.70, *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Aspects of Command and Control.*

d. ATP 3-11.37/MCRP 10-10E.7(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.*

e. ATP 3-11.41/MCRP 10-10E.6/(MCRP 3-37.2C)/NTTP 3-11.24/AFTTP 3-2.37, *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Consequence Management Operations.*

f. ATP 3-11.46/AFTTP 3-2.81, *Weapons of Mass Destruction—Civil Support Team Operations.*

g. ATP 3-11.47/AFTTP 3-2.79, *Chemical, Biological, Radiological, Nuclear, and High-Yield Explosives Enhanced Response Force Package (CERF)/Homeland Response Force (HRF) Operations.*

h. ATP 4-02.7/MCRP 3-40A.6 (MCRP 4-11.1F)/NTTP 4-02.7/AFTTP 3-42.3, *Multi-Service Tactics, Techniques, and Procedures for Health Service Support in a Chemical, Biological, Radiological, and Nuclear Environment.*

i. ATP 4-02.83/MCRP 3-40A.2 (MCRP 4-11.1B)/NTRP 4-02.21/AFMAN 44-161(1), *Multi-Service Tactics, Techniques, and Procedures for Treatment of Nuclear and Radiological Casualties.*

j. ATP 4-02.84/MCRP 3-40A.3 (MCRP 4-11.1C)/NTRP 4-02.23/AFMAN 44-156 IP, *Multi-Service Tactics, Techniques, and Procedures for Treatment of Biological Warfare Agent Casualties.*

k. ATP 4-02.85/MCRP 3-40A.1 (4-11.1A)/NTRP 4-02.22/AFTTP(I) 3-2.69, *Multi-Service Tactics, Techniques, and Procedures for Treatment of Chemical Warfare Agent Casualties and Conventional Military Chemical Injuries.*

l. ATP 4-32.2 (Army TTP 4-32.2)/MCRP 10-10D.1(MCRP 3-17.2B)/NTTP 3-02.4.1/AFTTP 3-2.12, *Multi-Service Tactics, Techniques, and Procedures for Explosive Ordnance.*

m. FM 3-11/MCRP 10-10E.3 (MCWP 3-37.1)/NWP 3-11/AFTTP(I) 3-2.42, *Multi-Service Doctrine for Chemical, Biological, Radiological, and Nuclear Operations.*

n. NTTP/Coast Guard TTP 3-20.31, *Surface Ship Survivability.*

**5. United States Marine Corps Publication**

MCTP 10-10E, *MAGTF Nuclear, Biological, and Chemical Defense Operations.*

## 6. United States Navy Publication

*Naval Ships' Technical Manual Chapter 470, Shipboard Chemical Warfare/Biological Warfare (CW/BW) Defense and Countermeasures.*

## 7. United States Army Publications

a. ATP 3-11.24, *Technical Chemical, Biological, Radiological, Nuclear, and Explosives Force Employment.*

b. ATP 4-32, *Explosive Ordnance Disposal (EOD) Operations.*

c. ATP 3-05.11, *Army Special Operations Forces Chemical, Biological, Radiological, and Nuclear Operations.*

## 8. United States Air Force Publications

a. Air Force Policy Directive 10-25, *Air Force Emergency Management Program*.

b. Air Force Policy Directive 10-26, *Countering Weapons of Mass Destruction Enterprise*.

c. Air Force Doctrine Annex 3-40, *Counter-Chemical, Biological, Radiological, and Nuclear Operations*.

d. Air Force Instruction (AFI) 10-2501, *Air Force Emergency Management Program*.

e. AFI 10-2519, *Public Health Emergencies and Incidents of Public Health Concern.*

f. AFI 10-2607, *Air Force Chemical, Biological, Radiological, and Nuclear Survivability*.

g. AFI 34-501, *Mortuary Affairs Program*.

h. AFI 48-148, *Ionizing Radiation Protection*.

i. AFMAN 10-2503, *Operations in a Chemical, Biological, Radiological, Nuclear, and High-Yield Explosive (CBRNE) Environment*.

j. AFMAN 10-2605, *Education, Training and Exercise Competencies for Counter-Chemical, Biological, Radiological, and Nuclear Operations*.

## 9. United States Coast Guard Publications

a. Commandant Instruction (COMDTINST) 3400.5, *Policy for Countering Weapons of Mass Destruction.*

b. COMDTINST M3400.51, *United States Coast Guard Countering Weapons of Mass Destruction Capabilities Manual.*

c. Coast Guard Publication 3-1, *Deployable Specialized Forces.*

## 10. Multinational Publications

a. NATO Allied Medical Publication (AMedP)-6(C) Volume 1, *NATO Handbook on the Medical Aspects of NBC Defensive Operations (Nuclear).*

b. NATO AMedP-6(C) Volume 2, *NATO Handbook on the Medical Aspects of NBC Defensive Operations (Biological).*

c. NATO AMedP-6(C) Volume 3, *NATO Handbook on the Medical Aspects of NBC Defensive Operations (Chemical).*

d. Allied Engineering Publication-7, *Chemical, Biological, Radiological, and Nuclear (CBRN) Defense Factors in the Design, Testing, and Acceptance of Military Equipment* (Edition 5).

e. NATO STANAG 2471 Edition 4, *Chemical, Biological, Radiological, and Nuclear (CBRN) Hazard Management for Airlift Operations.*

f. NATO STANAG 2473, *Commander's Guide to Radiation Exposures in Non-Article 5 Crisis Response Operations*.

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# APPENDIX K
## ADMINISTRATIVE INSTRUCTIONS

### 1. User Comments

Users in the field are highly encouraged to submit comments on this publication using the Joint Doctrine Feedback Form located at: https://jdeis.js.mil/jdeis/jel/jp_feedback_form.pdf and e-mail it to: js.pentagon.j7.mbx.jedd-support@mail.mil. These comments should address content (accuracy, usefulness, consistency, and organization), writing, and appearance.

### 2. Authorship

a. The lead agent for this publication is the US Army. The Joint Staff doctrine sponsor for this publication is the Director, Joint Requirements Office for Chemical, Biological, Radiological, and Nuclear Defense (J-8).

b. The following staff, in conjunction with the joint doctrine development community, made a valuable contribution to the revision of this joint publication: lead agent, Ms. Sharon McCann, US Army; Joint Staff doctrine sponsor, CWO5 James (David) Brookshire, Joint Staff J-8; LtCol Brian Mullery, Joint Staff J-7, Joint Doctrine Analysis Division; and Mr. Larry Seman, Joint Staff J-7, Joint Doctrine Division.

### 3. Supersession

This publication supersedes JP 3-11, *Operations in Chemical, Biological, Radiological, and Nuclear Environments,* 04 October 2013.

### 4. Change Recommendations

a. To provide recommendations for urgent and/or routine changes to this publication please complete the Joint Doctrine Feedback Form located at: https://jdeis.js.mil/jdeis/jel/jp_feedback_form.pdf and e-mail it to: js.pentagon.j7.mbx.jedd-support@mail.mil.

b. When a Joint Staff directorate submits a proposal to the CJCS that would change source document information reflected in this publication, that directorate will include a proposed change to this publication as an enclosure to its proposal. The Services and other organizations are requested to notify the Joint Staff J-7 when changes to source documents reflected in this publication are initiated.

### 5. Lessons Learned

The Joint Lessons Learned Program (JLLP) primary objective is to enhance joint force readiness and effectiveness by contributing to improvements in doctrine, organization, training, materiel, leadership and education, personnel, facilities, and policy. The Joint

Lessons Learned Information System (JLLIS) is the DOD system of record for lessons learned and facilitates the collection, tracking, management, sharing, collaborative resolution, and dissemination of lessons learned to improve the development and readiness of the joint force. The JLLP integrates with joint doctrine through the joint doctrine development process by providing lessons and lessons learned derived from operations, events, and exercises. As these inputs are incorporated into joint doctrine, they become institutionalized for future use, a major goal of the JLLP. Lessons and lessons learned are routinely sought and incorporated into draft JPs throughout formal staffing of the development process. The JLLIS Website can be found at https://www.jllis.mil (NIPRNET) or http://www.jllis.smil.mil (SIPRNET).

## 6. Distribution of Publications

Local reproduction is authorized, and access to unclassified publications is unrestricted. However, access to and reproduction authorization for classified JPs must be IAW DOD Manual 5200.01, Volume 1, *DOD Information Security Program: Overview, Classification, and Declassification,* and DOD Manual 5200.01, Volume 3, *DOD Information Security Program: Protection of Classified Information.*

## 7. Distribution of Electronic Publications

a. Joint Staff J-7 will not print copies of JPs for distribution. Electronic versions are available on JDEIS Joint Electronic Library Plus (JEL+) at https://jdeis.js.mil/jdeis/index.jsp (NIPRNET) and https://jdeis.js.smil.mil/jdeis/index.jsp (SIPRNET), and on the JEL at http://www.jcs.mil/Doctrine/ (NIPRNET).

b. Only approved JPs are releasable outside the combatant commands, Services, and Joint Staff. Defense attachés may request classified JPs by sending written requests to Defense Intelligence Agency (DIA)/IE-3, 200 MacDill Blvd., Joint Base Anacostia-Bolling, Washington, DC 20340-5100.

c. JEL CD-ROM. Upon request of a joint doctrine development community member, the Joint Staff J-7 will produce and deliver one CD-ROM with current JPs. This JEL CD-ROM will be updated not less than semi-annually and when received can be locally reproduced for use within the combatant commands, Services, and combat support agencies.

# GLOSSARY
## PART I—ABBREVIATIONS, ACRONYMS, AND INITIALISMS

| | |
|---|---|
| AFI | Air Force instruction |
| AFMAN | Air Force manual |
| AFTTP | Air Force tactics, techniques, and procedures |
| AFTTP(I) | Air Force tactics, techniques, and procedures (instruction) |
| ALARA | as low as reasonably achievable |
| AMedP | Allied medical publication |
| amu | atomic mass unit |
| AOR | area of responsibility |
| APOD | aerial port of debarkation |
| ATP | Army techniques publication |
| | |
| C2 | command and control |
| CAAF | contractors authorized to accompany the force |
| CBRN | chemical, biological, radiological, and nuclear |
| CBRNE | chemical, biological, radiological, nuclear, and high-yield explosives (USA/NGB/USCG) |
| CCDR | combatant commander |
| CCMD | combatant command |
| CJCS | Chairman of the Joint Chiefs of Staff |
| CJCSI | Chairman of the Joint Chiefs of Staff instruction |
| COA | course of action |
| COLPRO | collective protection |
| COMDTINST | Commandant instruction (USCG) |
| CT | computed tomography |
| CWMD | countering weapons of mass destruction |
| | |
| DOD | Department of Defense |
| DODD | Department of Defense directive |
| DODI | Department of Defense instruction |
| DOS | Department of State |
| DTPA | diethylenetriaminepentaacetic acid |
| DTRA | Defense Threat Reduction Agency |
| | |
| EDTA | ethylenediaminetetraacetic acid |
| EMP | electromagnetic pulse |
| EOD | explosive ordnance disposal |
| EP | emergency preparedness |
| ERG | Emergency Response Guidebook |
| | |
| FDA | Food and Drug Administration (DHHS) |
| FM | field manual (USA) |
| FP | force protection |

| | |
|---|---|
| GCC | geographic combatant commander |
| | |
| HEMP | high-altitude electromagnetic pulse |
| HN | host nation |
| HSPD | homeland security Presidential directive |
| | |
| IAA | incident awareness and assessment |
| ICBRN-R | international chemical, biological, radiological, and nuclear response |
| IED | improvised explosive device |
| IND | improvised nuclear device |
| IPE | individual protective equipment |
| ISR | intelligence, surveillance, and reconnaissance |
| | |
| JFC | joint force commander |
| JIPOE | joint intelligence preparation of the operational environment |
| JMAO | joint mortuary affairs office |
| JP | joint publication |
| | |
| LEMP | low-altitude electromagnetic pulse |
| | |
| MAGTF | Marine air-ground task force |
| MCRP | Marine Corps reference publication |
| MCTP | Marine Corps tactical publication |
| MCWP | Marine Corps warfighting publication |
| MHE | materials handling equipment |
| MOE | measure of effectiveness |
| MOP | measure of performance |
| MOPP | mission-oriented protective posture |
| MSC | Military Sealift Command |
| MTF | medical treatment facility |
| | |
| NATO | North Atlantic Treaty Organization |
| NGO | nongovernmental organization |
| NSF | National Strike Force (USCG) |
| NSPD | national security Presidential directive |
| NSS | national security strategy |
| NTA | nontraditional agent |
| NTRP | Navy tactical reference publication |
| NTTP | Navy tactics, techniques, and procedures |
| NWP | Navy warfare publication |
| | |
| OE | operational environment |
| OEG | operational exposure guidance |
| OPTEMPO | operating tempo |

| | |
|---|---|
| PIR | priority intelligence requirement |
| PPD | Presidential policy directive |
| PPE | personal protective equipment |
| | |
| RDD | radiological dispersal device |
| RED | radiological exposure device |
| RES | radiation exposure status |
| ROE | rules of engagement |
| ROM | restriction of movement |
| | |
| SecDef | Secretary of Defense |
| SJA | staff judge advocate |
| SME | subject matter expert |
| SOF | special operations forces |
| SPOD | seaport of debarkation |
| STANAG | standardization agreement (NATO) |
| | |
| TIB | toxic industrial biological |
| TIC | toxic industrial chemical |
| TIM | toxic industrial material |
| TIR | toxic industrial radiological |
| TTP | tactics, techniques, and procedures |
| | |
| USCG | United States Coast Guard |
| USG | United States Government |
| USTRANSCOM | United States Transportation Command |
| | |
| WMD | weapons of mass destruction |
| WMD-CST | weapons of mass destruction-civil support team |

## PART II—TERMS AND DEFINITIONS

**acute radiation dose.** Total ionizing radiation dose received at one time and over a period so short that biological recovery cannot occur. (DOD Dictionary. Source: JP 3-11)

**acute radiation syndrome.** An acute illness caused by irradiation of the body by a high dose of penetrating radiation in a very short period of time. Also called **ARS.** (DOD Dictionary. Source: JP 3-11)

**biological agent.** A microorganism (or a toxin derived from it) that causes disease in personnel, plants, or animals or causes the deterioration of materiel. (DOD Dictionary. Source: JP 3-11)

**biological hazard.** An organism, or substance derived from an organism, that poses a threat to human or animal health. (DOD Dictionary. Source: JP 3-11)

**blister agent.** A chemical agent that injures the eyes and lungs, and burns or blisters the skin. Also called **vesicant agent.** (DOD Dictionary. Source: JP 3-11)

**blood agent.** A chemical compound, including the cyanide group, that affects bodily functions by preventing the normal utilization of oxygen by body tissues. (DOD Dictionary. Source: JP 3-11)

**centigray.** None. (Approved for removal from the DOD Dictionary.)

**chemical agent.** A chemical substance that is intended for use in military operations to kill, seriously injure, or incapacitate mainly through its physiological effects. (DOD Dictionary. Source: JP 3-11)

**chemical, biological, radiological, and nuclear defense.** Measures taken to minimize or negate the vulnerabilities to, and/or effects of, a chemical, biological, radiological, or nuclear hazard or incident. Also called **CBRN defense.** (DOD Dictionary. Source: JP 3-11)

**chemical, biological, radiological, and nuclear environment.** An operational environment that includes chemical, biological, radiological, and nuclear threats and hazards and their potential resulting effects. Also called **CBRN environment.** (DOD Dictionary. Source: JP 3-11)

**chemical, biological, radiological, and nuclear hazard.** Chemical, biological, radiological, and nuclear elements that could create adverse effects due to an accidental or deliberate release and dissemination. Also called **CBRN hazard.** (DOD Dictionary. Source: JP 3-11)

**chemical, biological, radiological, or nuclear incident.** Any occurrence, resulting from the use of chemical, biological, radiological, and nuclear weapons and devices; the emergence of secondary hazards arising from friendly actions; or the release of toxic industrial materials or biological organisms and substances into the environment, involving the emergence of chemical, biological, radiological, and nuclear hazards. (Approved for incorporation into the DOD Dictionary.)

**chemical, biological, radiological, or nuclear weapon.** None. (Approved for removal from the DOD Dictionary.)

**chemical hazard.** Any chemical manufactured, used, transported, or stored that can cause death or other harm through toxic properties of those materials, including chemical agents and chemical weapons prohibited under the Chemical Weapons Convention as well as toxic industrial chemicals. (DOD Dictionary. Source: JP 3-11)

**chemical warfare.** All aspects of military operations involving the employment of lethal and incapacitating chemical munitions/agents and the warning and protective measures associated with such offensive operations. Also called **CW.** (Approved for incorporation into the DOD Dictionary.)

**chemical weapon.** Together or separately, (a) a toxic chemical and its precursors, except when intended for a purpose not prohibited under the Chemical Weapons Convention; (b) a munition or device, specifically designed to cause death or other harm through toxic properties of those chemicals specified in (a), above, which would be released as a result of the employment of such munition or device; (c) any equipment specifically designed for use directly in connection with the employment of munitions or devices specified in (b), above. (DOD Dictionary. Source: JP 3-11)

**clearance decontamination.** The final level of decontamination that provides the decontamination of equipment and personnel to a level that allows unrestricted transportation, maintenance, employment, and disposal. (DOD Dictionary. Source: JP 3-11)

**collective protection.** The protection provided to a group of individuals that permits relaxation of individual chemical, biological, radiological, and nuclear protection. Also called **COLPRO.** (DOD Dictionary. Source: JP 3-11)

**contamination.** 1. The deposit, absorption, or adsorption of radioactive material or of biological or chemical agents on or by structures, areas, personnel, or objects. Also called **fallout radiation.** 2. Food and/or water made unfit for consumption by humans or animals because of the presence of environmental chemicals, radioactive elements, bacteria or organisms, the byproduct of the growth of bacteria or organisms, or the decomposing material or waste in the food or water. (Approved for incorporation into the DOD Dictionary)

**contamination avoidance.** Individual and/or unit measures taken to reduce the effects of chemical, biological, radiological, and nuclear hazards. (DOD Dictionary. Source: JP 3-11)

**contamination control.** A combination of preparatory and responsive measures designed to limit the vulnerability of forces to chemical, biological, radiological, nuclear, and toxic industrial hazards and to avoid, contain, control exposure to, and, where possible, neutralize them. (DOD Dictionary. Source: JP 3-11)

**contamination mitigation.** The planning and actions taken to prepare for, respond to, and recover from contamination associated with all chemical, biological, radiological, and nuclear threats and hazards to continue military operations. (Approved for incorporation into the DOD Dictionary)

**decontamination.** The process of making any person, object, or area safe by destroying, neutralizing, making harmless, or absorbing and removing chemical or biological agents or by removing radioactive material clinging to or around it. (Approved for incorporation into the DOD Dictionary.)

**detection.** 1. In tactical operations, the perception of an object of possible military interest but unconfirmed by recognition. 2. In surveillance, the determination and transmission by a surveillance system that an event has occurred. 3. In arms control, the first step in the process of ascertaining the occurrence of a violation of an arms control agreement. 4. In chemical, biological, radiological, and nuclear environments, the act of locating chemical, biological, radiological, and nuclear hazards by use of chemical, biological, radiological, and nuclear detectors or monitoring and/or survey teams. (DOD Dictionary. Source: JP 3-11)

**half-life.** The time required for the activity of a given radioactive species to decrease to half of its initial value due to radioactive decay. (DOD Dictionary. Source: JP 3-11)

**immediate decontamination.** Decontamination carried out by individuals immediately upon becoming contaminated to save lives, minimize casualties, and limit the spread of contamination. Also called **emergency decontamination.** (DOD Dictionary. Source: JP 3-11)

**incapacitating agent.** A chemical agent, which produces temporary disabling conditions that can be physical or mental and persist for hours or days after exposure to the agent has ceased. (DOD Dictionary. Source: JP 3-11)

**individual protective equipment.** The personal clothing and equipment provided to all military, government civilians, and contractors authorized to accompany the force required to protect an individual from chemical, biological, and radiological hazards and some nuclear hazards. Also called **IPE.** (Approved for incorporation into the DOD Dictionary.)

**ionizing radiation.** Particulate (alpha, beta, and neutron) and electromagnetic (X-ray and gamma) radiation of sufficient energy to displace electrons from atoms, producing ions. (DOD Dictionary. Source: JP 3-11)

**mission-oriented protective posture.** A flexible system of protection against chemical, biological, radiological, and nuclear contamination in which personnel are required to wear only that protective clothing and equipment appropriate to the threat level, work rate imposed by the mission, temperature, and humidity. Also called **MOPP.** (DOD Dictionary. Source: JP 3-11)

**mission-oriented protective posture gear.** Military term for individual protective equipment, including suit, boots, gloves, mask with hood, first aid treatments, and decontamination kits, issued to authorized personnel. Also called **MOPP gear.** (Approved for incorporation into the DOD Dictionary.)

**nerve agent.** A potentially lethal chemical agent that interferes with the transmission of nerve impulses. (DOD Dictionary. Source: JP 3-11)

**nonpersistent agent.** A chemical agent that, when released, dissipates and/or loses its ability to cause casualties after 10 to 15 minutes. (Approved for incorporation into the DOD Dictionary.)

**nuclear hazard.** Dangers associated with the blast, thermal, and radiation effects from nuclear explosion. (Approved for inclusion in the DOD Dictionary.)

**operational decontamination.** Decontamination carried out by an individual and/or a unit, restricted to specific parts of operationally essential equipment, materiel, and/or working areas, to minimize contact and transfer hazards and to sustain operations. (Approved for incorporation into the DOD Dictionary.)

**operational exposure guidance.** The maximum amount of nuclear/external ionizing radiation that the commander considers a unit may be permitted to receive while performing a particular mission or missions. Also called **OEG.** (DOD Dictionary. Source: JP 3-11)

**overpressure.** The pressure resulting from the blast wave of an explosion referred to as "positive" when it exceeds atmospheric pressure and "negative" during the passage of the wave when resulting pressures are less than atmospheric pressure. (DOD Dictionary. Source: JP 3-11)

**persistent agent.** A chemical agent that, when released, remains able to cause casualties for more than 24 hours to several days or weeks. (DOD Dictionary. Source: JP 3-11)

**personal protective equipment.** Mission-specific protective clothing and equipment provided to shield or isolate selected personnel from a particular chemical, biological, radiological, and some nuclear hazards. Also called **PPE.** (Approved for incorporation into the DOD Dictionary.)

**prompt radiation.** The radiation, essentially neutrons and gamma rays, resulting from a nuclear burst and emitted from the fireball within one minute after burst. (Approved for the replacement of "initial radiation" in the DOD Dictionary.)

**protective clothing.** Clothing especially designed, fabricated, or treated to protect personnel against hazards. (DOD Dictionary. Source: JP 3-11)

**radiation dose.** The total amount of ionizing radiation absorbed by material or tissues. (DOD Dictionary. Source: JP 3-11)

**radiation dose rate.** Measurement of radiation dose per unit of time. (DOD Dictionary. Source: JP 3-11)

**radiation exposure status.** Criteria to assist the commander in measuring unit exposure to radiation based on total past cumulative dose, normally expressed in centigray. Also called **RES.** (DOD Dictionary. Source: JP 3-11)

**radiological dispersal device.** An improvised assembly or process, other than a nuclear explosive device, designed to disseminate radioactive material to cause destruction, damage, or injury. Also called **RDD.** (Approved for incorporation into the DOD Dictionary.)

**radiological exposure device.** A radioactive source placed to cause injury or death. Also called **RED.** (DOD Dictionary. Source: JP 3-11)

**radiological hazard.** Ionizing radiation that can cause damage, injury, or destruction from either external irradiation or due to radiation from radioactive materials within the body. (Approved for inclusion in the DOD Dictionary.)

**residual radiation.** Nuclear radiation caused by fallout, artificial dispersion of radioactive material, or irradiation that results from a nuclear explosion and persists longer than one minute after burst. (DOD Dictionary. Source: JP 3-11)

**riot control agent.** Any chemical, not listed in a schedule of the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction that can produce rapidly in humans sensory irritation or disabling physical effects that disappear within a short time following termination of exposure. Also called **RCA.** (DOD Dictionary. Source: JP 3-11)

**shielding.** 1. Material of suitable thickness and physical characteristics used to protect personnel from radiation during the manufacture, handling, and transportation of fissionable and radioactive materials. 2. Obstructions that tend to protect personnel or materials from the effects of a nuclear explosion. (DOD Dictionary. Source: JP 3-11)

**split-mission oriented protective posture.** The concept of maintaining heightened protective posture only in those areas (or zones) that are contaminated, allowing personnel in uncontaminated areas to continue to operate in a reduced posture. Also called **split-MOPP.** (DOD Dictionary. Source: JP 3-11)

**thorough decontamination.** Decontamination carried out by a unit to reduce contamination on personnel, equipment, materiel, and/or working areas equal to natural background or to the lowest possible levels, to permit the partial or total removal of individual protective equipment and to maintain operations with minimum degradation. (DOD Dictionary. Source: JP 3-11)

**toxic industrial biological.** Any biological material manufactured, used, transported, or stored by industrial, medical, or commercial processes which could pose an infectious or toxic threat. Also called **TIB.** (DOD Dictionary. Source: JP 3-11)

**toxic industrial chemical.** A chemical developed or manufactured for use in industrial operations or research by industry, government, or academia that poses a hazard. Also called **TIC.** (DOD Dictionary. Source: JP 3-11)

**toxic industrial material.** A generic term for toxic, chemical, biological, or radioactive substances in solid, liquid, aerosolized, or gaseous form that may be used, or stored for use, for industrial, commercial, medical, military, or domestic purposes. Also called **TIM.** (DOD Dictionary. Source: JP 3-11)

**toxic industrial radiological.** Any radiological material manufactured, used, transported, or stored by industrial, medical, or commercial processes. Also called **TIR.** (DOD Dictionary. Source: JP 3-11)

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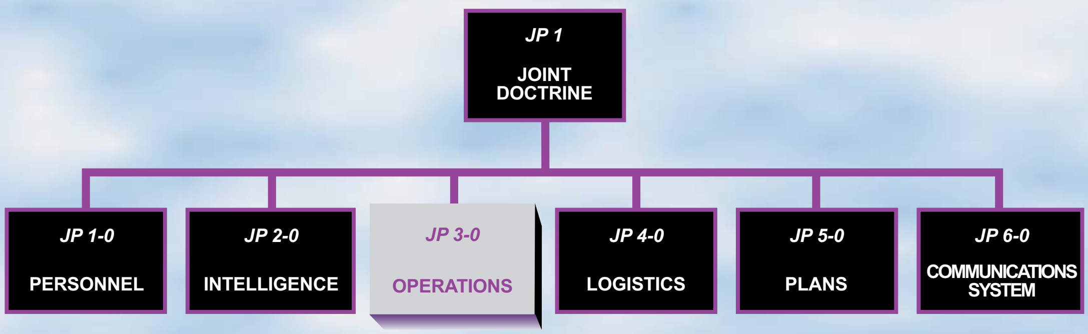
# JOINT DOCTRINE PUBLICATIONS HIERARCHY



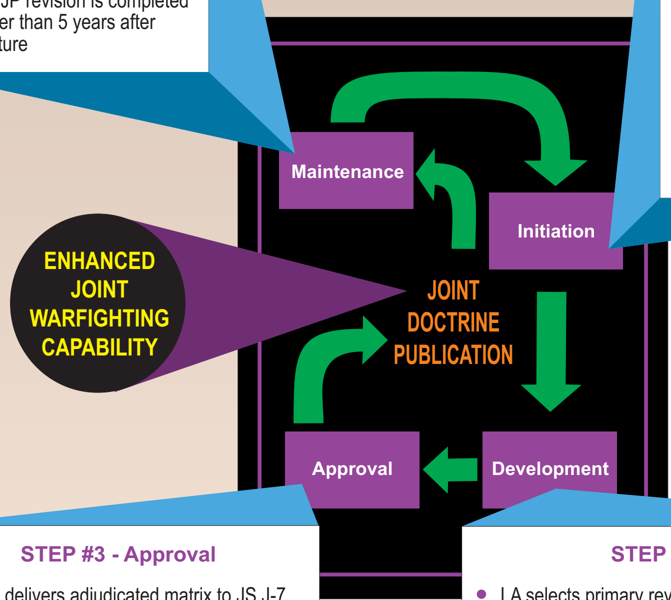

All joint publications are organized into a comprehensive hierarchy as shown in the chart above. **Joint Publication (JP) 3-11** is in the **Operations** series of joint doctrine publications. The diagram below illustrates an overview of the development process:

### STEP #4 - Maintenance

- JP published and continuously assessed by users
- Formal assessment begins 24-27 months following publication
- Revision begins 3.5 years after publication
- Each JP revision is completed no later than 5 years after signature

### STEP #1 - Initiation

- Joint doctrine development community (JDDC) submission to fill extant operational void
- Joint Staff (JS) J-7 conducts front-end analysis
- Joint Doctrine Planning Conference validation
- Program directive (PD) development and staffing/joint working group
- PD includes scope, references, outline, milestones, and draft authorship
- JS J-7 approves and releases PD to lead agent (LA) (Service, combatant command, JS directorate)




### STEP #3 - Approval

- JSDS delivers adjudicated matrix to JS J-7
- JS J-7 prepares publication for signature
- JSDS prepares JS staffing package
- JSDS staffs the publication via JSAP for signature

### STEP #2 - Development

- LA selects primary review authority (PRA) to develop the first draft (FD)
- PRA develops FD for staffing with JDDC
- FD comment matrix adjudication
- JS J-7 produces the final coordination (FC) draft, staffs to JDDC and JS via Joint Staff Action Processing (JSAP) system
- Joint Staff doctrine sponsor (JSDS) adjudicates FC comment matrix
- FC joint working group

JOINT
CHIEFS OF STAFF