

UNIFIED FACILITIES CRITERIA (UFC)

NON-PERMANENT DOD FACILITIES IN SUPPORT OF MILITARY OPERATIONS



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U.S. ARMY CORPS OF ENGINEERS

NAVAL FACILITIES ENGINEERING COMMAND (Preparing Activity)

AIR FORCE CIVIL ENGINEER Center

Record of Changes (changes are indicated by \1\ ... /1/)

Change No.	Date	Location

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FOREWORD

The Unified Facilities Criteria (UFC) system is prescribed by MIL-STD 3007 and provides planning, design, construction, sustainment, restoration, and modernization criteria, and applies to the Military Departments, the Defense Agencies, and the DoD Field Activities in accordance with [USD \(AT&L\) Memorandum](#) dated 29 May 2002. UFC will be used for all DoD projects and work for other customers where appropriate. All construction outside of the United States is also governed by Status of Forces Agreements (SOFA), Host Nation Funded Construction Agreements (HNFA), and in some instances, Bilateral Infrastructure Agreements (BIA.) Therefore, the acquisition team must ensure compliance with the most stringent of the UFC, the SOFA, the HNFA, and the BIA, as applicable.

UFC are living documents and will be periodically reviewed, updated, and made available to users as part of the Services' responsibility for providing technical criteria for military construction. Headquarters, U.S. Army Corps of Engineers (HQUSACE), Naval Facilities Engineering Command (NAVFAC), and the Air Force Civil Engineer Center (AFCEC) are responsible for administration of the UFC system. Defense agencies should contact the preparing service for document interpretation and improvements. Technical content of UFC is the responsibility of the cognizant DoD working group. Recommended changes with supporting rationale should be sent to the respective service proponent office by the following electronic form: [Criteria Change Request](#). The form is also accessible from the Internet sites listed below.

UFC are effective upon issuance and are distributed only in electronic media from the following source:

- Whole Building Design Guide web site <http://dod.wbdg.org/>.

Hard copies of UFC printed from electronic media should be checked against the current electronic version prior to use to ensure that they are current.




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**UNIFIED FACILITIES CRITERIA (UFC)
NEW DOCUMENT SUMMARY SHEET**

Document: UFC 1-201-01, Non-Permanent DOD Facilities in Support of Military Operations

Superseding: N/A

Description: This UFC provides life safety and habitability-related design requirements for non-permanent facilities designed and constructed for use by the Department of Defense (DoD) in support of military operations.

Reasons for Document: This UFC was developed to establish the minimum requirements for the Life Safety and Habitability aspects of non-permanent facilities in support of military operations.

Impact: The following will result from the publication of this UFC:

- There is currently no UFC for non-permanent facilities for military operations. This UFC establishes minimum life safety and habitability requirements for design and construction of these facilities and is intended to ensure protection of life safety and health of personnel occupying these facilities.
- The criteria established in this UFC may result in Doctrine, Organization, Training, Material, Leadership and Education, Personnel, Facilities, and Policy (DOTMLPF-P) impacts across the Services. Services should conduct DOTMLPF-P analysis to determine the impacts on their ability to execute construction in support of military operations. This includes but is not limited to a review of current standard facility designs.

Non-Unification Issues: There are no non-unified issues in this UFC.

TABLE OF CONTENTS

CHAPTER 1 INTRODUCTION.....	5
1-1 PURPOSE.....	5
1-2 APPLICABILITY.....	5
1-3 AUTHORITY AND SCOPE.....	5
1-4 FACILITY CONSTRUCTION LEVELS.....	6
1-4.1 Initial.....	6
1-4.2 Temporary.....	6
1-4.3 Semi-permanent.....	6
1-5 AUTHORITY HAVING JURISDICTION.....	7
1-6 WAIVERS.....	7
1-7 FACILITY DESIGN.....	7
1-7.1 UFC Criteria.....	7
1-7.2 Design Analysis and Documentation.....	8
1-7.3 Standard Designs.....	11
1-7.4 Alternative Materials.....	12
1-7.5 Local and Regional Codes.....	12
1-7.6 International Code Editions.....	12
1-8 EXPLOSIVES SAFETY.....	12
1-9 ANTITERRORISM / FORCE PROTECTION.....	12
1-10 CORROSION PROTECTION.....	13
1-11 ACCESSIBILITY.....	13
1-12 RESOURCE CONSERVATION.....	13
1-13 TESTS AND INSPECTIONS.....	13
CHAPTER 2 INITIAL FACILITY CONSTRUCTION LEVEL.....	15
2-1 PRIMARY CRITERIA.....	15
2-1.1 Supplemental Criteria.....	15
2-2 CIVIL/SITE.....	15
2-2.1 Water Treatment, Storage, and Distribution.....	15
2-2.2 Solid Waste Disposal.....	16
2-2.3 Hazardous and Medical Waste Disposal.....	16
2-2.4 Stormwater.....	16
2-3 STRUCTURAL SYSTEMS.....	16
2-4 FIRE PROTECTION.....	16
2-4.1 Allowable Area/Population.....	16
2-4.2 Space Separation.....	16

2-4.3	Interior Finishes/Fabric Coverings.	17
2-4.4	Fire Extinguishers.....	18
2-5	PLUMBING AND MECHANICAL SYSTEMS.....	18
2-5.1	Potable Water Treatment, Storage and Distribution.....	18
2-5.2	Waste Water.....	18
2-5.3	Fuel Systems.....	19
2-5.4	Heating, Ventilating, and Air-Conditioning (HVAC).	19
2-6	ELECTRICAL SYSTEMS.....	19
2-6.1	Grounding.....	19
2-6.2	Power Cable Installation.	20
2-6.3	Circuit Lockout Requirements.....	20
2-7	TELECOMMUNICATIONS SYSTEMS.....	20
2-7.1	Grounding.....	20
CHAPTER 3 TEMPORARY AND SEMI-PERMANENT FACILITY CONSTRUCTION LEVELS....		21
3-1	CIVIL/SITE.....	21
3-1.1	Temporary Construction Level Requirements.....	21
3-1.2	Semi-permanent Construction Level Requirements.....	22
3-2	STRUCTURAL SYSTEMS.....	22
3-2.1	Temporary Construction Level Requirements.....	22
3-2.2	Semi-Permanent Construction Level Requirements.	26
3-3	FIRE PROTECTION.....	26
3-3.1	Construction Level Requirements and Space Separation Requirements per Occupancy.	27
3-3.2	Sprinkler System Design Criteria.	37
3-4	PLUMBING AND MECHANICAL SYSTEMS.....	37
3-4.1	Temporary Construction Level Requirements.....	37
3-4.2	Semi-permanent Construction Level Requirements.....	42
3-5	ELECTRICAL SYSTEMS.....	43
3-5.1	Temporary Construction Level Requirements.....	43
3-5.2	Semi-Permanent Construction Level Requirements.	45
3-6	TELECOMMUNICATIONS SYSTEMS.....	45
3-6.1	Temporary and Semi-Permanent Construction Level Requirements.....	45
APPENDIX A REFERENCES		47
APPENDIX B OTHER RESOURCES.....		51
APPENDIX C FIGURES		53

APPENDIX D GLOSSARY, ACRONYMS AND ABBREVIATIONS.....55

FIGURES

FIGURE C-1 MISSION CRITICAL FACILITIES DECISION TREE53

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CHAPTER 1 INTRODUCTION

1-1 PURPOSE.

This UFC provides life safety and habitability-related design requirements for non-permanent facilities designed and constructed for use by Department of Defense (DoD) personnel in support of military operations.

1-2 APPLICABILITY.

This UFC applies to all DoD components involved with planning, design and construction of non-permanent facilities that support Military Operations where permanent construction is determined to be impracticable under prevailing operational conditions, and/or the need for the facility is transitory. This UFC is intended for facilities used by US military and civilian personnel primarily outside of the United States and its territories and possessions. Joint Publication JP 3-0, *Joint Operations*, provides typical examples of military operations where use of this UFC is appropriate.

This criteria applies to the following:

- Buildings
- Utility distribution and infrastructure
- Equipment that is primarily intended to provide occupants shelter from the elements, in lieu of a building or structure.

The assessment for utilization of existing facilities for military operations is not covered by this UFC. See UFC 1-201-02, *Assessment of Existing Facilities for Use in Military Operations*.

1-3 AUTHORITY AND SCOPE.

This UFC was developed in response to Section 807 of Public Law 111-84, "Policy and Requirements to Ensure the Safety of Facilities, Infrastructure, and Equipment for Military Operations". The technical requirements establish the minimum requirements for life safety and health of personnel consistent with the requirements of military operations for the following building systems.

- Fire protection
- Structural integrity
- Electrical systems
- Plumbing and mechanical systems
- Water treatment, storage and distribution
- Wastewater collection and treatment
- Telecommunications networks

1-4 FACILITY CONSTRUCTION LEVELS.

Non-permanent facilities are broken down into three Construction levels:

- Initial
- Temporary
- Semi-permanent

The levels of construction are based on life expectancy of the facility established in Joint Publication 3-34, *Joint Engineer Operations*. JP 3-34 discusses base development from the contingency through enduring phases of military operations, and can be used as a tool to determine facility construction level. The terminology used for Facility Construction levels listed in this UFC (“Initial”, “Temporary” and “Semi-Permanent”) align with those included in JP 3-34, which uses duration of military operation as the basis for determining level of construction for the facilities.

Facility construction levels are not characterized by the type of materials used; however, some building characteristics are typical for temporary and semi-permanent construction levels. Examples of Temporary Facility Types may include wood frame structures, relocatable structures and modular building systems. Some facility types may satisfy more than a single construction level, such as Pre-engineered buildings and tension fabric structures.

1-4.1 Initial.

Facilities set up on an expedient basis with minimal external engineering design support, using Service, Host Nation, or Contracted equipment and systems. Typically provides for initial force presence and maneuver activities. Common facility types include tents, containers, and fabric shelters. This does not include individual unit organic tentage when used during bivouac operations. Comply with the requirements in Chapters 1 and 2 for Initial Construction Level.

1-4.2 Temporary.

Buildings and facilities designed and constructed to serve a life expectancy of five years or less using low-cost construction. A minimal facility intended to increase efficiency of operations and moderately improve quality of life for occupants. Maintainability is a secondary consideration. Construction features are characterized by low cost, expedient, construction utilizing locally available materials and construction methods and equipment. Temporary construction typically cannot be economically converted to a higher construction level. Comply with the requirements in Chapters 1 and 3 for Temporary Construction Level.

1-4.3 Semi-permanent.

Buildings and facilities designed and constructed to serve a life expectancy of less than 10 years. With maintenance and upkeep of critical building systems, life expectancy of facility can be extended to 25 years. Expediency of construction and material

availability may be a factor. Facilities are intended for a more enduring presence with operational characteristics and functional performance similar to permanent construction. Maintainability of finishes and systems must be commensurate with the facility life expectancy and available maintenance capabilities. Some building systems must be fully code compliant to allow for economical upgrade to permanent construction through renovation. Comply with the requirements in Chapters 1 and 3 for Semi-Permanent Construction Level.

1-5 AUTHORITY HAVING JURISDICTION.

The terms "Building Official" and "Authority Having Jurisdiction" (AHJ) as used in the codes and standards referenced in this UFC mean the Military Service office of responsibility, i.e., U.S. Army, HQ USACE/CECW-CE; U.S. Navy, NAVFACENGCOM HQ Code CHE; U.S. Marine Corps, HQMC Code LFF-1; and U.S. Air Force, AFCEC/CF. The Service's Chief Engineer can delegate to their Technical Representative the enforcement of the codes and standards.

1-6 WAIVERS.

In accordance with DFAR Clause 246.270-3, any deviation from the requirements specified in this UFC due to prevailing operational conditions must be approved by the Combatant Commander or delegated engineering authority in writing. Any deviation for reasons other than operational conditions must be approved by the appropriate Service Chief Engineer as outlined in MIL-STD- 3007.

The waiver must include the following:

- The specific standard and/or criterion to be waived by publication, paragraph, and page.
- Justification for noncompliance. Demonstrate that mitigation measures incorporated will provide an acceptable level of safety for meeting the mission. Include studies or back-up information to support this decision.
- Rationale for the waiver. If the waiver is for operational reasons, clearly explain why it is impractical under the prevailing conditions to comply with the standard. Identify specific impacts on mission and safety.

1-7 FACILITY DESIGN.

Facility design efforts must be performed by qualified personnel. Professional engineering resources are available through reach-back capabilities within each branch of Service. See Appendix B for Reach-back Contacts for each branch of Service.

1-7.1 UFC Criteria.

UFC 1-200-01, *General Building Requirements*, does not apply. Only the referenced UFC requirements defined in this document for safety and habitability are mandatory. All other UFC requirements are considered guidance and best practices and can assist designers in identifying functional requirements of building systems and spaces.

Project authorization documentation (e.g., DD1391's) must include a statement of the required Facility Construction Level.

1-7.2 Design Analysis and Documentation.

The Facility Construction Level and other life safety-related design parameters must be indicated on all design plans and as-built documents. A statement similar to the following must be included: "This facility is designed in accordance with UFC 1-201-01 at a facility construction level of "Initial".

Submissions shall include the following to demonstrate compliance with this UFC:

1-7.2.1 Civil Submittals: For Temporary and Semi-Permanent Facility Construction Levels

- Drawings: Site plan showing location of water source supply, sanitary sewer facilities, solid waste disposal areas, and all other facilities critical to life safety and health.
- Calculations: Showing compliance with potable water testing requirements contained in referenced standards.

1-7.2.2 Fire Protection Submittals: For Temporary and Semi-Permanent Facility Construction Levels

- Drawing / Narrative Basis of Design (can be combined)
- A fire protection summary is required for all designs. Provide a summary discussing the following minimum fire protection provisions, based on UFC 1-200-01, UFC 1-201-01 and UFC 3-600-01:
- Building code analysis summary drawing (i.e., type of construction, height and area limitations, and building separation or exposure protection),
- Classification of occupancy, mixed use requirements, any hazardous areas,
- Requirements for fire and smoke barriers, fire rated walls,
- Life safety plan showing locations of fire rated walls, egress paths, travel distances, and emergency response vehicle access,
- Fire protection plan (include type of system and location of equipment), and water supply information (if system is required),

- Fire alarm/mass notification system plan showing type of system and location of equipment, indicating reporting method to a central station/base location (if system is required),
- Interior finish ratings required and provided
- Coordination with security and antiterrorism requirements.

1-7.2.3 Structural Submittals: For Temporary and Semi-Permanent Facility Construction Levels

- Drawings:
- General Notes
- Inspection Requirements
- Foundation Plans
- Framing Plans, all levels
- Roof Framing Plans
- Details
- Schedules as required (footings, columns, beams, shear walls)
- Calculations:
- Basis of Design; summary of applicable codes, live loading, snow loading, wind and seismic loads, and dead load assumptions
Gravity design; design of floor and roof framing members - beams, slabs, joists, decks, composite slabs, etc.
- Column and bearing wall design
- Foundation design
- Lateral design; design of diaphragms and collectors, distribution of loads to lateral forces resisting elements (frames, walls), design of shear walls, moment frames, and braced frames, design of foundations at lateral force resisting elements, design of hold downs, straps, etc.
- Design for AT/FP; confirm setbacks, wall construction types, and progressive collapse mitigation design requirements, check window designs, jambs and sills for AT/FP window loading requirements

1-7.2.4 Plumbing & Mechanical Submittals: For Temporary and Semi-Permanent Facility Construction Levels

- Drawings:
 - Natural ventilation - Floor plans showing the layout of the ventilation system, dimensions of openings and associated equipment, and the means of controlling the system.
 - Mechanical ventilation - Floor plans showing the layout of the ventilation system, equipment schedules and details, schematic diagrams, and control sequences and diagrams.
- Calculations based on facility function and local climatic conditions:
 - Natural ventilation – Calculations showing ventilation opening areas.
 - Mechanical ventilation – Calculations showing required ventilation air quantities based on facility occupancy.
- For any specific systems as defined in Section 3-4.1.1, Requirements for Specific Systems, provide Mechanical System documentation in accordance with UFC-3-400-10N, Chapter 3-4, “Calculations”, and Chapter 3-5, “Drawings”, and Plumbing System documentation per UFC 3-420-01, Chapter 1-10.2, “Calculations”, and Chapter 1-11, “Drawings”.

1-7.2.5 Electrical Submittals:

- Drawings
 - For Temporary Facility Construction Level comply with the requirements of UFC 3-501-01, *Electrical Engineering*, Section 3-3, “Drawing Requirements”, and the following subsections:
 - Section 3-3.2, “Site Plans”
 - Section 3-3.9, “Lightning Protection Plans”
 - Section 3-3.11, “Power One-line/Riser Diagrams”
 - Section 3-3.18, “Grounding Diagram”
 - For Semi-permanent Facility Construction Level comply with the requirements of UFC 3-501-01, *Electrical Engineering*,

Section 3-3, "Drawing Requirements", and the following subsections:

- Section 3-3.1, "Legends and Abbreviations"
- Section 3-3.2.2, "Transformer Details"
- Section 3-3.2.3, "Underground Distribution"
- Section 3-3.4, "Lighting Plans and Details"
- Section 3-3.5, "Power Plans"
- Section 3-3.12, "Telecommunications Riser Diagram"
- Section 3-3.13, "Intercommunication/Paging Riser Diagram"
- Section 3-3.14, "Fire Alarm Riser Diagram"
- Section 3-3.16, "Schedules and Elevations"
- Calculations
 - For Temporary and Semi-Permanent Facility Construction Levels comply with the requirements of UFC 3-501-01, *Electrical Engineering*, for the following calculations:
 - Section 3-2.4, "Short Circuit Analysis"
 - Section 3-2.6, "Arc Flash Analyses"
 - Section 3-2.15, "Lightning Protection Calculations"

1-7.3 Standard Designs.

Standard designs are available for use in constructing non-permanent facilities. Use of these standard designs is encouraged when specific site conditions and other life safety related design parameters are appropriate for application.

When standard designs for facilities are being utilized for construction by military forces, they must not be modified for use without review and approval by qualified personnel in the discipline applicable to the feature that is being modified. When standard designs are being utilized for construction by Contractors, they must not be modified for use without approval by the Contracting Officer or the Contracting Officer's representative.

Standard Designs are available from the following sources:

- Theater Construction Management System (TCMS) <http://www.tcms.net/>

- Center of Standardization for Contingency Designs (U.S. Army Corps, CETAM-EN-X) <https://mrsi.usace.army.mil/cos/med/default.aspx>

1-7.4 Alternative Materials.

Locally available materials may be utilized when deemed acceptable for the intent of protecting life safety and health of personnel by the AHJ.

1-7.5 Local and Regional Codes.

Established local or regional codes may be utilized when deemed by the AHJ to provide equivalent or enhanced protection of life safety and health of personnel when compared to the requirements stated herein.

1-7.6 International Code Editions.

For development of the criteria within this UFC, 2009 Editions of the International Building Codes (IBC, IMC and IPC) were used.

1-8 EXPLOSIVES SAFETY.

This document does not contain requirements for explosives safety. All facilities that involve DoD Ammunition and Explosives (AE) storage, handling, maintenance, manufacture or disposal, as well as any facilities within the explosives safety quantity distance (ESQD) arcs of AE facilities, must comply with the minimum DoD explosives safety criteria given in DoD Manual 6055.09-M, as implemented in DA PAM 385-64 (Army), NAVSEA OP5 (Navy and Marine Corps), and AFMAN 91-201 (Air Force). DoD facilities exposed to potential explosion effects from AE belonging to other nations are also required to meet DoD and Service explosives safety criteria.

It is essential that the planning and design of new facilities and occupation and renovation of existing AE-related facilities or any facilities within ESQD arcs be accomplished in close coordination with knowledgeable explosives safety professionals in theater or with the Services' explosives safety centers. This coordination should occur as early as possible in the planning/design process to avoid issues/problems and ensure compliance.

All facility construction or use within ESQD arcs requires review for compliance with explosives safety criteria and must have either an approved explosives safety site plan or an approved explosives safety deviation. Refer to the DoD and Service documents mentioned above for further guidance in this area.

1-9 ANTITERRORISM / FORCE PROTECTION.

Requirements for DoD minimum antiterrorism standards for expeditionary and temporary structures are covered in Appendices B and D of UFC 4-010-01 and Geographic Combatant Command supplemental Operational Orders. The *Joint Forward Operations Base (JFOB) Force Protection Handbook*, GTA 90-01-011,

provides force protection planning and protective construction concepts for military operations facilities.

1-10 CORROSION PROTECTION.

Provide durability and protection from corrosive environments for systems, components, and connections required by this UFC appropriate for the life expectancy of the facility.

1-11 ACCESSIBILITY.

Facilities for use in military operations are designed for combat capable, able-bodied personnel only. However, special use facilities, such as medical, may employ more stringent requirements. For facilities to be used for non-able-bodied personnel, refer to requirements for "Accessibility" in UFC 1-200-01.

1-12 RESOURCE CONSERVATION.

While not a life safety or habitability requirement for non-permanent facilities, sustainable design practices should be incorporated based on emerging DoD policy. Considerations include:

- Energy Conservation
- Fuel Conservation
- Pollution Prevention
- Recycling Programs
- Hazardous Waste Minimization and Reuse
- Water Conservation and Reuse
- Waste Minimization and Diversion
- Waste-to-Energy Conversion
- Stormwater Management

As occupancy of contingency sites is extended for longer periods of time, additional sustainable design features should be incorporated for conservation of resources.

1-13 TESTS AND INSPECTIONS.

Establish and maintain an effective Construction Quality Management (CQM) system through the duration of construction to ensure that facilities constructed are safe and habitable. The CQM system must consist of two components: Quality Control (QC) and Quality Assurance (QA). QC personnel are responsible for work and safety planning, establishing and monitoring work quality and executing all specified inspections and testing. QA personnel are responsible for reviewing QC, inspection and testing reports and workmanship for conformance with the specified requirements. QC and QA actions must be performed by separate individuals.

Quality Control and Quality Assurance personnel must be subject matter experts in one of the construction trades and have met Service or contract requirements. The Designer of Record (DOR) should consider potential constraints in typical CQM Systems used in the contingency environment, when developing the design solution.

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CHAPTER 2 INITIAL FACILITY CONSTRUCTION LEVEL

Construction requirements for Initial Facility Construction Level rely primarily on manufacturers' instructions provided with Government-approved systems, Service-specific Field Manuals, and Handbooks developed for pre-packaged assemblies and equipment. This Chapter addresses requirements that affect life safety and health of personnel when establishing base operations. These requirements do not apply to bivouac operations.

2-1 PRIMARY CRITERIA.

For unit organic tentage used in establishing base operations, comply with Sections 2-2 thru 2-7 of this document.

Comply with the following Service documents for the primary layout, habitability and safety criteria for specific equipment systems being used:

- Army/Force Provider - FM 4-20.07, Quartermaster Force Provider Company, and Capabilities Production Document (CPD) for Force Provider Expeditionary (FPE)
- Air Force/Basic Expeditionary Airfield Resources (BEAR) - AFH 10-222 Series
- Navy – NAVFAC ABFC View (online version of former NAVFAC Publication P-437, Naval Facility Planning Guide)

2-1.2 Supplemental Criteria.

The following are supplemental reference criteria for the Army:

- FM 3-34.400, *General Engineering*
- EP 1105-3-1, *Planning: Base Camp Development in the Theater of Operations*
- EM 0153, *Shelters, Tents, MILVANS and Camouflage Equipment*
- RDECOM Guide for Tactical Training Bases, *Shelters Handbook*

2-2 CIVIL/SITE.

The requirements for site water treatment, storage and distribution, and waste disposal may be included in Status of Forces Agreements (SOFA), Host Nation Funded Construction Agreements (HNFA) and as required by the Military Command having jurisdiction over the operation. The information below is a listing of some, but not necessarily all of those requirements. It is the responsibility of the user to determine which criteria are to be utilized for the operation.

2-2.1 Water Treatment, Storage, and Distribution.

See requirements outlined in Section 2-5 of this document for Plumbing and Mechanical Systems. Additional requirements are in TB MED 577 *Sanitary Control and Surveillance of Field Water Supplies*, Chapter 5 (Water Source Selection and Basic Testing for Potability), Chapter 6 (Advanced Water Surveillance and Testing), Chapter 7 (Evaluation of Field Tests and Analytical Results (Health Guidelines) and Chapter 9 (Water Treatment and Disinfection) and in FM 3-34.471 *Plumbing, Pipe Fitting and Sewerage*.

2-2.2 Solid Waste Disposal.

Army and Navy/Marines requirements are in FM 4-20.07, *Quartermaster Force Provider Company* Chapter 1 (Force Provide Overview) and Chapter 5 (Deploying Force Provider). Air Force requirements are in AFH 10-222, Volume 4, *Environmental Guide for Contingency Operations Overseas* Chapter 2 (Predeployment Planning). Additional requirements are in TM 3-34.56 *Waste Management for Deployed Forces*.

2-2.3 Hazardous and Medical Waste Disposal.

Army and Navy/Marines requirements are in FM 4-20.07, Chapter 4 (Force Provider Environmental Guidance and Safety Procedures). Air Force requirements are in AFH 10-222, Volume 4, Chapter 2 (Predeployment Planning).

2-2.4 Stormwater.

Locate facilities and equipment away from areas subject to stormwater runoff and flooding.

2-3 STRUCTURAL SYSTEMS.

Follow manufacturers' instructions for Government-approved systems for assembly of pre-packaged shelters in theater. The authority for Government-approved shelter systems is the Joint Committee on Tactical Shelters (JOCOTAS).

2-4 FIRE PROTECTION.

Fire protection requirements for Initial Construction Level assume no active fire protection or site water supplies are to be provided.

2-4.1 Allowable Area/Population.

No more than 288 persons shall be located within a billeting structure group. Occupant loads for this determination must be calculated based on the number of beds.

2-4.2 Space Separation.

This document gives the requirements for fire separation. See UFC 4-010-01 for antiterrorism/force protection requirements related to space separation.

2-4.2.1 Structure Group Definition.

Where this document uses the term structure group, this is defined as a cluster of independent structures, including tents, trailers, containerized housing units, or similar construction.

2-4.2.2 Structure Separation.

Separation of structures within structure groups consisting of fabric structures, containers, trailers, or similar structures must comply with the following:

- a. The minimum separation between individual structures within a row of a billeting structure group consisting of fabric structures must be 12 ft (3 m).
- b. The minimum separation between rows of structures within a billeting structure group must be 30 ft (9.1 m). This distance may be used for vehicle traffic, but must not be used for vehicle parking, storage, or vegetation other than a lawn.
- c. The minimum separation between billeting structure groups must be 60 ft (18.3 m). The separation distance may be used for vehicle traffic (including emergency response vehicles), but must not be used for vehicle parking, storage or vegetation other than a lawn.
- d. The minimum separation between billeting structure groups and other structures must be 100 ft (30.5 m). The separation distance may be used for vehicle traffic (including emergency response vehicles), but must not be used for vehicle parking, storage or vegetation other than a lawn.

2-4.2.3 Use of Revetments.

See UFC 4-010-01 Appendix D, figure D-1 for a diagram of the space separation requirements. If the space separations between individual structures given above cannot be achieved due to existing site constraints, then revetments may be used to reduce allowable separation distances between structures. Revetments may consist of engineered hardened walls, concrete barriers, HESCO type barriers, or similar separating barriers. Revetments adjacent to tents or other structures must be at least as tall as the height of the tent wall, or the lower eave of the building. In the event revetments are provided, adjacent structures need to be separated as stated in Appendix D-2.2 of UFC 4-010-01.

2-4.2.4 Fire Safety Analysis on Constrained Sites.

If site constraints do not permit compliance with the above space separation requirements, a fire-safety analysis must be done. This evaluation must be performed or reviewed by the Unit Safety Officer and this analysis must be approved by the first O-6 level officer in the chain of command.

2-4.3 Interior Finishes/Fabric Coverings.

Fabric coverings for tents or membrane structures must be in accordance with NFPA 701 requirements. Typically compliance with NFPA 701 is achieved using fire retardant chemically treated fabrics.

Other structures must comply with NFPA 101 requirements. Compliance with NFPA 101 can be achieved using painted or unpainted finishes of concrete masonry units, gypsum wallboard, sheet metal, or 3/8-inch (9.5 mm) plywood. Fabric covering or textile coverings must be fire retardant as established by the manufacturer through testing in accordance with NFPA requirements. Exposed Urethane foam or other plastic insulations must not be used on walls or ceilings.

2-4.4 Fire Extinguishers.

All facilities must be provided with listed portable fire extinguishers consistent with the occupancy of the facility (see NFPA 10, *Standard for Portable Fire Extinguishers*). If traditional listed/approved extinguishers are not available, the use of extinguishers with equivalent rating from EU, Asian, or other countries is permitted.

2-5 PLUMBING AND MECHANICAL SYSTEMS.

2-5.1 Potable Water Treatment, Storage and Distribution.

All potable water (drinking water) facilities and systems must be designed and operated to ensure protection of health and safety. Requirements for systems may be addressed in COCOM or coalition guidance or international agreements.

Water storage and distribution for Army must comply with FM 4-20.07, paragraphs 2-35 through 2-38 and 3-20 through 3-22, FM 3-34.471 *Plumbing, Pipe Fitting, and Sewerage*, FM 4-25.12 *Unit Field Sanitation Team* Chapter 2 Section II Water Supply, FM 8-250 *Preventive Medicine Specialist* Chapter 16 Water Supply and FM 3-34.400 *General Engineering* Chapter 11. Water storage and distribution for Air Force must comply with AFH 10-222, Volume 2, Chapter 3, Water Distribution and Sanitation Systems. Navy/Marine Corps personnel will follow approved technical manuals or manufacturer instructions for Government-approved systems for assembly of pre-packaged systems or equipment in theater.

Reverse osmosis systems for Air Force must comply with AFH 10-222, Volume 9, *Reverse Osmosis Water Purification Unit Installation and Operation*.

2-5.2 Waste Water.

2-5.2.1 Gray Water.

All gray water facilities and systems must be designed and operated to ensure protection of health and safety. Requirements for systems may be addressed in COCOM or coalition guidance. or international agreements.

Gray water collection and disposal for Army must comply with FM 4-20.07, paragraphs 2-46 through 2-47 and 3-22, FM 3-34.471 *Plumbing, Pipe Fitting, and Sewerage*

Chapter 1 Section IV “Wastewater”, FM 4-25.12 Unit Field Sanitation Team Chapter 2 Section IV “Waste Disposal”, FM 8-250 Preventive Medicine Specialist Chapter 18 “Waste Treatment and Disposal” and FM 3-34.400 General Engineering Chapter 11. Gray water collection and disposal for Air Force must comply with AFH 10-222, Volume 4, Section 2.8, “Wastewater”, and in Section 3.4.1, “Gray Water”. Navy/Marine Corps personnel will follow approved technical manuals or manufacturer instructions for Government-approved systems for assembly of pre-packaged systems or equipment in theater.

2-5.2.2 Black Water.

All black water facilities and systems must be designed and operated to ensure protection of health and safety. Requirements for systems may be addressed in COCOM or coalition guidance. or international agreements.

Black water disposal for Army must comply with FM 4-20.07, Chapter 2, paragraph 2-48, FM 3-34.471 Plumbing, Pipe Fitting, and Sewerage Chapter 1 Section IV “Wastewater”, FM 4-25.12 Unit Field Sanitation Team Chapter 2 Section IV “Waste Disposal”, FM 8-250 Preventive Medicine Specialist Chapter 18 “Waste Treatment and Disposal” and FM 3-34.400 General Engineering Chapter 11. Black water collection and treatment for Air Force must comply with AFH 10-222, Volume 4, Section 2.8, “Wastewater”, and in Section 3.4.2, “Black Water”. Navy/Marine Corps personnel will follow approved technical manuals or manufacturer instructions for Government-approved systems for assembly of pre-packaged systems or equipment in theater.

2-5.3 Fuel Systems.

Fuel storage and distribution for Army must comply with FM 4-20.07, paragraphs 2-39 through 2-43 and 3-16 through 3-19. Fuel storage and distribution systems for Air Force must comply with AFH 10-222, Volume 2, Section 4.2, “Generator Fuel Bladders”; AFH 10-222, Volume 2, Section 7.1.1, “Fuels Mobility Support Equipment”; and AFH 10-222, Volume 12, *Guide to Bare Base Mechanical Equipment*. Navy/Marine Corps personnel will follow approved technical manuals or manufacturer instructions for Government-approved systems for assembly of pre-packaged systems or equipment in theater.

2-5.4 Heating, Ventilating, and Air-Conditioning (HVAC).

Install Ventilation and Environmental Control Systems in accordance with manufacturer’s instructions and Service Technical Manuals for pre-packaged systems.

2-6 ELECTRICAL SYSTEMS.

Follow manufacturer’s assembly instructions for installation of pre-packaged electrical equipment in theater.

2-6.1 Grounding.

Force Provider equipment requirements are contained in FM 4-20.07, paragraphs 2-79 and 4-25. BEAR equipment requirements are in AFH 10-222, Volume 1, Table 2.8, and Attachment 6.

If pre-packaged systems are not available and when fabricating a grounding system from components, use grounding system requirements as stated for Temporary Facility Construction Level in Chapter 3.

2-6.2 Power Cable Installation.

Force Provider equipment requirements are contained in FM 4-20.07, paragraphs 4-26 and 5-42. BEAR equipment requirements are in AFH 10-222, Volume 1, Table 2.8, and Attachment 7.

If pre-packaged systems are not available and when fabricating an electrical distribution system from components, use electrical distribution system requirements as stated for Temporary Facility Construction Level in Chapter 3.

2-6.3 Circuit Lockout Requirements.

Force Provider equipment requirements are in FM 4-20.07, paragraph 4-27. For BEAR equipment or other Air Force systems, requirements are included in AFI 32-1064, *Electrical Safe Practices*.

If pre-packaged systems are not available and when fabricating an electrical distribution system from components, use electrical distribution system requirements as stated for Temporary Facility Construction Level in Chapter 3

2-7 TELECOMMUNICATIONS SYSTEMS.

2-7.1 Grounding.

Army requirements are contained in FM 4-20.07, paragraphs 2-79 and 4-25.

Air Force requirements are in AFH 10-222, Volume 1, Table 2.8, and Attachment 6.

Navy/Marine Corps must follow assembly instructions for installation of pre-packaged equipment in theater. If pre-packaged systems are not available and when fabricating a grounding system from components, use grounding system requirements as stated for Temporary Facility Construction Level in Chapter 3.

CHAPTER 3 TEMPORARY AND SEMI-PERMANENT FACILITY CONSTRUCTION LEVELS

This chapter presents requirements for Temporary and Semi-permanent Facility Construction Levels to ensure life safety and health protection for personnel. The definitions for these levels and additional information on these construction levels are included in Chapter 1 of this document.

3-1 CIVIL/SITE.

The requirements for site water treatment, storage and distribution, and waste disposal may be included in Status of Forces Agreements (SOFA), Host Nation Funded Construction Agreements (HNFA) and as required by the Military Command having jurisdiction over the operation. The information below is a listing of some, but not necessarily all of those requirements. It is the responsibility of the user to determine which criteria are to be utilized for the operation.

3-1.1 Temporary Construction Level Requirements.

3-1.1.1 Potable Water Supply Source Selection and Testing.

Use TB MED 577, *Sanitary Control and Surveillance of Field Water Supplies*, Chapter 5 "Water Source Selection and Basic Testing for Potability", Chapter 6 "Advanced Water Surveillance and Testing", Chapter 7 "Evaluation of Field Tests and Analytical Results (Health Guidelines)" for water supply source selection and testing. Use UFC 3-230-03A, *Water Supply*, Chapter 5, "Groundwater Supplies" for construction of wells for groundwater supplies.

3-1.1.2 Potable Water Treatment and Disinfection.

All drinking water facilities and systems must be designed and operated to ensure protection of personnel health and safety. The environmental annex (i.e., Annex L) of the applicable CCMD OPLAN/OPORD must be reviewed and updated as required to ensure appropriate force health protection standards for drinking water are included. Additional criteria may be applied in accordance with COCOM guidance, any applicable DoD policies, or international agreements. Facilities must also comply with TB MED 577, Chapter 9 Water Treatment and Disinfection, for potable water treatment and disinfection.

3-1.1.3 Gray Water Collection and Disposal.

Use Army FM 4-20.07, Chapter 2, Section I, "Gray Water Collection and Disposal"; Army FM 4-20.07, Chapter 3, Section II, "Gray Water Collection Subsystem"; AFH 10-222, Volume 4, Section 2.8, "Wastewater"; and AFH 10-222, Volume 4, Section 3.4.1, "Gray Water".

3-1.1.4 Black Water Collection and Disposal.

Use Army FM 4-20.07, Chapter 2, Section I, "Black Water Disposal"; AFH 10-222, Volume 4, Section 2.8, "Wastewater"; and AFH 10-222, Volume 4, Section 3.4.2, "Black Water".

3-1.1.5 Stormwater.

Locate facilities and equipment away from areas subject to stormwater runoff and flooding.

3-1.2 Semi-permanent Construction Level Requirements.

3-1.2.1 Potable Water Supply Source Selection and Testing.

Comply with the water supply source selection and testing requirements as defined for Temporary facilities specified above.

3-1.2.2 Potable Water Treatment and Disinfection.

Comply with potable water treatment and disinfection requirements as defined for Temporary facilities specified above.

3-1.2.3 Gray Water and Black Water Collection and Disposal.

Comply with the wastewater collection and treatment system requirements as defined for Temporary facilities specified above, plus the following requirements outlined in the subsection below titled, "Semi-Permanent Wastewater Treatment System".

3-1.2.4 Semi-Permanent Wastewater Treatment System.

If a wastewater treatment system is to be constructed to support facilities, use UFC 3-240-04A, *Wastewater Collection*, for wastewater collection, and use UFC 3-240-09FA, *Domestic Wastewater Treatment*, for wastewater treatment.

3-1.2.5 Stormwater.

Locate critical facilities and equipment away from areas subject to stormwater runoff and flooding.

3-2 STRUCTURAL SYSTEMS.

3-2.1 Temporary Construction Level Requirements.

3-2.1.1 Structural Design.

Structural Design must be in accordance with the International Building Code (IBC) 2009 edition, Chapters 16, 17, 18, 19, 20, 21, 22, and 23 as modified by the Unified Facilities Criteria 3-301-01 *Structural Engineering*, and Unified Facilities Criteria 3-310-04 *Seismic Design for Buildings*, except as modified herein.

3-2.1.2 1604.3 Serviceability [Supplement].

Frame drift discussed in UFC 3-301-01 Section 2-1.2.1 need not be limited to prevent all damage to non-structural elements provided any damage sustained does not create unsafe conditions for personnel in or around the structure.

3-2.1.3 1604.3.1 Deflections [Replacement].

Modify UFC 3-301-01 Sections 2-1.2.2 and 2-1.2.3 as follows: Deflections of structural members may exceed the limitations of Sections 1604.3.2 through 1604.3.5, Table 1604.3, and Table 2-1 of UFC 3-301-01 provided: (1) The increased deflection does not cause excessive rotations in connections at ends of members that could result in connection failure or, (2) The increased deflection does not create an unsafe condition where finishes or other non-structural items could become dislodged and fall on personnel. Under no circumstances are member deflections to exceed $L/120$ where L is the member span in inches. Members supporting mission critical equipment sensitive to excessive member deflection or vibration must be designed to meet equipment requirements.

3-2.1.4 1607 Live Loads [Supplement].

It is permissible to design structures for Live Loads less than those shown in UFC 3-301-01 Table D-1 or IBC Table 1607.1 provided they are designed for specific calculated Live Loads when the magnitudes and positions of these loads can be accurately predicted. The DOR must provide equipment plans and maximum occupancy information to the user as part of the construction documents and project record. Live Load reduction is not permissible when designing using Live Loads less than those shown in UFC 3-301-01 Table D-1 or IBC Table 1607.1. Under no circumstances are the design Live Loads to be less than 50% of the tabulated UFC and IBC design Live Loads.

3-2.1.5 1609 Wind Loads [Supplement].

It is permissible to multiply the basic wind speed, V , as identified in UFC 3-301-01, by a reduction factor of 0.78 for structures that meet the definition of temporary construction except in regions defined as Hurricane Prone Regions where the basic wind speed is greater than 90 mph (145 km/hr).

3-2.1.6 1613 Earthquake Loads [Supplement].

For structures that meet the definition of temporary construction, it is permissible to multiply design loads calculated per the above referenced code sections by a reduction factor of 0.6 for structures that meet the following requirements:

1. For Occupancy Category I, II, or III structures, S_s does not exceed 0.55 and S_1 does not exceed 0.13.
2. For Occupancy Category IV structures, S_s does not exceed 0.32 and S_1 does not exceed 0.08.

3-2.1.7 Structural Test and Special Inspections [Revision].

Delete IBC Chapter 17 Structural Tests and Special Inspections. The DOR must delineate all testing and inspection requirements in the construction drawings or specifications to ensure performance of the structural system. The DOR is responsible to provide an appropriate design in which the testing and inspection requirements specified in IBC Sections 1713, 1714, and 1715 can be met based on field capability and resources. Testing and inspections should include, but not be limited to, the following:

1. All Materials: Inspection of suitable sub-surface conditions. Visual inspection of member sizes, locations, spacing, and configuration. Visual inspection of splice/cold joint locations, connections, and adequate bearing.
2. Wood structures: In addition to the inspections for All Materials also perform visual inspection of connector (e.g. nails, screws, bolts) sizes, spacing and locations. Visual inspection of size and location of plate connections. Visual inspection of all straps, hold downs, and connection hardware. Visual inspection of overlapping lengths at splices. Visual inspection of member material grades. Visual inspection of sheathing thickness, sheathing material grades, shear wall locations, and cross bracing.
3. Masonry: In addition to the inspections for All Materials also perform visual inspection of grout placement. Visual inspection of reinforcing steel sizes, locations, clearances, configuration, embedment, and splice lengths. Grout cylinder compression tests, CMU compression tests, and verification of mortar and grout proportions.
4. Steel: In addition to the inspections for All Materials also perform visual inspection of deck profiles, diaphragm sizes and locations, and diaphragm connections. Visual inspection of completed welds. Visual inspection of connector (e.g. bolts, screws) number and patterns, and connector sizes. Inspection confirming proper tightening of the nuts. Visual inspection of cross bracing.
5. Concrete: In addition to the inspections for All Materials also perform visual inspection of formwork. Visual inspection of reinforcing steel sizes, locations, clearances, configuration, embedment, and splice lengths. Concrete anchors and embed sizes and locations. Concrete cylinder compression test, and water/cement ratio measurement.

3-2.1.8 1803.1 Geotechnical Investigations, General [Supplement].

Add exception: The DOR or qualified DoD personnel must accept simplified geotechnical investigations in lieu of the full requirements of sections 1803.3 through

1803.5 for one-story, simple span structures without basements that bear on shallow foundations and meet the following requirements:

1. For Occupancy Category I, II, or III structures, S_s does not exceed 0.55 and S_1 does not exceed 0.13.
2. For Occupancy Category IV structures, S_s does not exceed 0.32 and S_1 does not exceed 0.08.

In the absence of a Geotechnical Report, the DOR must design foundations for presumptive bearing capacities per IBC Section 1806.

3-2.1.9 1803.6 Reporting [Supplement].

The DOR must stipulate the required items, if any, to be included in a written report of the geotechnical investigations, which need not include any or all of IBC Section 1803.6, items 1 through 10.

3-2.1.10 1807.1.4 Permanent Wood Foundation Systems [Supplement].

Delete preservative treatment requirements except in regions with a known significant risk of destructive insect infestations.

3-2.1.11 1808.6.1 Foundations [Supplement].

Modify second sentence to read, "Deflection and racking of the supported structure must be limited to that which will not compromise the strength or stability of the structure."

3-2.1.12 1809.5 Frost Protection [Supplement].

Add exception: One-story, simple span structures that bear on shallow foundations need not be protected.

3-2.1.13 1809.12 Timber Footings [Supplement].

Delete preservative treatment requirements except in regions with a known significant risk of destructive insect infestations.

3-2.1.14 1904 Durability Requirements [Delete].

Delete IBC Section 1904.

3-2.1.15 1907.7.6 Corrosive Environments [Delete].

Delete UFC 3-301-01 Section 2-4.2.1 and IBC Section 1907.7.6.

3-2.1.16 2203.2 Protection [Delete].

Delete IBC Section 2203.2.

3-2.1.17 2204.2 Bolting [Delete].

Delete UFC 3-301-01 Section 2-6.1.1.

3-2.1.18 2205.1 General [Supplement].

Delete UFC 3-301-01 Section 2-6.2.1. Members supporting mission critical equipment sensitive to excessive vibration must be designed to meet equipment requirements.

3-2.1.19 2205.4 Steel Structures in Corrosive Environments [Supplement].

Delete UFC 3-301-01 Section 2-6.2.2 except for steel sections with elements thinner than 3/8".

3-2.1.20 2210.8 Floor Vibrations [Supplement].

Delete UFC 3-301-01 Section 2-6.4.3. Members supporting mission critical equipment sensitive to excessive vibration must be designed to meet equipment requirements.

3-2.1.21 2304.11 Protection Against Decay and Termites [Delete].

Delete section except in regions with a known significant risk of destructive insect infestations.

3-2.2 Semi-Permanent Construction Level Requirements.

Structural Design must be in accordance with the International Building Code (IBC) 2009 edition, Chapters 16, 17, 18, 19, 20, 21, 22, and 23, and UFC 3-301-01 *Structural Engineering*, and UFC 3-310-04 *Seismic Design For Buildings*, except as modified below.

3-2.2.1 Structural Test and Special Inspections [Revision].

Comply with testing and inspection requirements in Section 3-2.1.7 of this document.

3-3 FIRE PROTECTION.

The general fire protection requirements in this section are the same for Temporary and Semi-permanent Construction Levels.

The intent of this document is to provide modular type buildings that are limited in size (overall building height and floor area) so as to not require installed active fire protection or fire alarm systems, except where explicitly required by the International Building Code (IBC) Chapter 9, Fire Protection Systems, or UFC's for a given occupancy regardless of the building size (i.e. residential and hazardous occupancies). Area limits stated within this UFC are for a stand-alone building as defined in the IBC Chapter 5, General Building Heights and Areas. If larger building areas than stated herein are needed to meet the needs of users, then the following guidance is provided to facilitate the construction of buildings with larger areas, in order of preference:

1. Provide fire separation distance between separate structures in accordance with IBC Chapter 6, Types of Construction, requirements for fire separation between buildings.
2. Provide pedestrian walkways between buildings individually compliant with IBC Chapter 31, Special Construction, fire separation requirements to provide separate buildings interconnected with enclosed, conditioned walkways.
3. Provide fire rated exterior walls or fire walls between buildings in accordance with IBC Chapter 6, Types of Construction, requirements.
4. Provide buildings of an area or height to require fixed fire protection systems in accordance with IBC Chapter 5, General Building Heights and Areas requirements, and provide these fixed protection systems.

For mission critical facilities, see Figure C-1 in Appendix C for a decision tree with guidance on protection of assets for these facilities.

This document provides requirements for allowable fire separations between structures. Refer to UFC 4-010-01 for antiterrorism/force protection requirements related to space separation compliance.

For all buildings, provide access to at least one side of any building for the largest emergency response vehicle serving the site.

Unenclosed vertical openings are generally not permitted. Vertical openings include but are not limited to atriums, stairways; hoist ways for elevators, dumbwaiters, or inclined and vertical conveyors (escalators); shafts used for light, ventilation or building services. Mezzanines shall comply with requirements for mezzanines herein and in IBC Chapter 5, General Building Heights and Areas, and are not treated as vertical openings. All vertical openings shall be enclosed or protected with shafts constructed as fire barriers as called for by the IBC Chapter 7, Fire and Smoke Protection Features, or NFPA 101 Chapters 7, Means of Egress, and 8, Features of Fire Protection, for the fire resistance rating of the barrier. Any planned unenclosed vertical opening needs to be approved through a variance process.

3-3.1 Construction Level Requirements and Space Separation Requirements per Occupancy.

Classifications of buildings within this section are based on occupancy. As defined by NFPA 101, Chapter 3, Definitions, the occupancy is the purpose for which a building or other structure, or part thereof, is used or intended to be used. The occupant load of these areas is calculated per NFPA 101, Chapter 7, Means of Egress.

3-3.1.1 Assembly

Assembly occupancy is an occupancy used for a gathering of 50 or more persons for deliberation, worship, entertainment, eating, drinking, amusement, awaiting

transportation or similar uses; or used as a special amusement building, regardless of occupant load. Assembly occupancies include but are not limited to: dining facilities, clubs, chapels, conference rooms, and morale welfare, and fitness centers for general personnel use

3-3.1.1.1 Building Construction.

Buildings must be constructed in accordance with one of the following options (a or b):

- a. Buildings must be limited to one story high.

Buildings constructed of combustible construction must be limited to 6,000 sq. ft. (557 sq. m.) in area.

Buildings constructed of non-combustible or fire-resistive construction must be limited to 9,500 sq. ft. (883 sq. m.) in area.

- b. Buildings must be provided with a sprinkler system designed in accordance with Section 3-3.2 of this document. Buildings provided with this protection must be constructed in accordance with 2009 IBC Chapter 5, General Building Heights and Areas, limits on building areas. Building height must be limited to 2 stories.

3-3.1.1.2 Building Separation.

Buildings must be separated from other buildings by one of the following options (a or b):

- a. A fire separation distance of 30 ft. (9.1 m) must be provided between the building and other buildings. The clear space may be used for vehicle roadways or pedestrian walkways, but not for parking, storage or vegetation other than lawns.
- b. If fire separation distances as noted in Option (a) cannot be provided due to site constraints, one of the following must be provided:
 - i. Each exterior wall of the building that faces an exposing building must be rated at one hour with opening protectives in accordance with IBC Chapters 6, Types of Construction, and 7, Fire and Smoke Protection Features, requirements.
 - ii. Each exterior wall of the building that faces an exposing building must be provided with a full height barrier (earth-filled bastions, pre-cast concrete barrier, sandbag revetment, or other similar type) without openings. The barrier must be at least as high as the eave level of the tallest structure involved. Adjacent buildings must be separated by at least twice the height of the taller building.

3-3.1.1.3 Egress Requirements.

Comply with NFPA 101, Chapters 7, Means of Egress, and 12, New Assembly Occupancies, for egress, except as follows:

- a. For buildings without sprinkler protection in accordance with this document, provide exits 100% above the number required by NFPA 101, Chapters 7, Means of Egress, and 12, New Assembly Occupancies. Exits must be evenly distributed along at least three sides of the building.
- b. Provide local fire alarm notification throughout the space for evacuation in the event of an emergency. The notification system must be activated by manual stations at each exit. The notification system may be integrated with the required mass notification system for the building. Fire alarm and mass notification systems must comply with NFPA 72 requirements.

3-3.1.1.4 Kitchen Requirements.

Provide an exhaust hood with a listed kitchen hood fire protection system for any commercial-type cooking operation.

Provide one-hour rated fire barrier separation between any cooking/serving operations and the seating area(s).

3-3.1.2 Business.

Business occupancy is an occupancy used for the transaction of business other than mercantile. Business occupancies include the following: general offices and administrative facilities, outpatient clinics, doctors' offices, and fitness centers that are located within an office, solely for office personnel use (no public or common use).

3-3.1.2.1 Building Construction.

Buildings must be constructed in accordance with one of the following options (a or b):

- a. Buildings constructed of combustible construction must be limited to 9,000 sq. ft. (836 sq. m.) per floor, and 3 stories above grade.

Buildings constructed of non-combustible or fire-resistive construction must be limited to 23,000 sq. ft. (2,137 sq. m.) per floor, and 3 stories above grade.
- b. Buildings must be provided with a sprinkler system designed in accordance with Section 3-3.2 of this document. Buildings provided with this protection must be constructed in accordance with 2009 IBC Chapter 5, General Building Heights and Areas, limits on floor areas. Building height must be limited to 3 stories.

3-3.1.2.2 Building Separation.

Buildings must be separated from other buildings by one of the following (a or b):

- a. A fire separation distance of 30 ft. (9.1 m) must be provided between the building and other buildings within the same contingency compound. A clear space of 100 ft. (30.5 m) must be provided between the building and other buildings not associated with the contingency compound. Clear space must not be used for vehicle parking, storage, or vegetation other than lawns.
- b. If fire separation distances as noted in Option (a) cannot be provided, one of the following must be provided:
 - i. Each exterior wall of the building that faces an exposing building must be rated at one hour with opening protectives in accordance with IBC Chapters 6, Types of Construction, and 7, Fire and Smoke Protection Features, requirements.
 - ii. Each exterior wall of the building that faces an exposing building must be provided with a full height barrier (earth-filled bastions, pre-cast concrete barrier, sandbag revetment, or other similar type) without openings. The barrier must be at least as high as the eave level of the tallest structure involved. Buildings must be separated by at least twice the height of the taller building.

3-3.1.2.3 Egress Requirements.

Comply with NFPA 101, Chapters 7 and 38, for egress except that all exits, including grade level exit doors, exit stairs, and fire-rated exit passageways must discharge directly to the exterior to public ways.

3-3.1.2.4 Fire Alarm System.

Provide local fire alarm notification throughout the space where any of the following conditions occur:

- a. Levels of the building located on other than grade level exceed 5,000 sq. ft. (465 sq. m.) per floor.
- b. The total area of all floors exceeds 30,000 sq. ft. (2,787 sq. m.).

The notification system must be activated by manual pull stations at each exit. The notification system may be integrated with the required mass notification system for the building. Fire alarm and mass notification systems must comply with installation requirements of NFPA 72.

3-3.1.3 Industrial.

A factory-industrial occupancy is an occupancy in which products are manufactured or in which processing, assembling, mixing, packaging, finishing, decorating, or repair operations are conducted. This occupancy includes factories, laundries, power plants, maintenance shops, and pumping stations.

3-3.1.3.1 Building Construction.

Buildings must be constructed in accordance with one of the following options (a or b):

- a. Buildings constructed of combustible construction must be limited to 8,500 sq. ft (790 sq. m.) and one story above grade.

Buildings constructed of non-combustible or fire-resistive construction must be limited to 15,500 sq. ft. (1,440 sq. m.) per floor and two stories above grade.

- b. Buildings must be provided with a sprinkler system designed in accordance with NFPA 13. Buildings provided with this protection must be constructed in accordance with IBC Chapter 5, General Building Heights and Areas, requirements for floor areas and heights.

3-3.1.3.2 Building Separation.

Buildings must be provided fire separation from other buildings by one of the following (a or b):

- a. A fire separation distance of 30 ft. (9.1 m) must be provided between the building and other buildings. Clear space must not be used for vehicle parking, storage, or vegetation other than lawns.
- b. If fire separation distance as noted in Option (a) cannot be provided, one of the following must be provided:
 - i. Each exterior wall of the building that faces an exposing building must be rated at one hour with opening protectives in accordance with IBC requirements.
 - ii. Each exterior wall of the building that faces an exposing building must be provided with a full height barrier (earth-filled bastions, pre-cast concrete barrier, sandbag revetment, or other approved type) without openings. The barrier must be at least as high as the eave level of the tallest structure involved. Fire separation distance between these buildings must be at least twice the height of the taller building.

3-3.1.3.3 Egress Requirements.

Comply with NFPA 101, Chapters 7, Means of Egress, and 40, Industrial Occupancies, for egress.

3-3.1.3.4 Mezzanines.

Mezzanines within industrial buildings cannot be used for normally occupied spaces (such as offices). Mezzanines must be limited to storage rooms and/or mechanical/electrical rooms only.

3-3.1.3.5 Fire Alarm and Mass Notification Systems.

Provide local fire alarm notification throughout the space where a floor area more than 7500 sq. ft. (697 sq. m.) is located above or below grade, or if the total building area of all floors exceeds 30,000 sq. ft. (2,787 sq. m.). The notification system must be activated by manual stations at each exit. The notification system may be integrated with the required mass notification system for the building. Fire alarm and mass notification systems must be installed in accordance with NFPA 72.

3-3.1.4 Hazardous Areas.

Hazardous areas such as flammable painting operations, combustible dust producing operations, areas with combustible hydraulic fluid systems over 100 gallons (379 liters), or other industrial operations with significant flammable liquid or gas storage and/or use must be protected by one of the following (a or b):

- a. Provided protection in accordance with NFPA 13, 30, and 101 requirements.
- b. These areas must be located in buildings with a minimum 100 ft (30.5 m) fire separation distance from adjacent buildings.

3-3.1.5 Residential.

The residential occupancy is defined as an occupancy that provides sleeping accommodations for purposes other than health care or detention and correctional. Residential occupancies include one- and two-family dwellings, dormitories, barracks, billeting, Bachelor Enlisted Quarters and Bachelor Officer's Quarters, apartment buildings, and converted CONEX boxes.

3-3.1.5.1 Building Construction.

Buildings must be constructed in accordance with one of the following requirements (a or b):

- a. Buildings constructed of combustible construction must be limited to 7,000 sq. ft. (650 sq. m.) per floor, and 2 stories in height.

Buildings constructed of non-combustible construction must be limited to 15,000 sq. ft. (1,394 sq. m.) per floor, and 4 stories in height.

- b. Buildings must be provided with a sprinkler system designed in accordance with NFPA 13R and Section 3-3.2 of this document. Buildings provided with this protection must be constructed in accordance with IBC Chapter 5, General Building Heights and Areas, requirements for floor areas. Building heights must be limited to 4 stories.

3-3.1.5.2 Building Separation.

Buildings must be separated from other buildings by one of the following (a or b):

- a. A fire separation distance of 30 ft. (9.1 m) must be provided between the building and other buildings. Clear space must not be used for vehicle parking, storage, or vegetation other than lawns.
- b. If fire separation distances as noted in Option (a) cannot be provided due to site constraints, one of the following must be provided (i, ii or iii):
 - i. Each exterior wall of the building that faces an exposing building must be rated at one hour with opening protectives in accordance with IBC Chapters 6, Types of Construction, and 7, Fire and Smoke Protection Features, requirements.
 - ii. Each exterior wall of the building that faces an exposing building must be provided with a full height barrier (earth-filled bastions, pre-cast concrete barrier, sandbag revetment, or other similar type) without openings. The barrier must be at least as high as the eave level of the tallest structure involved. Fire separation distance must be at least twice the height of the taller building.
 - iii. The residential building must be provided with sprinkler protection by a system designed in accordance with NFPA 13R and Section 3-3.2 of this document.

3-3.1.5.3 Fire/Smoke Alarms.

Multiple station type smoke alarms must be provided throughout each room of the living unit in accordance with NFPA 72 residential fire alarm system requirements. Actuation of any smoke alarm must cause all smoke alarms within the living unit to generate an audible signal.

A manual alarm system must be provided throughout each building, with notification appliances provided in each living unit in accordance with NFPA 72 for residential type occupancies.

3-3.1.5.4 Range-Top Extinguishing Systems.

For all living units with residential range-top cooking units, an approved residential range-top extinguishing system must be provided. Actuation of the residential range-top extinguishing system must cause a general building alarm, and automatically shut off all sources of fuel and electrical power to the cooking unit.

3-3.1.5.5 Egress Requirements.

Comply with NFPA 101, Chapters 7, Means of Egress, and 28, New Hotels and Dormitories, for egress, except as modified below:

Means of egress from sleeping rooms must be provided in accordance with one of the following (a or b):

- a. A secondary means of escape must be provided, consisting of a door or window readily operable from inside with no special tools or knowledge. The window must be sized at a minimum of 5.7 sq. ft, (0.53 sq. m.) with a width of at least 20 inches (508 mm) and an open height of at least 24 inches (610 mm). The secondary means of escape must be located on a different exterior wall than the main entrance door to the sleeping room.
- b. For sleeping rooms where it is not practical to provide a secondary means of escape as noted in (a), the following must be provided (i and ii):
 - i. Walls between sleeping rooms must be rated at a minimum of 30 minutes.
 - ii. Sprinkler protection must be provided throughout the building installed in accordance with NFPA 13R or NFPA 13D requirements.

3-3.1.6 Storage.

Storage occupancy is an occupancy used primarily for the storage or sheltering of goods, merchandise, products, or vehicles. Storage occupancies include: barns, cold storage, freight terminals, parking structures, truck and marine terminals, and warehouses. See section 3-3.1.8 of this document for requirements of fuel and hazardous materials storage areas.

3-3.1.6.1 Building Construction.

Buildings must be constructed in accordance with one of the following requirements (a, b or c):

- a. Buildings of combustible construction must be limited to 9,000 sq. ft. (836 sq. m.) in area and one story. Storage heights must be limited to 12 ft. (3.66 m) maximum.

- b. Buildings of noncombustible or fire resistive construction must be limited to 17,500 sq. ft. (1,626 m.) and one story. Storage heights must be limited to 12 ft. (3.66 m) maximum.
- c. Sized based on IBC Chapter 5, General Building Heights and Areas, and provided with sprinkler protection in accordance with UFC 3-600-01 and NFPA 13 requirements.

3-3.1.6.2 Building Separation.

Storage buildings must be provided with fire separation distance from surrounding buildings by one of the following options (a or b):

- a. Fire separation distance of at least 60 feet (18.3 m) from any adjacent building must be provided.
- b. Exterior walls must be rated at two hours or more, in accordance with IBC Chapters 6, Types of Construction, and 7, Fire and Smoke Protection Features, with 1-1/2 hour opening protectives provided for all openings on building sides where fire separation is less than 60 feet (18.3 m).

3-3.1.6.3 Egress Requirements.

Comply with NFPA 101, Chapters 7, Means of Egress, and 42, Storage Occupancies, for egress.

3-3.1.6.4 Mezzanines.

Mezzanines cannot be used for occupied spaces (such as offices). Any mezzanines can only be used for storage or mechanical/electrical equipment.

3-3.1.7 Aircraft Hangars.

Aircraft hangars must be protected as follows:

- a. Single hangars over 15,000 sq. ft. (1,394 sq. m.) must be provided with fire protection as called for by UFC 3-600-01 Section 6-16, "Aircraft Facilities".
- b. Multiple hangars less than 15,000 sq. ft. (1,394 sq. m.) per hangar, that are separated by less than 50 ft. (15.2 m.) from each other, must be provided with fire protection as called for by UFC 3-600-01 Section 6-16, "Aircraft Facilities".
- c. Any hangar within 100 ft. (30.5 m.) of a normally occupied structure (office, shop, lodging building, etc) must be provided with fire protection as called for by UFC 3-600-01 Section 6-16, "Aircraft Facilities".

3-3.1.8 Fuel Depots (Petroleum, Oil and Lubricants (POL) and Hazardous Material Storage Areas)

3-3.1.8.1 Fixed POL Storage

Fixed POL installations, including cut and cover type tanks, must comply with UFC 3-460-01.

3-3.1.8.2 Hazardous Materials and Hazardous Waste Storage

Hazardous materials and hazardous waste must be protected in accordance with UFC 3-600-01.

3-3.1.8.3 Flammable Liquid Storage

Flammable liquid storage tanks must be located as follows:

- a. Above-ground tanks containing liquids with flash points less than 100 degrees F (38 degrees C) (gasoline, most solvents) must be separated from adjacent tanks or important buildings by 100 ft. (30.5 m.) or one tank diameter, whichever is greater.
- b. Above-ground tanks containing liquids with flash points over 100 degrees F (38 degrees C) (typical diesel fuel and fuel oil) and more than 50,000 gallons (189,270 liters) must be separated from important buildings by 100 ft. (30.5 m.).
- c. Above-ground tanks containing liquids with flash points over 100 degrees F (38 degrees C) and less than 50,000 gallons (189,270 liters) must be separated from important buildings by a minimum of 60 ft. (18.3 m.).
- d. Underground storage tanks and bladders must be separated from adjacent underground tanks or important buildings by a minimum of 25 ft. (7.6 m.). Each underground bladder or tank must be provided an independent berm sized for containment of the largest tank's volume.
- e. All flammable liquid tanks must be provided with fire response vehicle access within one tank diameter of the tank on at least one side.

3-3.1.9 Mixed-use Occupancies and Co-locating of Occupancies.

Residential occupancies with accommodations for more than 10 persons must be located in separate buildings from dining, offices, and recreational occupancies. Dining, offices, and recreational occupancies may be co-located in a single building. Conference rooms, lunch rooms, gymnasiums, or other assembly spaces located within a business or other occupancy may have an occupant load of up to 49 persons in a single space without the facility being considered a mixed-use occupancy. Occupant loads shall be calculated using NFPA 101 Chapter 7, Means of Egress.

Comply with NFPA 101 Chapter 6, Classification of Occupancy and Hazard of Contents, requirements for occupancy classifications and egress related to mixed-use occupancies and with IBC Chapter 5, General building Heights and Areas, for all other requirements related to mixed-use occupancies.

3-3.1.10 Medical Facilities.

Refer to the applicable Service Medical Group for guidance in constructing medical facilities.

3-3.2 Sprinkler System Design Criteria.

3-3.2.1 Non-Residential Buildings

For the purposes of non-residential military facilities in the temporary or semi-permanent construction level, NFPA 13 serves as the sprinkler standard for sprinkler systems. In situations where it may not be possible to construct systems meeting the requirements of NFPA 13 related to water storage volume, the number of design sprinklers from NFPA 13R and an amended water supply duration may be used in lieu of the NFPA 13 requirements for non-storage buildings or non-hazardous occupancies.

NFPA 13R requires that all (or 4 at most if more than 4 exist in compartment) sprinklers in the hydraulically most remote compartment must be able to operate at the required density for 30 minutes. For the purposes of this document, the water supply must be required to supply sprinklers for 20 minutes, with a maximum supply volume of 2,000 gallons (7,571 liters) of water (based on 4 sprinklers operating at 25 gpm for 20 minutes).

For non-residential buildings, all other aspects of sprinkler installation, including scope of sprinkler system coverage and installation standard must be per NFPA 13.

3-3.2.1.1 Storage Buildings, Factory-Industrial and Hazardous Areas.

Storage buildings, factory-industrial, and hazardous areas, if sprinklered, must be protected by systems designed per NFPA 13, including supply duration and flow volume requirements.

3-3.2.1.2 Residential Buildings.

For residential buildings requiring sprinkler protection, sprinkler systems must be designed per NFPA 13R and this section, or NFPA 13D as applicable.

3-4 PLUMBING AND MECHANICAL SYSTEMS.

3-4.1 Temporary Construction Level Requirements.

Provide interior spaces intended for occupancy with ventilation by natural or mechanical means in accordance with the International Mechanical Code (IMC), Chapter 4, "Ventilation".

Recommend interior spaces intended for occupancy be provided with active or passive air-conditioning systems capable of maintaining the spaces at an ASHRAE effective maximum temperature of 93 degrees Fahrenheit (33.9 deg. C), and effective minimum temperature of 60 degrees Fahrenheit (15.5 deg. C).

3-4.1.1 Requirements for Specific Systems.

The requirements listed below in the remainder of this section are additional life safety and habitability requirements that must be incorporated if these features are included in order to meet the functional requirements as defined by the COCOM.

3-4.1.1.1 Engineering Weather Data.

Follow UFC 3-400-02, *Design: Engineering Weather Data*.

3-4.1.1.2 HVAC Systems and Controls.

Follow IMC Chapter titled "General Regulations".

3-4.1.1.3 Exhaust Systems.

Follow IMC Chapter 5, Exhaust Systems.

3-4.1.1.4 Noise.

Noise levels shall not exceed the permissible exposures of 29 CFR 1910.95, Table G-16.

3-4.1.1.5 Plumbing - Introduction and Administration.

Follow UFC 3-420-01, *Plumbing Systems*, Section titled "Purpose and Scope," through Section titled "Primary Voluntary Consensus Standard Reference," and Section titled "Conflicts in Criteria."

Requirements in UFC 3-420-01, Section titled "Energy Efficiency in Water Conservation" and Section titled "Reliability" do not apply; however, consideration must be given to resource conservation where and when practical. See paragraph 1-11 of this UFC, "Resource Conservation." Follow UFC 3-420-01, Section titled "Piping Arrangement." Piping is not required to be concealed or painted.

Follow UFC 3-420-01, Appendix A: IPC Chapter 1 "Administration" Supplements, Item A, Delete Chapter 1 in its entirety.

Follow UFC 3-420-01, Appendix A: IPC Chapter 2 "Definitions" Supplements.

3-4.1.1.6 Plumbing - General Regulations.

Follow the International Plumbing Code (IPC), Chapter 3, General Regulations, with the following exceptions:

- Section 305.1, “Corrosion”: does not apply
- Section 305.8, “Protection Against Physical Damage”: does not apply
- Section 310.5, “Urinal Partitions”: does not apply
- Section 313, “Equipment Efficiencies”: does not apply
- Section 314.2.1, “Condensate Disposal”: does not apply with the exception of the last sentence that does apply (i.e., “Condensate cannot discharge into a street, alley, or other areas so as to cause a nuisance”).
- Section 314.2.2, “Drain Pipe Materials and Sizes”: does not apply; instead refer to IPC Table 314.2.2, Condensate Drain Sizing, for condensate drain sizing.
- Section 314.2.3, “Auxiliary and Secondary Drain Systems”: does not apply
- Follow UFC 3-420-01, *Plumbing Systems*, Appendix A: IPC Chapter 3 “General Regulations” Supplements, Item F, Section 305.6 Freezing, with the exception of the third, fourth, and fifth sentences regarding piping freeze protection that do not apply.
- Follow UFC 3-420-01, *Plumbing Systems*, Appendix A: IPC Chapter 3 “General Regulations” Supplements, Item G, Section 305.6.1 Sewer Depth, with the following revision: Revise to state: “Replace with the following: ‘Building sewers must be installed not less than 6 inches (150 mm) below the frost line.’”
- Follow UFC 3-420-01, *Plumbing Systems*, Appendix A: IPC Chapter 3 “General Regulations” Supplements, Item H, Section 312.4 Drainage and Vent Final Test, with the following revision: Revise to state “Add after the last sentence: ‘A peppermint test may be accepted as a final test for the drainage and vent systems, provided the contractor submits a testing procedure for approval.’”

3-4.1.1.7 Plumbing Fixtures.

Follow the International Plumbing Code, Chapter 4, Fixtures, Faucets, and Fixture Fittings, with the following exceptions:

- Section 402, “Minimum Plumbing Facilities”: does not apply. Instead provide a minimum of one water closet and one showerhead for every 20 occupants and a maximum of one water closet and one showerhead for every 10 occupants.
- Section 404, “Accessible Plumbing Facilities”: does not apply except for special use facilities, such as medical, where more stringent standards may apply.
- Section 405.3, “Setting”: does not apply
- Section 405.4.1, “Floor Flanges”: does not apply

- Section 405.4.3, “Securing Wall-hung Water Closet Bowls”: does not apply
- Section 405.5, “Water-tight Joints”: does not apply
- Section 405.6, “Plumbing in Mental Health Centers”: does not apply
- Section 405.7.1, “Connection of Overflows”: does not apply
- Section 405.8, “Slip Joint Connections”: does not apply
- Section 405.9, “Design and Installation of Plumbing Fixtures”: does not apply
- Follow UFC 3-420-01, *Plumbing Systems*, Appendix A: IPC Chapter 4 “Fixtures, Faucets, and Fixture Fittings” Supplements, Item A, Section 401.2 Prohibited fixtures and connections, Item J, Add “Section 411.3 Design guidance for emergency shower and eyewash stations”, Item K, Add “Section 412.5 Required locations and construction“, and Item L, Add “Section 412.6 Floor drains for emergency shower and eyewash stations”.

3-4.1.1.8 Water Heaters.

Follow the International Plumbing Code, Chapter 5, Water Heaters, with the following exceptions:

- Section 501.2, “Water Heater as a Space Heater”: does not apply
- Section 502.3, “Water Heaters Installed in Attics”: does not apply
- Section 503, “Connections”: does not apply
- Section 505, “Insulation”: does not apply
- Follow UFC 3-420-01, *Plumbing Systems*, Appendix A: IPC Chapter 5 “Water Heaters” Supplements, Item H, Add “Section 506 Sizing Hot Water Systems, 506.1 Sizing Calculations” with the following revision: Revise to state: “Design in accordance with American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE) Handbook – *HVAC Applications*, Chapter 49 ‘Service Water Heating’; and in accordance with ASHRAE Standard 90.1, *Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings*. Size hot water system and set service water heater (SWH) storage temperature set point for not less than 140°F (60°C) to limit the potential for growth of *Legionella pneumophila*. Provide a hot water and cold water blending, tempering valve immediately downstream of the SWH storage tank to provide anti-scalding protection. Provide a balanced-pressure-type tempering valve. Set the blending valve to deliver 110°F (43°C) water to the fixtures except where higher temperatures are required by specialized equipment”.

3-4.1.1.9 Water Supply and Distribution.

Follow the International Plumbing Code Chapter 6, Water Supply and Distribution, with the following exceptions:

- Section 604.10, “Gridded and Parallel Water Distribution Systems”: does not apply
- Section 604.11, “Individual Pressure Balancing In-line Valves for Individual Fixture Fittings”: does not apply
- Section 608.8.3, “Size”: does not apply
- Follow UFC 3-420-01, *Plumbing Systems*, Appendix A: IPC Chapter 6 “Water Supply and Distribution” Supplements, Item B, Add “Section 602.2.1 Non-potable water exception”, Item J, Add “Section 607.1.1 Legionella Pneumophila (Legionnaire’s Disease)”, Item M, Section 608.1 “General”, and Item N, Section 611.2 “Reverse osmosis systems”.

3-4.1.1.10 Sanitary Drainage.

Follow International Plumbing Code, Chapter 7, “Sanitary Drainage”.

Follow UFC 3-420-01, *Plumbing Systems*, Appendix A: IPC Chapter 7, “Sanitary Drainage Supplements”, Item B, Section 712.3.2 “Sump Pit”, and Item D, Section 712.3.6 “Controls”.

3-4.1.1.11 Indirect/ Special Waste.

Follow International Plumbing Code, Chapter 8, “Indirect/Special Waste”.

3-4.1.1.12 Vents.

Follow International Plumbing Code, Chapter 9, “Vents”.

3-4.1.1.13 Traps, Interceptors, and Separators.

Follow International Plumbing Code, Chapter 10, “Traps, Interceptors, and Separators”, with the following exceptions:

- Section 1002.4, “Trap Seals”: applies with the exception of the second sentence that does not apply (i.e. “Where a trap seal is subject to loss by evaporation, a trap seal primer valve must be installed”).
- Follow UFC 3-420-01, *Plumbing Systems*, Appendix A: IPC Chapter 10, “Interceptors and Separators Supplements”; Item A, Section 1002.4, “Trap Seals”.

3-4.1.1.14 Storm Drainage.

Follow International Plumbing Code, Chapter 11, “Storm Drainage”.

Follow UFC 3-420-01, *Plumbing Systems*, Appendix A: IPC Chapter 11 “Storm Drainage” Supplements, Item B, Section 1104.2, “Combining Storm with Sanitary Drainage”, and Item C, Add “Section 1104.4 Insulation of rainwater conductors”.

3-4.1.1.15 Special Piping and Storage Systems.

Follow UFC 4-510-01, *Design: Medical Military Facilities*, Section titled “Medical Gas Systems” for medical gas and vacuum systems.

3-4.1.1.16 Gray Water Recycling Systems.

Follow International Plumbing Code, Appendix C, “Gray Water Recycling Systems”, Sections C101 and C102.

3-4.1.1.17 Emergency Shower and Eyewash Stations.

Follow UFC 3-420-01, Appendix D, “Design Guidance for Emergency Shower and Eyewash Stations”.

3-4.1.1.18 Structural Safety.

Follow International Plumbing Code, Appendix F, “Structural Safety”.

3-4.1.1.19 Compressed Air Systems.

Follow Compressed Air and Gas Institute’s *Compressed Air and Gas Handbook* and ASME Boiler and Pressure Vessel Codes.

3-4.1.1.20 Fuel Oil Piping and Storage.

Follow requirements in IMC Chapter 13 for fuel storage and piping supporting building systems.

3-4.1.1.21 Boilers, Water Heaters, and Pressure Vessels.

Follow requirements in IMC Chapter 10 for facilities that are provided with boilers or water heaters, and pressure vessels.

3-4.1.1.22 Refrigeration.

Follow requirements in IMC Chapter 11 for facilities that are provided with refrigerant systems.

3-4.2 Semi-permanent Construction Level Requirements.

For Semi-permanent facilities for use in military operations, include the plumbing and mechanical system requirements for Temporary facilities specified in the paragraph above titled “Temporary Construction Level Requirements”, plus the requirements for specific systems that follow below.

3-4.2.1 Plumbing - General Regulations.

Follow the International Plumbing Code, Chapter 3, General Regulations, Section 305.1, “Corrosion”.

Follow the International Plumbing Code, Chapter 3, General Regulations, Section 305.8, "Protection Against Physical Damage".

Follow the International Plumbing Code, Chapter 3, General Regulations, Section 314.2.3, "Auxiliary and Secondary Drain Systems".

3-4.2.2 Plumbing Fixtures.

Follow UFC 3-420-01, *Plumbing Systems*, Appendix A: IPC Chapter 4, "Fixtures, Faucets, and Fixture Fittings" Supplements, Items D or E, and F.

3-4.2.3 Duct Systems.

Follow IMC Chapter 6, Duct Systems.

3-4.2.4 Hydronic Systems.

Follow IMC Chapter 12, Hydronic Piping.

3-5 ELECTRICAL SYSTEMS.

3-5.1 Temporary Construction Level Requirements.

3-5.1.1 Hazardous Material and Waste.

Comply with the requirements of UFC 3-501-01, *Electrical Engineering*, Section 2-1.1, "Hazardous Materials and Waste".

3-5.1.2 Arc Flash Analysis.

Comply with the requirements of UFC 3-501-01, *Electrical Engineering*, Section 3-2.2, "Electrical Calculations Overview", with the exception of the list of required calculations as outlined at the end of the referenced section. The only required calculations are short circuit, arc flash and lightning protection analyses.

Comply with the requirements of UFC 3-501-01, Section 3-2.6, "Arc Flash Analysis".

Comply with the requirements of UFC 3-501-01, Section 2-1.10, "Arc Flash Warning Labels".

3-5.1.3 Short Circuit Analysis.

Comply with the requirements of UFC 3-501-01, *Electrical Engineering*, Section 3-2.2, "Electrical Calculations Overview", with the exception of the list of required calculations as outlined at the end of the referenced section. The only required calculations are short circuit, arc flash and lightning protection analyses.

Comply with the requirements of UFC 3-501-01, Section 3-2.4, "Short Circuit Analysis".

3-5.1.4 Lightning Protection.

Comply with the requirements of UFC 3-501-01, *Electrical Engineering*, Section 3-2.2, “Electrical Calculations Overview”, with the exception of the list of required calculations as outlined at the end of the referenced section. The only required calculations are short circuit, arc flash and lightning protection analyses.

Comply with the requirements of UFC 3-501-01, Section 3-2.15, “Lightning Protection Calculations”.

Comply with the requirements of UFC 3-520-01, *Interior Electrical Systems*, Section 3-12, “Lightning Protection Systems”.

3-5.1.5 Service Entrance and Distribution Equipment.

Comply with the requirements of UFC 3-520-01, *Interior Electrical Systems*, Section 3-2, “Service Entrance and Distribution Equipment”, third paragraph. First, second and fourth paragraphs are not applicable.

3-5.1.6 Circuit Lockout Requirements.

Comply with the requirements of UFC 3-520-01, *Interior Electrical Systems*, Section 3-2.6, “Circuit Lockout Requirements”.

3-5.1.7 Raceway and Wiring.

Comply with the latest edition of NFPA 70, *National Electrical Code*, Chapter 2, “Wiring and Protection”; Chapter 3, “Wiring Methods and Materials”; and Chapter 4, “Equipment for General Use”.

3-5.1.8 Emergency and Exit Lighting.

Comply with the requirements of UFC 3-530-01, *Design: Interior and Exterior Lighting and Controls*, Section 5-6, “Emergency and Exit Lighting”.

3-5.1.9 General Electrical Installation Requirements.

Comply with the requirements of UFC 3-550-01, *Exterior Electrical Power Distribution*, Section 3-2, “General Electrical Installation Requirements”.

3-5.1.10 Configuration for Pad-mounted Distribution Transformers, Switchgears, and Sectionalizing Termination Cabinets.

Use dead-front construction for pad-mounted distribution transformers, switchgears, and sectionalizing termination cabinets unless not available within system parameters.

In rare cases when “live-front construction” is required due to equipment ratings (available system fault current values), obtain approval from the authority having jurisdiction.

3-5.1.11 Distribution System Grounding.

Comply with the requirements of UFC 3-520-01, *Interior Electrical Systems*, Section 3-11, "Grounding, Bonding, and Static Protection".

Comply with UFC 3-550-01, *Exterior Electrical Power Distribution*, Section 3-14, "Distribution System Grounding".

3-5.1.12 Fire Protection System for Oil-filled Equipment.

Comply with the requirements of UFC 3-550-01, *Exterior Electrical Power Distribution*, Section 3-19, "Fire Protection Considerations".

3-5.1.13 Underground Structures (Manholes and Handholes).

Where required, power and communication systems must be in separate manholes.

3-5.1.14 Emergency and Standby Power Systems.

Comply with the requirements of International Building Code (IBC) latest edition, Chapter 27, Electrical, Section 2702, with the exception of the following subsections: 2702.2.8, Semiconductor Fabrication Facilities; 2702.2.9, Membrane Structures; 2702.2.14, Covered Mall Buildings; and 2402.2.18, Airport Traffic Control Towers.

Comply with the requirements of UFC 3-520-01 *Interior Electrical Systems*, Section 3-8.1, "Emergency Generators Applications".

3-5.2 Semi-Permanent Construction Level Requirements.

For Semi-permanent facilities for use in military operations, include the electrical system requirements for Temporary facilities specified in the previous section titled "Temporary Construction Level Requirements", plus the following requirements outlined in the subsections of this section below.

3-5.2.1 Underground Distribution General Criteria – Cable Identification in Manholes.

Tag all underground cables in all accessible locations such as in manholes, transformers, switches and switchgear. Install a detectable locator tape above all buried underground circuits.

3-6 TELECOMMUNICATIONS SYSTEMS.

3-6.1 Temporary and Semi-Permanent Construction Level Requirements.

For Telecommunications Systems the requirements for Temporary and Semi-Permanent Construction Levels are the same.

3-6.1.1 Grounding and Bonding.

Follow UFC 3-580-01, *Telecommunications Building Cabling Systems Planning and Design*, Section 2-7, "Grounding".

Follow UFC 3-580-01, Appendix A, Item 12: ANSI-J-STD-607-A-2002, *Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications*.

Follow UFC 3-580-01, Appendix A, Item 24: MIL-STD-188-124B, *Grounding, Bonding And Shielding for Common Long Haul/Tactical Communication Systems Including Ground Based Communications- Electronics Facilities and Equipments*.

Follow UFC 3-580-01, Appendix A, Item 25: MIL-HDBK-419A, *Grounding, Bonding, and Shielding For Electronic Equipments and Facilities*.

CANCELLED

APPENDIX A REFERENCES

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

www.ansi.org

ANSI-J-STD-607-A-2002, *Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications*

AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR CONDITIONING ENGINEERS (ASHRAE)

www.ashrae.org

ASHRAE Handbook, *HVAC Applications*

ASHRAE 90.1, *Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings*

DEPARTMENT OF THE AIR FORCE

<http://www.e-publishing.af.mil/>

AFH 10-222, Volume 1, *Civil Engineer Bare Base Development*

AFH 10-222, Volume 2, *Guide to Bare Base Assets*

AFH 10-222, Volume 4, *Environmental Guide for Contingency Operations*

AFH 10-222, Volume 9, *Reverse Osmosis Water Purification Unit Installation and Operation*

AFH 10-222, Volume 12, *Guide to Bare Base Mechanical Systems*

AFI 32-1064, *Electrical Safe Practices*

AFMAN 91-201, *Explosives Safety Standards*

DEPARTMENT OF THE ARMY

<http://armypubs.army.mil/>

<http://140.194.76.129/publications/index.html>

DA PAM 385-64, *Ammunition and Explosives Safety Standards*

EP 1105-3-1, *Planning: Base Camp Development in the Theater of Operations*

EM 0153, *Shelters, Tents, MILVANS and Camouflage Equipment*
<https://www.logsa.army.mil/etms/welcom1.cfm>

FM 3-34.400, *General Engineering*

FM 3-34.471, *Plumbing, Pipe Fitting and Sewerage*

FM 4-20.07, *Quartermaster Force Provider Company*

FM 4-25.12, *Unit Field Sanitation Team*

FM 8-250, *Preventive Medicine Specialist*

RDECOM *Guide for Tactical Training Bases, Shelters Handbook*
<http://nsrdec.natick.army.mil/media/print/index.htm>

TM 3-34.56, *Waste Management for Deployed Forces*

DEPARTMENT OF DEFENSE

DoD Manual 6055.09-M, *DoD Ammunition and Explosives Safety Standards*;
<http://www.dtic.mil/whs/directives/corres/pub1.html>

GTA 90-01-011, *Joint Forward Operations Base (JFOB) Force Protection Handbook*;
<https://rdl.train.army.mil/catalog/catalog/search.html>

Joint Publication 3-0, *Joint Operations*; <http://www.fas.org/irp/doddir/dod/index.html>

Joint Publication 3-34, *Joint Engineer Operations*;
<http://www.fas.org/irp/doddir/dod/index.html>

MIL-HDBK-419A, *Grounding, Bonding, and Shielding for Electronic Equipments and Facilities*; http://www.wbdg.org/ccb/browse_cat.php?c=71

MIL-STD-188-124B, *Grounding, Bonding And Shielding for Common Long Haul/Tactical Communication Systems Including Ground Based Communications- Electronics Facilities and Equipments*; http://www.wbdg.org/ccb/browse_cat.php?c=71

TB MED 577, *Sanitary Control and Surveillance of Field Water Supplies*;
<http://armypubs.army.mil/med/index.html> (TB MED document)

DEPARTMENT OF THE NAVY

NAVSEA OP5, *Volume 1, Ammunition and Explosives Safety Ashore*;
<https://acc.dau.mil/CommunityBrowser.aspx?id=278680%20>

NAVFAC ABFC View (online version of former NAVFAC Publication P-437, Naval Facility Planning Guide); [http://logtool.net/html/ tool_detail.php?tid=514](http://logtool.net/html/tool_detail.php?tid=514)

INTERNATIONAL CODE COUNCIL

<http://www.iccsafe.org/Pages/default.aspx>

International Building Code (IBC), 2009 Edition

International Mechanical Code (IMC), 2009 Edition

International Plumbing Code (IPC), 2009 Edition

NATIONAL FIRE PROTECTION ASSOCIATION

www.nfpa.org

NFPA 10, *Standard for Portable Fire Extinguishers*

NFPA 13, *Standard for the Installation of Sprinkler Systems*

NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two- Family Dwellings and Manufactured Homes*

NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*

NFPA 30, *Flammable and Combustible Liquids Code*

NFPA 70, *National Electrical Code*

NFPA 72, *National Fire Alarm and Signaling Code*

NFPA 101, *Life Safety Code*

NFPA 701, *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films*

UNIFIED FACILITIES CRITERIA

http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4

UFC 1-200-01, *General Building Requirements*

UFC 1-201-02, *Assessment of Existing Facilities for Use in Military Operations*

UFC 3-230-03A, *Water Supply*

UFC 3-240-04A, *Wastewater Collection*

UFC 3-240-09FA, *Domestic Wastewater Treatment*

UFC 3-301-01, *Structural Engineering*

UFC 3-310-04, *Seismic Design for Buildings*

UFC 3-400-02, *Design: Engineering Weather Data*

UFC 3-420-01, *Plumbing Systems*

UFC 3-460-01, *Design: Petroleum Fuel Facilities*

UFC 3-501-01, *Electrical Engineering*

UFC 3-520-01, *Interior Electrical Systems*

UFC 3-530-01, *Design: Interior and Exterior Lighting and Controls*

UFC 3-550-01, *Exterior Electrical Power Distribution*

UFC 3-580-01, *Telecommunications Building Cabling Systems Planning and Design*

UFC 3-600-01, *Fire Protection Engineering For Facilities*

UFC 4-010-01, *DoD Minimum Antiterrorism Standards for Buildings*

UFC 4-510-01, *Design: Medical Military Facilities*

Also see Appendix B for additional resources.

APPENDIX B OTHER RESOURCES

The following documents can be utilized as informational resources.

ASME

www.asme.org

Boiler and Pressure Vessel Codes

COMPRESSED AIR AND GAS INSTITUTE

www.cagi.org

Compressed Air and Gas Handbook

DEPARTMENT OF THE AIR FORCE

<http://www.e-publishing.af.mil/>

AFH 10-222, Volume 3, *Civil Engineer Guide to Expeditionary Force Protection*

AFH 10-222, Volume 5, *Guide to Contingency Electrical Power System Installation*

AFH 10-222, Volume 6, *Guide to Bare Base Facility Erection*

AFH 10-222, Volume 22, *Refugee Camp Planning and Construction Handbook*

AFPAM 10-219 Volume 6, *Planning and Design of Expeditionary Airbases*

AFPAM 91-216, *U.S. Air Force Safety Deployment and Contingency Pamphlet*

ETL 09-3, *Chemical Dust Control for Contingency Roads, Base Camps, Helipads, and Airfields*

ETL 10-6, *External Foam Insulation of Temporary Structures*

ETL 10-7, *Connection Methods for Standby Generators – 600 Volts or Less*

DEPARTMENT OF THE ARMY

Army Handbook, *Environmental Baseline Survey and Occupational and Environmental Health Site Assessment Handbook: Contingency Operations (Overseas)*

<https://www.us.army.mil/suite/designer>

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

29 CFR 1910.95, *Occupational Noise Exposure*;

[http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS
&p_id=9735](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9735)

SERVICE REACHBACK CONTACTS:

Army:

USACE Reachback Operations Center (UROC);

Email: UROC@usace.army.mil or UROC@usace.army.smil.mil ;

NIPR website: <https://uroc-redi.usace.army.mil>;

SIPR website: <https://uroc-redi.uroc.usace.army.smil.mil>

Navy/Marine Corps:

NAVFAC PAC (PACOM AOR)

Cary Watanabe

cary.watanabe@navy.mil

(808) 472-1177

NAVFAC LANT (All other AORs)

CDR James F. Croom

james.croom@navy.mil

NFCEL_CE_Reachback@navy.mil

757-322-8302

Air Force:

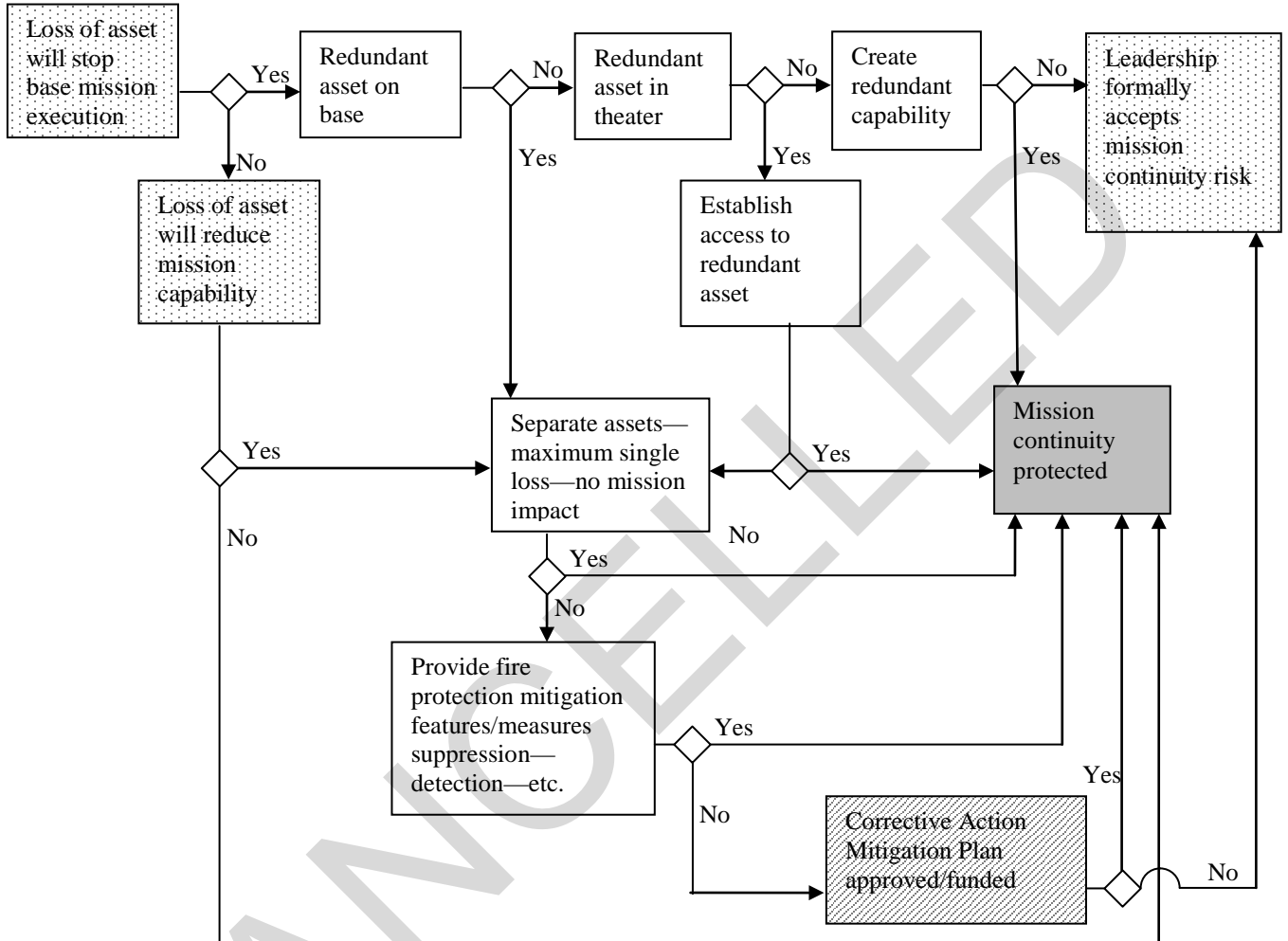
AFCEC Reach-back Center

Email: AFCECE.RBC@tyndall.af.mil

Phone: DSN 312.523.6995, Comm 850.283.6995

APPENDIX C FIGURES

Figure C-1 Mission Critical Facilities Decision Tree



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APPENDIX D GLOSSARY, ACRONYMS AND ABBREVIATIONS

A

AE	Ammunition and Explosives
AFCEC	Air Force Civil Engineer Center
AFH	Air Force Handbook
AFI	Air Force Instruction
AHJ	Authority Having Jurisdiction
ANSI	American National Standards Institute, Inc.
ASHRAE	American Society of Heating, Refrigeration And Air Conditioning Engineers, Inc.

C

C	Degrees Celsius
CCMD	Combatant Command
CQM	Construction Quality Management
CMU	Concrete Masonry Unit
COCOM	Combatant Command
Controlled Perimeter	The perimeter of a DoD site with a physical boundary at which vehicular access is restricted. For a more complete definition of this term, see UFC 4-010-01.
CPD	Capabilities Production Document

D

DoD	Department of Defense
DOR	Designer of Record

E

EM	Engineering Manual
EP	Engineering Pamphlet
ESQD	Explosives Safety Quantity Distance

F

F	Degrees Fahrenheit
FM	Field Manual
FPE	Force Provider Expeditionary
Ft	feet

G

gpm Gallons per minute

H

HN Host Nation
HNFA Host Nation Funding Agreement
Hr hour
HVAC Heating, ventilation, and air conditioning

I

IBC International Building Code
IMC International Mechanical Code
IPC International Plumbing Code

J

JFOB Joint Forward Operations Base
JOCOTAS Joint Committee on Tactical Shelters
JP Joint Publication

K

Km kilometer
kV kilovolt

M

m meter
MIL-HDBK Military Handbook
MIL-STD Military Standard
mm millimeter

N

NAVFAC Naval Facilities Engineering Command
NCR Naval Construction Regiment
NFPA National Fire Protection Association

O

O&M Operations & Maintenance
OPLAN Operations Plan
OPORD Operations Orders

P

POL Petroleum, Oil & Lubricants

Q

QA Quality Assurance
QC Quality Control

R

RDECOM Research, Development and Engineering Command

S

SOFA Status of Forces Agreement
Sq. ft. square feet
Sq. m. square meter

Structure Group Cluster of tents, containers, trailers, or similar structures located in rows, with individual structures separated by space. For more details on this term see UFC 4-010-01, and for a graphic representation showing structure groups and a typical arrangement of a DoD contingency compound, see UFC 4-010-01, and Figure D1 from UFC 4-010-01.

SWH service water heater

T

TCMS Theater Construction Management System

U

UFC Unified Facilities Criteria
USACE United States Army Corps of Engineers

V

Vol Volume

W

W width