



TECHNICAL GUIDE – Version 2.1¹

New Construction and Renovations

Guiding Principles Implemented by

UFC 1-200-02 (December 2016)

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Introduction

For use with Guiding Principles Assessment, Department of Defense: Building Design and Construction
UFC 1-200-02

From the EPA to NASA, federal agencies work to abide by the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings² for building, renovating, and operating optimal, efficient buildings. The Green Business Certification Inc. (GBCI) has been working with these federal agencies to offer assessments of each agency's work to meet the Guiding Principles. GBCI can help you evaluate your success, streamline reporting, and guide your efforts toward complying with the principles, using its depth and breadth of knowledge of green building certification.

The Department of Defense (DOD) initiated the Unified Facilities Criteria (UFC) program to unify all technical criteria and standards pertaining to planning, design, construction, and operation and maintenance of real property facilities³. The Guiding Principles Requirements ("Requirements") are incorporated into the UFC 1-200-02 High Performance and Sustainable Building Requirements (UFC 1-200-02). For the DOD, compliance with UFC 1-200-02 is compliance with Guiding Principles for Federal Sustainable Buildings. Guiding Principles Assessment (GPA) assesses compliance with UFC 1-200-02.

This Technical Guide, along with the Guiding Principles Assessment Handbook, will take you through the steps to show your projects' compliance with the Guiding Principles as specified in UFC 1-200-02⁴.

UFC, DOD and Installation Policy Version Applicability

This guidance includes updates through UFC 1-200-02 Change 4. Buildings designed under UFC 1-200-02 Change 4 must meet Change 4. See UFC 1-200-01 section 1-3.1 for more information. GBCI does not determine UFC or policy applicability on behalf of the project team. If the building is designed under previous versions of UFC or specific department or installation policy, the Project Information Form must indicate the publication date of the version applied. Otherwise, applications will be held to UFC 1-200-02 Change 4 and the most current related UFC and policies.

² Guiding Principles for Sustainable Federal Buildings <https://www.epa.gov/greeningepa/guiding-principles-sustainable-federal-buildings>

³ Department of Defense (DOD) UNIFIED FACILITIES CRITERIA PROGRAM
<http://www.wbdg.org/ffc/dod>

⁴ UFC 1-200-02 <http://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-1-200-02>

TECHNICAL GUIDANCE

2-1. OVERVIEW

These requirements apply to all New Construction, New Addition, and Renovation projects.

The Requirements noted for each of the following are from UFC 1-200-02 (UFC).

2-1.1 Life Cycle Cost Analysis

UFC Section 1-7 LIFE-CYCLE COST ANALYSIS (LCCA) The purpose of the LCCA methodology as detailed in CFR Title 10 Part 436 Subpart A is to identify and compare life-cycle cost-effective (LCCE) building energy and water systems that will in total achieve the energy and water requirements as detailed in UFC 1-200-02.

An LCCA is required for the following:

1. Systems contributing to energy footprint of the building. Energy consuming systems include, but are not limited to, HVAC, lighting, and the building envelope⁵
2. Renewable energy generating systems (example: photovoltaic panels)
3. When LCCE is selected as the reason any requirement of this document is “Partially compliant” or “Not Applicable” (reference paragraph 4-2 Compliance with Federal Requirements)

For methodology and requirements, see UFC 1-200-02.

2-1.2 Project Team Definitions

Owner Organization: The “Owner Organization” also known as the Building Owner Organization is the building owner organization or the DOD department that will maintain and occupy after construction (US Army, US Air Force, US Navy, or US Marine Corps)

Owner Name: The “Owner Name” also known as the Building Owner Name is the name of the point of contact within the Owner Organization aka Building Owner Organization representing the owner during the project and once the building is occupied (the individual filling this role may change once the building is occupied).

Primary Contact Organization: The “Primary Contact Organization” also known as Project Owner Organization is the DOD department that is executing project for the “Owner Organization” also known as Building Owner Organization (US Army, US Air Force, US Navy, or US Marine Corps).

Primary Contact Name: The “Primary Contact Name” also known as Project Owner Name is the name of the person within the Primary Contact Organization also known as Project Owner Organization responsible for the project.

Project Administrator Organization: “The Project Administrator Organization” is either the DOD or non-DOD (often and Architecture or Engineering firm) organization that the executes the project for the Primary Contact Organization aka Project Owner Organization.

Project Administrator Name: The “Project Administrator” is the name of the person within the Project Administrator Organization responsible for the project.

2-1.3 Applicability and Compliance

UFC 4-2 COMPLIANCE WITH FEDERAL REQUIREMENTS.

Fully Compliant: The project is in full compliance with the Requirement.

Not Applicable: The requirement is not applicable, based on LCCE (example, LCCE excludes use of Alternative Water); mission exclusion (example, no daylighting in a theater or a SCIF); location/regional exclusion (example, Host Nation Agreement or no local recycling facility); locale exclusion (example, there is no steam to meter), or safety (example, building orientation restriction for AT/FP due to existing infrastructure), and is marked “Not Applicable” with justification. Provide written justification and/or contracting officer approval.

Partially Applicable: In instances where a Requirement is only partially applicable to a building, within the Project Information Form select the documentation path that will be used to document the applicable portions of the Requirement. “Not applicable” should only be selected if the Requirement is not applicable in its entirety to the entire building space. If a Requirement is partially applicable (e.g. daylighting not permitted in select secure areas of the building or a renovation project that also includes new construction areas), it is expected that the project comply with all the requirements for the applicable areas of the project.

Renovations: Additions, sustainment, modernization, and restoration buildings (“Renovations”) must comply with UFC Requirements relevant to the scope of the project. UFC Requirements not within the project scope of work may be marked Not Applicable.

The completion of aspects of Requirements by different teams and/or prior to the current team’s involvement does not preclude the overall project from meeting the Requirements. Demonstration of compliance with elements completed prior to development and issuance of current scope (e.g. sustainability charrette, etc.) is required. If documentation of specific elements from prior design and scoping exercises is unavailable to the project team, provide written exemption from the contracting officer for the specific elements is required for submittal.

2-1.4 Definition of Terms

Basis of Design (BOD): The BOD is the project team’s interpretation of the project requirements as presented in the RFP and contract documents. Any revision to the project requirements should be reflected in the BOD. See also DD Form 1391. Refer to 2-2.2 Commissioning for additional information.

Enacted DD Form 1391: A programming document enacted into law, in public domain that is used by the DOD to submit requirements and justifications in support of funding requests for military construction to Congress.

Life-Cycle Cost Analysis (LCCA): Assessment of the direct, indirect, recurring, nonrecurring, and other related costs incurred or estimated to be incurred in the design, development, production, operation, maintenance, support, and final disposition of a major system over its anticipated useful life span. LCCA considers all costs (capital, operating, and decommissioning expenses for the duration of a project) for various alternative approaches, including inflation and discount rates.

Life-Cycle Cost Effectiveness (LCCE): A documented statement of costs to be incurred to complete all stages of a project from planning through acquisition, maintenance, operation, remediation, disposition, long-term stewardship, and disposal. The results of a LCCA.

Life-Cycle Costing (LCC): An important economic analysis used in the selection of alternatives that impact both pending and future costs. It compares initial investment options and identifies the least cost alternatives for a 40-year period. As applied to building design energy conservations measures, the process is mandated by law and is defined in 10 CFR Part 426, Subpart A: Program Rules of the Federal Energy Management Program (NIST Handbook 135). The National Institute of Standards and Technology has established the Building Life-Cycle Cost (BLCC) computer program to perform LCC analyses. The program incorporates user entered data and compares the following: Sunk Costs, First Costs, Salvage Value, Future Investment, Residual Value, Annually Recurring Fixed Costs, Annually Recurring Escalating Costs, and Energy (Fuel Costs) Escalation Rates.

2-1.5 General Documentation Requirements

All projects must submit each of the following, in addition to the documentation requirements specified in each Requirement:

- Project Information Form
- Basis of Design (BOD)
- General project narrative that includes a brief description of building use, occupancy, site conditions, renovation scope if applicable, special circumstances, or other information that will provide a holistic understanding of the project
- Site plan highlighting the location of the Guiding Principles Assessment project boundary and project footprint
- Floor plans of each floor in the building
- Mechanical plans and schedules
- Enacted DD Form 1391, which may be obtained from the Primary Contact or Owner (as defined above). Note that the Enacted DD1391 is labeled Public Law, and therefore may be viewed by anyone, including GBCI personnel. In lieu of an Enacted DD1391 the following documentation may be substituted: Basis of Design or Scope of Work (accepted for renovation / comprehensive replacement and SRM projects only) to serve as the OPR or other “Owner” Requirements Document

Guidelines for applications:

- Ensure that relevant information is clearly highlighted within the submission documents
- Clearly and intuitively label all documents
- Submit only required information (if only a few pages of a large report are needed to provide the required information, provide only the relevant sections)

2-1.6 Compliance Paths

The Project Information Form is used to indicate the compliance path selected for each Requirement. A completed form must be provided to GBCI; if compliance paths are updated during the assessment process, a revised form must also be provided.

A portion of the Requirements have a compliance path that allows a project to demonstrate compliance using the prescribed documentation and/or the related calculators for compliance with a LEED prerequisite or credit . Note that this compliance path option does not require that the project be registered with USGBC to pursue LEED certification.

For more information about the not applicable compliance path see section 2-1.3 Applicability and Compliance of this document.

2-1.7 Shared Site Approach Requirements

If multiple buildings seeking Guiding Principles Assessment are located on the same site and can be included in the same Guiding Principles Assessment project boundary, qualified projects may elect to document the buildings via the Shared Site approach.

Shared Site Approach: a set of buildings located within the same Guiding Principles Assessment site boundary that, because of shared site features and uniformity in building traits, can document a subset of Requirements on the site level as listed under each Requirement.

Documentation Requirements

In addition to the general documentation requirements, the following must be provided for buildings documenting via the shared site approach. These documents are to be submitted in the first building that submits for review among those that will be leveraging the shared site approaches.

- A schematic site plan showing the location of the shared site boundary, the location of each building pursuing the Guiding Principles Assessment and their associated individual project boundaries and project footprints, and any future buildings located in the shared site boundary (if known)
- A list of the GBCI registration IDs and names of buildings for which the shared site approaches will apply
- For all subsequent projects that submit for review that have already had their shared site Requirements deemed compliant, provide a narrative that references the GBCI registration ID of the building that provided the shared site documentation. The narrative must also confirm that the shared site boundary remains the same as previously documented and that there are no changes within the shared site boundary that affect the compliance of a Requirement previously deemed compliant.

2-2. EMPLOY INTEGRATED DESIGN PRINCIPLES

Integrated design is the most important requirement in achieving a high-performance building. A design team must have strong, consistent representation from all stakeholders throughout the project phases to avoid missing opportunities to improve building performance and to fully realize increased savings potential.

2-2.1 Integrated Design

Requirements

Incorporate the following planning and evaluation into the integrated design, as described in Section F1.1.1 (Charrette Process), with the exception that subparagraph b. does not apply.

The Integrated Design requirements are addressed by the Enacted DD Form 1391 coordination from Base to Congress, prior to delivery to the project team. Documentation can be obtained from the Primary Owner Contact.

Compliance

Step 1. Review ASHRAE 189.1 Requirements and DD Form 1391

- Obtain the Enacted DD Form 1391 form to understand the owner's project goals and any department, base, or other requirements provided by the Owner.
- Obtain the design charrette process information and other early design phase documentation from the Owner that would have been developed as part of the creation and approval of the "Enacted DD Form 1391."

Step 2. Assemble team

- In addition to the owner or primary contact, core members of the integrated design team often include the architect, engineers, construction manager or general contractor, landscape architect, facilities manager, green building or sustainable design specialist, other professionals from relevant disciplines, building users, and government support staff.
- Team members with broad experience play a key role in contributing meaningfully to the major areas of focus: siting, energy, water, materials, indoor environmental quality, and other design goals.

Step 3. Document performance goals and targets

- Well-defined performance objectives serve as a road map to guide the integrated design team throughout the building process. They help keep the team on track and provide a basis for systematic decision-making. Document performance goals, such as compliance with the DD Form 1391, UFC 1-200-02, and/or any Owner specific goals and targets.
- If practical and where allowed by building mission, maximize the use of natural systems for energy conservation, lighting, ventilation, and passive heating and cooling before mechanical systems are engaged, taking into account the impact of the design on the site and its larger context including the environmental impact on a life-cycle cost basis.

- As a best practice, if practical, use building information modeling (BIM) software, design tools, and the experience of the design team to help optimize the design.

Step 4. Establish and maintain an open communication process throughout design and construction

- Members of the team will communicate frequently throughout both the design and construction phases of the project. Provide opportunities for communication through coordinated meetings and workshops, document sharing, and/or collaborative software.
- Consider and ensure how project goals will be maintained should the project transition from one responsible party to another.
- Collaboration is an iterative process rather than a checklist, with team members brainstorming, testing, and refining their design ideas against the performance targets.
- If possible when making design decisions, solicit feedback and inform all members of the design and construction team and consider future operation and maintenance (O&M) requirements.

Documentation Requirements

Design Submittal

Path One:

- Copy of Enacted DD1391 Form. In lieu of an Enacted DD1391 the following documentation may be substituted: Basis of Design or Scope of Work (accepted for renovation / comprehensive replacement and SRM projects only) to serve as the OPR or other “Owner” Requirements Document
- Narrative description of project team’s process for distributing and incorporating the results from the DD Form 1391 and process for ensuring owner and project goals will be met throughout the lifetime of the project, including necessary transition from design to construction to project completion.
- If the Owner requires goals that are more specific or beyond what is required in UFC 1-200-02, provide a narrative document including the goals and how the team addressed each goal.

Path Two:

Projects jointly pursuing LEED certification (not applicable permitted for Air Force or Navy or Air Force-owned buildings per department policy):

- Demonstrate compliance with [LEED BD+C v4 IPc Integrative Process](#)
- Copy of Enacted DD1391 Form. In lieu of an Enacted DD1391 the following documentation may be substituted: Basis of Design or Scope of Work (accepted for renovation / comprehensive replacement and SRM projects only) to serve as the OPR or other “Owner” Requirements Document
- Narrative description of project team’s process for distributing and incorporating the results from the DD1391 (or approved alternative documentation) and process for ensuring owner and project goals will be met throughout the lifetime of the project, including necessary transition from design to construction to project completion
- If the Owner requires goals that are more specific or beyond what is required in UFC 1-200-02 or LEED credit requirements, generate a narrative document including the goals and how the team addressed each goal

Path Three:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.

- Shared Site Approach: Eligible to be documented at a shared site level, if all projects are planned at the same time. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-2.1.1 Integrated Planning

Requirements

Use a collaborative, integrated planning and design team, composed of user, government support staff, and appropriate professionals, to identify requirements and to establish performance goals for siting, energy, water, materials, indoor environmental quality, and other comprehensive design goals. Ensure incorporation of these goals throughout design and construction.

Note that the requirements “to establish performance goals for siting” and “Ensure incorporation of these goals throughout design and construction” are addressed by the DD Form 1391 creation and development process.

Compliance

Step 1. Performance goals

- Performance goals will have been established by the Enacted DD Form 1391 as well as the work completed to meet the Integrated Design (2-2.1) Requirement as described in ASHRAE 189.1 Appendix F.
- Ensure that all stages of the building’s life cycle are considered while incorporating the performance goals into the final design and construction of the project.

Step 2. Documentation

- Maintain a log or other record dedicated to tracking discussions and decisions related to the Integrated Planning as described in ASHRAE 189.1 Appendix F.

Documentation Requirements

Design Submittal

Path One:

- Narrative regarding how the project team ensured that all stages of the building’s life cycle, were considered while incorporating the performance goals into the final design and construction of the project
- Copy of Integrated Planning Log or other record documenting discussions and decisions related to Integrated Planning as described in ASHRAE 189.1 Appendix F

Path Two:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Eligible to be documented at a shared site level, if all projects are planned at the same time. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-2.1.2 Evaluation for Design Strategies

Requirements

Evaluate the site and building components to determine whether passive and natural design strategies and features are cost effectively incorporated before the active and mechanical systems are designed. Incorporate these features where applicable and where allowed by building mission. Take into account site attributes, including climate and local and regional context, which impact the design of the building.

Compliance

Step 1. Leverage Integrated Design and Integrated Planning

- While working with the Integrated Design and Planning requirements and within the context of the Enacted DD Form 1391, incorporate as many passive and natural design strategies as are cost effective prior to incorporating the active and mechanical systems.
- Evaluate the local climate, site conditions, waste treatment infrastructure, energy load distribution, water sources, transportation options, and potential building features. Understanding these aspects will help inform which sustainable strategies to employ on the project.

Documentation Requirements
Design Submittal

Path One:

- For site and building attributes, highlight the documentation that demonstrates that the passive and natural design strategies and features were evaluated and incorporated where life cycle cost effective. Evaluation must address local climate, site conditions, , energy load distribution, and potential building features.

Path Two:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Eligible to be documented at a shared site level, if all projects are planned at the same time. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-2.1.3 Evaluation of the Site

Requirements

During the site selection process, meet the requirements of UFC 2-100-01. See Appendix B “Best Practices” for desirable site characteristics.

Compliance

Step 1. Implement DD Form 1391

- The evaluation and site selection has been addressed and incorporated into the Enacted DD Form 1391. See Appendix B of the UFC 1-200-02 document “Best Practices” for desirable site characteristics.

Documentation Requirements

Design Submittal

Path One:

- The Enacted DD Form 1391 addresses and incorporates UFC 2-100-01, no further documentation is necessary.

Path Two:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Eligible to be documented at a shared site level, if all projects are planned at the same time. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-2.1.4 Site Integration and Design of the Building

Requirements

During the planning and design process, meet the requirements of applicable UFCs and use the following site development considerations and passive strategies:

- Site design elements that ensure safe and convenient pedestrian access
- Meet the requirements of UFC 3-201-02 (Landscape Architecture)
- Incorporate results of site analysis, to design the building, focusing on orientation, configuration and massing
- Orient building to maximize energy efficiency, passive solar, and daylighting potential
- Select, design, and integrate into the overall building, high performance and sustainable systems (e.g. HVAC, plumbing, water heating systems, lighting systems, control systems, elevators, building envelope, and fire protection systems).
- Promote opportunities for occupants to voluntarily increase physical activity

Compliance

Step 1. Identify site characteristics that can be modified

- Consider the following factors:
 - Site factors that are conducive to the implementation of sustainable building strategies (e.g. opportunity for daylighting and passive energy efficiency measures)
 - Building orientation to maximize energy efficiency, passive solar, and daylighting potential of the building
 - Site design elements that provide safe and convenient pedestrian access

Step 2. Meet the Landscape Design Requirements of UFC 3-201-02

Documentation Requirements

Design Submittal

Path One:

Narrative that addresses the actions and/or considerations taken when selecting the project site as related to the following:

- How site design elements that ensure safe and convenient pedestrian access were considered and/or implemented
- How the project meets the requirements of UFC 3-201-02 (Landscape Architecture)
- How the results of the site analysis were incorporated into design of the building, focusing on orientation, configuration, and massing
- How the building orientation maximizes energy efficiency, passive solar, and daylighting potential.
- How high performance and sustainable systems (e.g. HVAC, plumbing, water heating systems, lighting systems, control systems, elevators, building envelope, and fire protection systems) were selected, designed, and integrated into the overall building
- How opportunities for occupants to voluntarily increase physical activity are promoted within the project
- Narrative confirming details related to meeting the Landscape Design Requirements from UFC 3-201-02 1-4 Critical Design Requirements.

Path Two:

- Demonstrate compliance with LEED v2009 BD+C credits: SSc1 Site Selection
- Provide narrative confirming details related to meeting the Landscape Design Requirements from UFC 3-201-02 1-4 Critical Design Requirements

Path Three:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
- Shared Site Approach: Landscape requirements may be documented at the shared site level. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-2.2 Commissioning

Requirements

To verify design and performance and ensure that the Government requirements are met, employ commissioning practices appropriate to the size and complexity of the building and its system components. This must include an experienced commissioning provider, who should be independent of the project design and construction team, and the operations team. The choice of either contracted services or Government personnel as the commissioning provider will be determined at project level. Meet the requirements of ASHRAE 189.1 Section 10.3.1.2 (Building Project Commissioning), with the following modifications:

- For buildings and systems that are less complex⁶, commissioning can be tailored as determined by the DOD Component AHJ⁷.
- “Schematic design” is the design charrette or similar conceptual design activity.
- Documentation as described in ASHRAE 55 Section 6.2 is not required.

Exception: For Medical Treatment Facilities, refer to UFC 4-510-01 Medical Military Facilities for commissioning requirements.

Commissioning: Per DOE Guidance 42 USC 8253(f), “The commissioning process ensures that all of the equipment and systems within a facility are currently operating and functioning properly and identifies items that need to be fixed or adjusted, typically in a low or no cost fashion.”

Compliance

When working with the following guidance, for buildings and systems that are less complex (for Army projects, refer to Army policy for determination of systems to commission), commissioning can be tailored as determined by the DOD Component AHJ (for Air Force and Navy projects, the Project Delivery Team must determine the level of commissioning activities required.)

Step 1. Develop OPR and BOD

- For buildings and systems that are less complex, commissioning can be tailored as determined by the DOD Component AHJ.

The owner / executing service organization, with the help of the design team and other stakeholders, must develop the initial owner’s project requirements document (OPR) in the predesign stage. This document establishes the owner’s goals and the building’s intended function and operation. Update the commissioning plan throughout the design and construction process.

NOTE: For Army Executed Projects - Begin development of the OPR in predesign in coordination with the owner, supported by the design team and stakeholders. The OPR provides the building’s intended operation and function along with the owner’s goals. Update the commissioning plan as needed throughout design and construction.

⁶ For Army projects, refer to Army policy for determination of systems to commission.

⁷ For Air Force & Navy projects, the Project Delivery Team must determine the level of commissioning activities required.

NOTE: For Navy Executed Projects - A separate OPR document is not required. However, one of the following must be submitted:

- For Design-Build: Request for Proposal (RFP)
- For Design-Bid-Build: For MILCON and Specials, provide the DD1391 (Basis of Design can be submitted with the DD1391, but not instead of) (NOTE: In lieu of an Enacted DD1391 the following documentation may be substituted: Basis of Design or Scope of Work (accepted for renovation / comprehensive replacement and SRM projects only) to serve as the OPR or other “Owner” Requirements Document); for comprehensive replacement or Repair, Sustainment, Modernization (SRM) (AKA renovations): Scope of Work (SOW).

For projects using LEED, follow LEED OPR requirements, regardless of executing Service.

- In the schematic design phase, the design team will create a basis of design (BOD) to provide clear technical guidance for the project. Update the BOD throughout the design and construction process.
- For Army Executed projects only: Owner’s Project Requirements establish the owner’s goals and the building’s intended function and operation. The owner will use this document as the foundation for all design, construction, acceptance, and operational decisions.
- The OPR details the functional requirements as well as the expectations of the building’s use and operation. The intention is to document the owner’s requirements and objectives for the project to verify that those goals are carried through the life of the project. An OPR outline might include the following:
 - Key project requirements. Items that the Cx process will focus on and that the owner has deemed critical to the project.
 - Occupant requirements. Functions, number of occupants, and schedules for the building.
 - Budget considerations and limitations. The expected cost restrictions and considerations for the project’s design, construction, and commissioning process.
 - Target goals. The owner’s overall goals, such as energy efficiency and sustainability.
 - Performance criteria. The standards by which the project will be evaluated by the Commissioning team. Each criterion should be measurable and verifiable. Potential topics include general, economic, user requirements, construction process, operations, systems, and assemblies.
 - Operations and maintenance requirements. Established criteria for ongoing operations and maintenance, as well as training requirements for personnel.

Step 2. Step 3. Step 2 Commissioning Provider (CxP) reviews OPR and BOD

- The review provides a third party, acting as an advocate for the owner, and to document that the BOD reflects the OPR and that both contain sufficient detail.
- Conduct first review during 35% / concept design, to allow the project team to make any necessary changes that emerge from the review.

Step 3. Develop preliminary commissioning plan

- Outline the scope of commissioning, including systems to be commissioned. Include project roles and responsibilities, the commissioning team's project directory, and schedule of commissioning activities. Update the commissioning plan throughout the design and construction process.

Step 4. Incorporate commissioning requirements into construction documents

- Incorporate commissioning requirements into construction documents per UFGS 01 91 00.15.10 (for USACE-executed), or UFGS 01 91 00.15 20 (for Navy-executed), Total Building Commissioning⁸

Step 5. Confirm that the CxP reviews design documents

- Documents and specifications must meet the requirements of the OPR and BOD. The CxP must review and supply feedback on these documents twice, at a minimum:
 - At 50% design completion
 - Prior to hand-off to contractor

Step 6. Develop construction checklists

- Construction checklists must be generated and completed for all equipment, assemblies, and systems included in the CxP scope. They provide confirmation that systems have been installed, started up, programmed, tested, and balanced, and that the team is ready to proceed with functional testing.
- The CxP, design team, or contractor must prepare the construction checklists. Step 7. Confirm that the CxP reviews submittals
- Verify that the CxP reviewed project submittals for construction quality control and specification conformance.

Step 8. Conduct prefunctional inspections

- The CxP conducts site visits as determined and scheduled in plan as indicated in the commissioning plan to inspect the installation of individual systems and components. Site visits are an important opportunity to observe equipment installation and identify issues before a system becomes difficult to access or change.

Step 9. Execute functional testing

- CxP provides contractors and design engineers with the functional test scripts prior to testing to allow them the opportunity to review the scripts, verify proper operating mode, and comment on any modifications to match actual operation.
- CxP performs functional performance testing once all system components are installed, energized, programmed, balanced, and otherwise ready for operation under part- and full-load conditions.

⁸ Army and Air Force - <https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-01-91-00-15-10>

Navy - <https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-01-91-00-15-20>

Step 10. Verify operations training and documentation

- Verify operations training in accordance with the OPR. Include the owner, building engineer, and/or relevant staff in the commissioning testing execution.
- Review O&M documentation
- Confirm that a system manual has been developed and contains O&M documentation, warranty information, and provides future operating staff the information to understand and optimally operate the commissioned systems.
 - For Army Executed Projects: Submit Maintenance and Service Life Plans as described in UFGS 01 91 00.15 10 Total Building Commissioning para 3.2.9. Coordinate with UFGS 01 78 23 Operation and Maintenance Data and UFGS 01 45 00.00 10 QUALITY CONTROL.
 - For Navy Executed Projects: Review UFGS 01 78 23 Operation and Maintenance Data and UFGS 01 41 00.05 20 DESIGN AND CONSTRUCTION QUALITY CONTROL (D8) or 01 45 00.00 20 QUALITY CONTROL (DBB), in accordance with UFGS 01 91 00.15 20 para 3.10.
 - For projects pursuing LEED, follow the LEED Manual Requirements, regardless of executing Service.

Step 11. Conduct warranty period & after occupancy review

- CxP reviews current building operation by end of warranty period to find any discrepancies between actual and design performance and identify any repairs.

Step 12. Complete final commissioning report

- Ensure project design is in alignment with what was constructed and incorporate findings into final commissioning report.
- Once all systems testing is complete, the CxP will prepare a final commissioning report that covers all components of the commissioning process, including the following:
 - Executive summary of commissioning process and results, system deficiencies identified and resolution, and outstanding issues
 - Project directory
 - Cx process overview
 - Owner's project requirements
 - Basis of design
 - Submittals
 - Design review log
 - Cx specifications
 - List of systems commissioned
 - Installation verification checklists
 - Functional performance tests

Documentation Requirements

Construction Submittal

Path One:

- Verification of CxP activities and reviews
- Commissioning plan
- Documentation of testing and verification
- Confirmation of O&M plan review
- Commissioning report

Path Two:

- Demonstrate compliance with [LEED BD+C v4 EAp Fundamental Commissioning and Verification](#)
- Provide CxP previous experience narrative
- Clarification that the following systems were included during the commissioning process: irrigation systems, building envelope, process water and meters

Path Three:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-3. OPTIMIZE ENERGY PERFORMANCE

Energy Modeling: The process by which conceptual designs, including size, material choices, factors such as site, solar, and wind orientations, daylighting percentages, and energy system choices (solar water heat, underfloor vs. overhead air distribution systems) are analyzed to show how to optimize these factors for efficient building operation and resource consumption.

2-3.1.1 Energy Efficiency - Commercial and Multi-Family High-Rise Residential Buildings

Requirements

Meet the requirements of ASHRAE 90.1-2013.

Design the building to achieve at least 30% energy consumption reduction from ASHRAE 90.1 baseline.

If a 30% reduction is not life-cycle cost-effective (LCCE⁹), modify the design of the proposed building to achieve an energy consumption level at the highest level of energy efficiency that is LCCE.

Determine energy consumption levels for both the ASHRAE Baseline Building and proposed building by using the Performance Rating Method found in appendix G of ASHRAE 90.1, except the formula for calculating the Performance Rating. Replace the formula in G1.2 with the following:

$$\text{Percentage improvement} = 100 \times ((\text{Baseline building consumption} - \text{Receptacle and process loads}) - (\text{Proposed building consumption} - \text{Receptacle and process loads})) / (\text{Baseline building consumption} - \text{Receptacle and process loads})^{10}$$

Base energy efficiency design decisions on LCCA as indicated in Chapter 1 of UFC 1-200-02. The LCCA includes a minimum of three energy efficient alternatives to the baseline standard (ASHRAE 90.1, , etc.).

Commercial and Multi-Family High-Rise Residential Buildings: All buildings, other than low-rise residential buildings.

Compliance

Step 1. Design the building to achieve at least 30% energy consumption reduction.

- Utilize current version of ASHRAE Standard 90.1. “Design the building to achieve at least 30% energy consumption reduction from ASHRAE 90.1 baseline.”

⁹ See Reference section at end of document for description and definition for LCCE and LCCA.

¹⁰ Energy consumption for the purposes of calculating the 30 percent savings requirements in CFR Title 10 Part 433 §433.100 shall include the building envelope and energy consuming systems normally specified as part of the building design by ASHRAE 90.1 such as space heating, space cooling, ventilation, service water heating, and lighting, but shall not include receptacle and process loads not within the scope of ASHRAE 90.1 such as specialized medical or research equipment and equipment used in manufacturing processes.

- Follow all applicable guidance in the UFC 3-410-01 1 HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS, .
- Be sure to utilize the step by step instructions in the UFC
- Use the following formula to calculate the percentage improvement = $100 \times ((\text{Baseline building consumption} - \text{Receptacle and process loads}) - (\text{Proposed building consumption} - \text{Receptacle and process loads})) / (\text{Baseline building consumption} - \text{Receptacle and process loads})$ ¹¹
- When evaluating energy usage in different scenarios, inspect strategies for lighting and daylighting, envelope, orientation, and passive conditioning and ventilating systems, in terms of projected energy savings and capital costs as they relate to all building systems
- If a 30% reduction is not life-cycle cost-effective (LCCE¹²), modify the design of the proposed building to achieve an energy consumption level at the highest level of energy efficiency that is LCCE.
- When working to determine the LCCA, utilize the NIST handbook 135 “Life-cycle cost Manual for the Federal Energy Management Program” along with the “Annual Supplement to Handbook 135, Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis”.

Documentation Requirements

Design Submittal

Path One:

If achieved target

- Energy models including simulation input reports for rooms, systems, and plants and the simulation output reports
- LCCA
- Summary of how target was achieved, and the three energy-efficient solutions reviewed for each individual building energy system
- Narrative inclusive of; Energy reduction target; Energy standard utilized; Total design energy use intensity EUI in kBtu/sf/yr
- Calculated energy use by type
- List of energy end uses for the project building (for both the baseline case and the design case)
- If the project is using a computer energy simulation, adhere to Appendix G of ASHRAE 90.1 (or equivalent local code) and retain the final report indicating the annual energy cost of the baseline and design cases
- If the project is using the prescriptive compliance path, assemble documentation demonstrating that the project meets all applicable requirements
- Energy Compliance Analysis (ECA) that identifies the specific energy conservation criteria that applies to the project, the software used to prepare the necessary calculations, a summary of all

¹¹ Energy consumption for the purposes of calculating the 30 percent savings requirements in CFR Title 10 Part 433 §433.100 shall include the building envelope and energy consuming systems normally specified as part of the building design by ASHRAE 90.1 such as space heating, space cooling, ventilation, service water heating, and lighting, but shall not include receptacle and process loads not within the scope of ASHRAE 90.1 such as specialized medical or research equipment and equipment used in manufacturing processes.

¹² See Reference section at end of document for description and definition for LCCE and LCCA.

input to and output from the calculations, and the calculated baseline and as-designed building energy consumption of the proposed design

If target not achieved

- Energy models including simulation input reports for rooms, systems, and plants and the simulation output reports
- LCCA
- Summary of why target was not achieved, and the three energy-efficient solutions reviewed for each individual building energy system
- Narrative inclusive of; Energy reduction target; Energy standard utilized; Total design energy use intensity EUI in kBtu/sf/yr
- Calculated energy use by type
- List of energy end uses for the project building (for both the baseline case and the design case)
- If the project is using a computer energy simulation, adhere to Appendix G of ASHRAE 90.1 (or equivalent local code) and retain the final report indicating the annual energy cost of the baseline and design cases
- If the project is using the prescriptive compliance path, assemble documentation demonstrating that the project meets all applicable requirements
- Energy Compliance Analysis (ECA) that identifies the specific energy conservation criteria that applies to the project, the software used to prepare the necessary calculations, a summary of all input to and output from the calculations, and the calculated baseline and as-designed building energy consumption of the proposed design

Path Two:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-3.1.2 Energy Efficiency – Low-Rise Residential Buildings

Requirements

Meet the requirements of the International Energy Conservation Code (IECC).

Design the building to achieve at least 30% energy consumption reduction from the IECC baseline using the Simulated Performance Alternative found in Section 405 of the IECC.

If a 30% reduction is not LCCE, modify the design of the proposed building to achieve an energy consumption level at the highest level of energy efficiency that is LCCE.

Low-Rise Residential Buildings: All buildings three stories or less in height above grade that include sleeping accommodations where the occupants are primarily permanent in nature (30 days or more). Base energy efficiency design decisions on LCCA as indicated in Chapter 1 of UFC 1-200-02. The LCCA includes a minimum of three energy efficient alternatives to the baseline standard (IECC, etc.).

Compliance

Step 1. Design the building to achieve at least 30% energy consumption reduction

- Utilize the 2015 version of International Energy Conservation Code (IECC). “Design the building to achieve at least 30% energy consumption reduction from the IECC baseline using the Simulated Performance Alternative found in Section 405 of the IECC.”
- Follow all applicable guidance in the UFC 3-410-01 1 HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS. Be sure to utilize the step by step instructions in the UFC 3-410-01 Appendix E: HVAC System Selection Flow Chart¹³,
- Ensure that step 3, “Develop three energy-efficient solutions for each individual building energy system.”
- When evaluating energy usage in different scenarios, inspect strategies for lighting and daylighting, envelope, orientation, and passive conditioning and ventilating systems, in terms of projected energy savings and capital costs as they relate to all building systems
- If a 30% reduction is not life-cycle cost-effective (LCCE), modify the design of the proposed building to achieve an energy consumption level at the highest level of energy efficiency that is LCCE.
- When working to determine the LCCA, utilize the NIST handbook 135 “Life-cycle cost Manual for the Federal Energy Management Program” along with the “Annual Supplement to Handbook 135, Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis”.

Documentation Requirements

Design Submittal

Path One:

If achieved target

- Energy models including simulation input reports for rooms, systems, and plants and the simulation output reports
- LCCA output reports
- Summary of how target was achieved, and the three energy-efficient solutions reviewed for each individual building energy system

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- Narrative inclusive of; Energy reduction target; Energy standard utilized; Total design energy use intensity EUI in kBTU/sf/yr
- Calculated energy use by type
- List of energy end uses for the project building (for both the baseline case and the design case)
- If the project is using the prescriptive compliance path, assemble documentation demonstrating that the project meets all applicable requirements
- Energy Compliance Analysis (ECA) that identifies the specific energy conservation criteria that applies to the project, the software used to prepare the necessary calculations, a summary of all input to and output from the calculations, and the calculated baseline and as-designed building energy consumption of the proposed design

If target not achieved

- Energy models including simulation input reports for rooms, systems, and plants and the simulation output reports
- LCCA
- Summary of why target was not achieved, and the three energy-efficient solutions reviewed for each individual building energy system
- Narrative inclusive of; Energy reduction target; Energy standard utilized; Total design energy use intensity EUI in kBTU/sf/yr
- Calculated energy use by type
- List of energy end uses for the project building (for both the baseline case and the design case)
- If the project is using the prescriptive compliance path, assemble documentation demonstrating that the project meets all applicable requirements
- Energy Compliance Analysis (ECA) that identifies the specific energy conservation criteria that applies to the project, the software used to prepare the necessary calculations, a summary of all input to and output from the calculations, and the calculated baseline and as-designed building energy consumption of the proposed design

Path Two:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-3.1.3 Energy Efficiency - Renovations

Requirements

Renovation projects that replace everything above the foundation must either apply 2-3.1.1 or 2-3.1.2 as applicable.

All other renovations choose one of the following options:

1. Reduce measured building energy use by at least 30%, below FY 2003, or earlier, energy use baseline.
2. Reduce measured building energy use by at least 20% below FY 2015 energy use baseline.
3. Reduce modeled energy use (from all sources including renewable energy) by 30% compared to the ASRHAE 90.1 baseline building design for Commercial or Multi-Family High-Rise Residential Buildings, or the IECC baseline using the Simulated Performance Alternative found in Section 405 of the IECC for Low-Rise Residential buildings.

If none of the reduction choices is life-cycle cost-effective, modify the design of the proposed building system(s) to achieve an energy consumption level at the highest level of energy efficiency that is life-cycle cost-effective.

Base energy efficiency design decisions on LCCA as indicated in Chapter 1 of this UFC 1-200-02. The LCCA includes a minimum of three energy efficient alternatives to the baseline standard (ASRHAE 90.1, IECC, etc.).

Compliance

Step 1. Determine if project is eligible for 2-3.1.3 Renovation requirement

- If the renovation project is replacing everything above the foundation, do not follow the 2-3.1.3 Energy Efficiency - Renovation requirements.
- Depending on project type follow the 2-3.1.2 Energy Efficiency - Low-Rise Residential Buildings or the 2-3.1.1 Energy Efficiency - Commercial and Multi-Family High-Rise Residential Buildings requirements.

Step 2. Choose one of the following methods to reduce measured building energy use:

- Reduce measured building energy use by at least 30%, below FY 2003, or earlier, energy use baseline
or
- Reduce measured building energy use by at least 20% below FY 2015 energy use baseline.
or
- Reduce modeled energy use (from all sources including renewable energy) by 30% compared to the ASRHAE 90.1 baseline building design for Commercial or Multi-Family High-Rise Residential Buildings, or the IECC baseline using the Simulated Performance Alternative found in Section 405 of the IECC for Low-Rise Residential buildings.

Step 3. Utilize the UFC 3-410-01 1

- Follow all applicable guidance in the UFC 3-410-01 1 HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS.

- Ensure that step 3, “Develop three energy-efficient solutions for each individual building energy system.”
- Use the following formula to calculate the percentage improvement = $100 \times ((\text{Baseline building consumption} - \text{Receptacle and process loads}) - (\text{Proposed building consumption} - \text{Receptacle and process loads})) / (\text{Baseline building consumption} - \text{Receptacle and process loads})$ ¹⁴
- When evaluating energy usage in different scenarios, inspect strategies for lighting and daylighting, envelope, orientation, and passive conditioning and ventilating systems, in terms of projected energy savings and capital costs as they relate to all building systems
- If a 30% reduction is not life-cycle cost-effective (LCCE), modify the design of the proposed building to achieve an energy consumption level at the highest level of energy efficiency that is LCCE.
- When working to determine the LCCA, utilize the NIST handbook 135 “Life-cycle cost Manual for the Federal Energy Management Program” along with the “Annual Supplement to Handbook 135, Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis”.

Documentation Requirements

Design Submittal

Path One:

If achieved target

- Energy models including simulation input reports for rooms, systems, and plants and the simulation output reports
- LCCA
- Summary of how target was achieved, and the three energy-efficient solutions reviewed for each individual building energy system.
- Narrative inclusive of; Energy reduction target; Energy standard utilized; Total design energy use intensity EUI in kBtu/sf/yr
- Calculated energy use by type
- List of energy end uses for the project building (for both the baseline case and the design case)
- If the project is using the prescriptive compliance path, assemble documentation demonstrating that the project meets all applicable requirements
- Energy Compliance Analysis (ECA) that identifies the specific energy conservation criteria that applies to the project, the software used to prepare the necessary calculations, a summary of all input to and output from the calculations, and the calculated baseline and as-designed building energy consumption of the proposed design

If target not achieved

- Energy models including simulation input reports for rooms, systems, and plants and the simulation output reports
- LCCA

¹⁴ Energy consumption for the purposes of calculating the 30 percent savings requirements in CFR Title 10 Part 433 §433.100 shall include the building envelope and energy consuming systems normally specified as part of the building design by ASHRAE 90.1 such as space heating, space cooling, ventilation, service water heating, and lighting, but shall not include receptacle and process loads not within the scope of ASHRAE 90.1 such as specialized medical or research equipment and equipment used in manufacturing processes.

- Summary of why target was not achieved, and the three energy-efficient solutions reviewed for each individual building energy system
- Narrative inclusive of; Energy reduction target; Energy standard utilized; Total design energy use intensity EUI in kBtu/sf/yr
- Calculated energy use by type
- List of energy end uses for the project building (for both the baseline case and the design case)
- If the project is using the prescriptive compliance path, assemble documentation demonstrating that the project meets all applicable requirements
- Energy Compliance Analysis (ECA) that identifies the specific energy conservation criteria that applies to the project, the software used to prepare the necessary calculations, a summary of all input to and output from the calculations, and the calculated baseline and as-designed building energy consumption of the proposed design

Path Two:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-3.1.4 Energy Efficient Products

Requirements

Per EISA 2007 Section 525, acquire products that are ENERGY STAR®-qualified or meet FEMP-designated efficiency requirements in all covered product categories considering cost-effectiveness and availability. Link to EPA sites: <http://www.energystar.gov/> or <https://energy.gov/eere/femp/federal-energy-management-program>

Compliance

Step 1. Specify products that are ENERGY STAR®-qualified or meet FEMP-designated efficiency requirements

- Review project documents to verify that all applicable ENERGY STAR, FEMP-designated energy efficient products, and products meeting other energy efficiency requirements have been called out in the specifications.
- Document any required product substitutions or product exclusions based on LCCA

Step 2. Perform construction submittal reviews to verify implementation

- During construction, coordinate a review of the construction submittals to verify that energy efficient products as specified were purchased and installed

Documentation Requirements

Construction Submittal

Path One:

- List of ENERGY STAR and FEMP – designated Energy Efficient Products installed
- Narrative regarding substitutions or exclusions based on LCCA

Path Two:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-3.1.5 Standby Powered Devices

Requirements

Per EISA 2007 Section 524, provide commercially available, off-the-shelf products that use no more than 1 watt in their standby mode.

Compliance

Step 1. Specify devices in accordance with EISA 2007 Section 524

- In the construction documents specify commercially available, off-the-shelf products that use no more than 1 watt in their standby mode according to EISA 2007 Section 524 when applicable. The Federal Energy Management Program (FEMP) has complied with priority product categories to assist federal buyers in compliance with the low standby power product requirement (<https://www.energy.gov/eere/femp/low-standby-power-product-purchasing-requirements-and-compliance-resources>).
- Document any required product exclusions based on LCCA

Step 2. Perform construction submittal reviews to verify implementation

- During construction, coordinate a review of the construction submittals to verify products as specified were purchased and installed

Documentation Requirements

Construction Submittal

Path One:

- List of installed products that use no more than 1 watt in their standby mode
- LCCA for any excluded product

Path Two:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building.

2-3.2 On-Site Renewable Energy

Requirements

Provide on-site renewable energy systems in accordance with ASHRAE 189.1 Section 7.4.1.1 (On-Site Renewable Energy Systems) and UFC 3-440-01 where LCCE, considering climate, infrastructure condition, mission compatibility, and effects on base wide electrical system (grid) power quality. When available, utilize Installation-specific studies to determine LCCE renewable energy systems. Studies must be dated within five years of project design start. Exception: Do not use purchase of renewable energy certificates (RECs) as a substitute for the Section 7.4.1.1 new building requirement.

For Army projects, if not life-cycle cost effective, utilize ASHRAE 189.1 Section 7.3.2 (On-Site Renewable Energy Systems) for future installation of on-site renewable energy systems.

Navy and Air Force will utilize an installation-level solution to renewable energy systems and will not require ASHRAE 189.1 Section 7.3.2.

Components may choose centralized renewable energy development in lieu of building by building application. Meet the requirements of UFC 3-540-08.

Compliance

Step 1. Research opportunities for renewables

- Determine the feasibility of renewable systems, where LCCE, given the project site's climate, context, mission, and infrastructure. Analyze the features of the site, such as solar availability (greater than 1.2 kBtu/ft²/day or 4.0 kWh/m²/day), wind patterns, and other renewable energy sources, and any seasonal or daily variations in supply. If regional feasibility analysis, conducted within the last 5 years, is available and applicable teams can utilize to inform LCCE decisions.
- According to EPA Act 2005, Section 203, qualifying renewable technologies include solar, wind, biomass, landfill gas, ocean (including tidal, wave, current, and thermal), geothermal, municipal solid waste, or hydroelectric energy generation if it is from new generation capacity achieved from increased efficiency or addition of new capacity at an existing hydroelectric site.
- Follow guidance for designing and installing facility-scale renewable energy systems in the UFC 3-440-01 FACILITY-SCALE RENEWABLE ENERGY SYSTEMS¹⁵.
- FEMP supported resources to support research:
- FEMP Screening maps
<https://maps.nrel.gov/femp/#/?aL=0&bL=groad&cE=0&IR=0&mC=40.21244%2C-91.625976&zL=4>
- NREL develops an array of maps to support renewable energy development and generation projects: <https://www.nrel.gov/gis/maps.html>
- PV Solar Resources of the United States:
https://www.nrel.gov/gis/images/eere_pv/national_photovoltaic_2012-01.jpg

Step 2. Conduct LCCA cost analysis

¹⁵ UFC 3-440-01 FACILITY-SCALE RENEWABLE ENERGY SYSTEMS <https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-3-440-01>

- Determine the projected energy demand and cost for the project.

Conduct LCCA cost analysis for renewable systems. Step 3. Set a renewable energy target

- Use the environmental goals of the project, and results of the LCCE analysis work, as defined in the integrated design process to inform the establishment of a renewable energy target for the project beyond the minimum requirements of ASRHAE 189.1, 7.4.1.1.
- Calculate the renewable energy requirement as per ASHRAE 189.1 Section 7.4.1.1:
For single-story buildings: Renewable energy required = 6.0 kBtu/ft² (20 kWh/m²) * Total roof area
For all other buildings: Renewable energy required = 10.0 kBtu/ft² (32 kWh/m²) * Total roof area

Step 4. Compare renewable energy technology requirements

- Given the target renewable energy generation, carefully evaluate the space requirements, upfront and maintenance costs, and efficiencies for each renewable technology under review.

Step 4. Design and specify system criteria

- For technologies that are determined life-cycle cost effective, design and specify requirements for their implementation.
- Many resources are available, some for no or little cost, for planning and designing a renewable energy system. Given basic information for the project, many manufacturers can complete the necessary calculations for the project team. Teams will also find software tools that help in sizing.
- Review and implement the IEEE 1547 requirements for the renewable systems-grid interface.

Documentation Requirements

Design Submittal

Path One:

- Relevant excerpt of the design or construction documents showing onsite renewable energy generation project or demonstrating installation of the renewable energy generation project
- Renewable system rated capacity
- Calculations to determine energy generated
- LCCA output reports

Army only: Documentation showing future installation of on-site renewable energy systems to meet ASHRAE 189.1 section 7.3.2 if not LCCE.

Path Two:

- Demonstrate compliance with [LEED BD+C v4 EAc Renewable Energy Production](#), minimum of 1 point and must include renewable energy generated on-site

Path Three:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.

- Shared Site Approach: Eligible to be documented installation-wide.. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-3.2.1 Solar Domestic Hot Water (SDHW)

Requirements

Per EISA 2007 Section 523, meet at least 30% of the annual domestic hot water requirement through the installation of solar water heating unless SDHW is not Life-Cycle Cost Effective (LCCE).

Compliance

Step 1. Conduct LCCE analysis

- Determine the projected hot water demand for the project.
- Research energy cost for heating water.
- The following link will take you to the FEMP solar hot water calculator a tool that may be utilized to estimate what size solar system will work best and how much it will cost:
http://apps1.eere.energy.gov/femp/solar_hotwater_system/. Additional information:
<https://energy.gov/energysaver/estimating-cost-and-energy-efficiency-solar-water-heater>

Step 2. Determine if including SDHW system

- Determine LCCE calculations for providing 30% of hot water demand through the installation of solar hot water heaters
- Generate report with results of the SDHW LCCE analysis

Step 3. If LCCE determines SDHW is cost effective

- If LCCE is cost effective, include the solar domestic hot water heater in design documents.

Documentation Requirements

Design Submittal

Path One:

- Excerpts of the design or construction documents showing solar water heating system, and calculations that demonstrate minimum of 30% hot water demand will be met
- LCCA output report

Path Two:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-3.4 Metering

Requirements

A utility meter must be installed at each building, for each utility serving the building (steam, electricity, and natural gas) in the standard units of the measure. Where base wide energy and utility monitoring and control systems exist, meters must be connected using the installation's advanced metering protocols. The installation of meters is required per DODI 4170.11, and as amended by DOD *Utilities Meter Policy*, 16 April 2013. Meter configuration must comply with requirements of UFC 4-010-06.

Compliance

Step 1. Review relevant DOD metering policies

- Review and follow guidance included in the DOD Utilities Meter Policy, 16 April 2013 and UFGS 26 27 13.10 30 Electricity Meters¹⁶, UFGS 26 27 14.00 20 Electricity Meters and Accessories¹⁷ and UFGS 33 51 13.00 30 Natural-Gas Metering¹⁸.

Step 2. Identify all energy sources that serve the building

- Identify all sources of energy delivered to the building. Sources of energy that must be metered include: steam, electricity, and natural gas

Step 3. Determine number, type, and location of all meters

- Utilize the Overarching metering policy: Office of the Under Secretary of Defense (OSD) Utilities Meter Policy¹⁹ to implement the following as applicable:
- If a base wide energy and utility monitoring and control system is in place connect meters using the installation's advanced metering protocols

Documentation Requirements

Design Submittal

Path One:

- Provide excerpt of design drawing highlighting the location of the buildings utility meters
- Provide a narrative describing how the installed utility meter(s) complies with the DOD Utilities Meter Policy, January 2021 and UFC 4-010-06
- Systems metered
- Confirmation that meters are connected to a base wide energy and utility monitoring and control system using the installation's advanced metering protocols, if applicable.

¹⁶ <https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-26-27-13-10-30>

¹⁷ <https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-26-27-14-00-20>

¹⁸ <https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-33-51-13-00-30>

¹⁹ <http://www.denix.osd.mil/references/dod/policy-guidance/16-apr-13-odusd-policy-memo-on-utilities-metering-policy/>

Path Two:

- Demonstrate compliance with [LEED BD+C v4 EAp Building-level Energy Metering](#) DOD
- Confirmation that meters are connected to a base wide energy and utility monitoring and control system using the installation's advanced metering protocols, if applicable. Confirmation that all applicable policies have been met.

Path Three:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
- Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-4. PROTECT AND CONSERVE WATER

Base water efficiency design decisions on life-cycle cost as indicated in Chapter 1 of UFC 1-200-02.

2-4.1 Indoor Water

Requirements

Meet the requirements of ASHRAE 189.1 Section 6.3.2 (Building Water User Reduction), which incorporates EPA WaterSense-labeled products. Water closet replacements in major renovations may have a flush value of up to 1.6 GPF (6.1 LPF) to accommodate existing plumbing infrastructure. Fixtures used for sanitizing potential biohazards are exempt from low-flow and WaterSense labeling requirements.

Meet the requirements of ASHRAE 189.1 Section 6.4.2 (Building Water Use Reduction).

Meet the requirements of ASHRAE 189.1 Section 6.4.3 (Special Water Features).

Compliance

Step 1. Specify high-efficiency fixtures

- For all product categories included in Table 1 below, specify and install fixtures that comply with the maximum water uses listed in the second column of the table.
- WaterSense-labeled products contribute toward meeting efficiency requirements. Use WaterSense-labeled products where required by ASHRAE 189.1 Section 6.3.2.
- When included in the project scope, clothes washers and dishwashers must meet the current program requirements of ENERGY STAR or water factor requirements, as applicable per ASHRAE 189.1 Section 6.3.2.2. Refer to Table 2 below.

Table 1

| Fixture | Maximum Water Use (as per ASHRAE 189.1 Section 6.3.2.1) | EPA WaterSense Standards |
|--|---|--------------------------|
| Water closet (toilet) – flushometer valve type | 1.28 gpf (4.8 L/flush)* | |
| Water closet (toilet) – tank-type | 1.28 gpf (4.8 L/flush)* | 1.28 gpf |
| Urinal | 0.5 gpf (1.9 L/flush) | 0.5 gpf |
| Public lavatory faucet | 0.5 gpm (1.9 L/min) at 60 psi | |
| Public metering self-closing faucet | 0.25 gal per metering cycle (1.0 L per metering cycle) | |
| Residential bathroom lavatory sink faucet | 1.5 gpm (5.7 L/min) at 60 psi | 1.5 gpm at 60 psi |
| Residential kitchen faucet | 1.8 gpm (6.8 L/min) at 60 psi** | |
| Residential showerhead or shower compartment | 2.0 gpm (7.6 L/min) at 80 psi*** | 2.0 gpm at 80 psi |

* Maximum Water Use for renovations is 1.6 gpf (6.1 L/flush).

** Kitchen faucets shall be permitted to temporarily increase the flow greater than 1.8 gpm (6.8 L/min) but shall not exceed 2.2 gpm (8.3 L/min) and must automatically revert to the established maximum flow rate of 1.8 gpm (6.8 L/min) upon physical release of the activation mechanism or closure of the faucet valve.

*** Where the area of a shower compartment exceeds 2600 in² (1.7 m²), an additional flow of 2.0 gpm (7.6 L/min) shall be permitted for each multiple of 2600 in² (1.7 m²) of floor area or fraction thereof.

Table 2

| Appliance | Location | Requirement |
|---------------------------|--|---|
| Clothes washers | Dwelling units | ENERGY STAR Program Requirements for Clothes Washers. Maximum water factor of 5.4 gal/ft ³ of drum capacity (0.72 L/L of drum capacity). |
| Clothes washers | Publicly accessible spaces (e.g. multifamily and hotel common areas) and coin- and card-operated clothes washers of any size used in laundromats | Maximum water factor of 4.0 gal/ft ³ of drum capacity-normal cycle (0.53 L/L of drum capacity-normal cycle). |
| Standard-size Dishwashers | Dwelling units | ENERGY STAR Program Requirements for Dishwashers. Maximum water factor of 3.8 gal/full operating cycle (14.3 L/full operating cycle). |
| Compact-size Dishwashers | Dwelling units | ENERGY STAR Program Requirements for Dishwashers. Maximum water factor of 3.5 gal/full operating cycle (13.2 L/full operating cycle). |
| Commercial Dishwashers | Commercial food-service facilities | Version 2.0 ENERGY STAR Program Requirements for Commercial Dishwashers |

Step 2. Compile documentation

- Compile fixture cut sheets or manufacturers' information for all fixtures and appliances. The fixture data must highlight the flush or flow rates and the water factor or evidence of ENERGY STAR label for appliances. A plumbing fixture schedule is acceptable, provided it includes information on the manufacturer and model for each fixture, flush or flow rate, and water factor for appliances.

Documentation Requirements

Design Submittal

Path One:

- Manufacturers' data, cut sheets, or fixture schedules showing the water consumption rates, manufacturer, and model of each fixture and fitting. If fixtures and appliances are not selected in the design phase, submit this Requirement in the construction phase
- The fixture documentation must highlight the flush or flow rates. The appliance documentation must highlight the water factor or evidence of ENERGY STAR label for appliances. A plumbing fixture schedule is acceptable, provided it includes information on the manufacturer and model for each fixture, flush or flow rate, and water factor for appliances
- LCCA for any excluded fixture or appliance

Path Two:

- Demonstrate compliance with [LEED BD+C v4 WEp Indoor Water Use Reduction](#), Compliance Path 1: Prescriptive Achievement

Path Three:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-4.1.1 Indoor Water Metering

Requirements

Install advanced water meters to monitor building indoor potable water consumption as required by DOD Utilities Meter Policy, 16 April 2013. Meter configuration must comply with requirements of UFC 4-010-06.

Compliance

Step 1. Review relevant DOD metering policy

- Review and follow guidance included in the DOD Utilities Meter Policy, Step 2. Identify all potable water end uses.
- Determine all end uses of potable water in the project building and on the grounds. These could include water consumption for plumbing fixtures, cooling towers and evaporative condensers, laundering, dishwashing, indoor and outdoor features, irrigation, exterior cleaning, and manufacturing processes. Examples of potable water sources to meter include the following:
 - Public water supply
 - On-site well
 - On-site potable water treatment system

Step 3. Determine number, type, and location of all meters

- Water meter(s) shall be installed between the main water supply(ies) and water using fixtures.
- Select locations with easy access for reading and maintenance.

Documentation Requirements

Design Submittal

Path One:

- Provide excerpt of design drawing highlighting the location of the building's indoor potable water meter
- Provide manufacturer's data indicating how the installed indoor potable water meter complies with the advanced meter requirements of the DOD Utilities Meter Policy.

Path Two:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-4.2.1 Outdoor Water - Landscaping

Requirements

In accordance with DOD Memo “Water Use for Landscape Architecture on Department of Defense Installations/Sites,” potable water use is prohibited for irrigating new landscaping, other than for plant establishment.

For existing landscaping irrigated by new or existing irrigation systems, if a building has a single water meter, reduce combined indoor and outdoor potable water use by at least 20% compared to building water use in 2007. Compare results to a baseline building, using the EPA WaterSense landscape water budget tool version 1.01 or later, or a Component approved tool.

Show preference for irrigation contractors who are certified through a WaterSense labeled program, or other industry-recognized credentialing programs.

Refer to UFC 3-201-02 for additional requirements.

Compliance

Projects without a permanent irrigation systems should select Path Two, not in scope of work. For projects with permanent irrigation system:

New Landscaping

Step 1. Follow guidance as outlined in the Memo dated March 10, 2017 “Water Use for Landscape Architecture on Department of Defense Installations/Sites”

- Prohibit potable water use to irrigate new landscaping other than for plant establishment.
- Apply drought resistant, water smart, and/or Xeriscaping landscape architectural design to all new and updated landscape architecture.
- Prohibit ornamental or potable water features in new landscape design.
- Phase out ornamental or potable water features in older landscape designs. Water features listed in the National Register of Historic Places are exempt.
- Assess irrigated turf grass areas and install non-water intensive native vegetation where reasonable
- Assess existing landscape irrigation systems for leaks and system in efficiencies, and consider replacing, upgrading, or converting to an alternative water source when reasonable.
- Make water conservation for golf courses a priority and use alternative water in Lou of partible water if sources are available.

Step 2. Engage a qualified landscape designer

- Use the UFC 3-201-02 to determine if required to engage a qualified landscape designer.
- The landscape designer will be responsible for safety, sustainability, accessibility, and cost effectiveness of the project site, along with compliance with the Outdoor Water guiding principle requirements.
- Existing Landscaping
- Step 1. Use EPA WaterSense landscape water budget tool to determine water use reduction

- If a building has a single water meter, reduce combined indoor and outdoor potable water use by at least 20% compared to building water use in 2007
- Refer to UFC 3-201-02 for additional requirements and relevant tools.

Documentation Requirements

Design Submittal

Path One:

- Narrative addressing plant species, water source, and irrigation requirements
- Landscape plan showing location and size of the vegetated areas and landscape zones
- For existing landscaping, Water Budget Tool calculations or tool approved by Component that demonstrate a reduction of combined indoor and outdoor potable water use by at least 20% compared to building water use in 2007

Path Two:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
- Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-4.2.2 Outdoor Water Metering

Requirements

For existing irrigation systems using potable water and serving more than 25,000 square feet of landscape, provide water meters, when life-cycle cost-effective. Install advanced water meters to monitor outdoor potable water consumption, as required by DOD *Utilities Meter Policy*, 16 April 2013. Meter configuration must comply with requirements of UFC 4-010-06.

For all other existing irrigation systems using potable water, meters are encouraged.

Compliance

Projects without existing irrigation systems are compliant and should select Path Two, not in scope of work

Step 1. Determine if project has 25,000 SF of landscaping or more.

- If the project has more than 25,000 SF of landscaping, install water meter if life-cycle cost effective.
- Install advanced water meters to monitor outdoor potable water consumption, as required by DOD *Utilities Meter Policy*, 16 April 2013. Meter configuration must comply with requirements of UFC 4-010-06.
- For all other existing irrigation systems using potable water, meters are encouraged.

Documentation Requirements

Design Submittal

Path One:

- Excerpt of design drawing highlighting the location of the building's outdoor potable water meter

Path Two:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-4.3 Alternative Water

Requirements

Where life-cycle cost-effective and permitted by local laws and regulations, use alternative water sources.

Compliance

Step 1. Use alternative water sources

- Evaluate opportunities for alternate water sources and implement the use of alternative water sources where life-cycle cost effective.
- Alternative Water Sources: Non-potable water from sources such as harvested rainwater (refer to UFC 3-210-10), treated wastewater, air handler condensate capture, grey water, or reclaimed water. The use of alternative water sources must comply with applicable codes and standards

Documentation Requirements

Design Submittal

Path One:

- Narrative describing the alternative water source(s) and their uses
- Drawings and specifications that demonstrate the use of alternate water sources

Path Two:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Eligible to be documented at a shared site level. . For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-4.3.1 Stormwater Management

Requirements

Meet the requirements of UFC 3-210-10 (Low impact development)

Compliance

Step 1. Evaluate applicability as specified in UFC 3-210-10 section 1-4

Applicable only for projects in the United States, United States Territories, and Possessions of the United States as specified in the UFC 3-210-10 in paragraph 1-4. For projects that do not meet section 1-4 conditions, LID techniques apply to the extent practical and document under Path One.

Step 2. Establish pre-development conditions and design objective

Step 3. Evaluate design options and technical constraints. Select appropriate low impact development (LID) requirements per UFC 3-210-10²⁰, document LID strategies implemented

- Preferred examples include a combination of the following engineered treatment options: bioretention, vegetated swales, rain gardens, vegetated filter strips, downspout disconnection, reduced impervious area, tree preservation, re-vegetation using native plants, soil amendments, open space, cisterns and rain barrels.
- Perform calculations indicating the difference between the post-development hydrology and pre-development hydrology for the design storm event. Calculations must demonstrate “No net increase” in stormwater runoff where technically feasible.
- When low impact development (LID) features are technically feasible, the use of a detention/retention basin alone is not considered a LID feature as defined by UFC 3-210-10. Detention/retention basins do not mimic natural site hydrology as they do not provide a decentralized approach to infiltration as defined by UFC3-210-10. Refer to UFC 3-210-10 for definition of appropriate LID measures.

Documentation Requirements

Design Submittal

- As stated above, for projects that do not meet section 1-4 conditions, LID techniques apply to the extent practical and should be documented under Path One.

Path One:

- Narrative and site plan indicating the pre-development conditions
- Site plan highlighting the calculated project footprint area per UFC 3-210-10

²⁰ <https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-3-210-10>

- Calculations for pre-development and post-development runoff volumes and rates using the 95th percentile rainfall event to identify the volume of stormwater requiring management and the extent to which the design objective has been met. Drawings highlighting all implemented LID features
- Documentation of technical constraints, if applicable. Refer to sections 2-1.3 Maximum Extent Technically Feasible (METF) and 2-1.4 Technical Infeasibility within UFC 3-210-10. Note that cost alone should not be used as a constraint to justify technical infeasibility.

Path Two:

- Demonstrate compliance with [LEED BD+C v4 WEc Rainwater Management](#)

Path Three:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Eligible to be documented at a shared site level. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-5. ENHANCE INDOOR ENVIRONMENTAL QUALITY

2-5.1 Part 1 Ventilation

Requirements

Comply with UFC 3-410-01 for ventilation criteria. Consider the use of passive (non-mechanical) thermal comfort methods as described in paragraph entitled, “Integrated Design” in this UFC. Exception: For Medical Treatment Facilities, refer to UFC 4-510-01 Medical Military Facilities for ventilation and thermal comfort criteria

Compliance

Step 1. Evaluate project site characteristics

- Investigate local outdoor air quality at the project location. Use the results of this analysis to inform ventilation strategy selection and system design. For example, natural ventilation will not be appropriate in high-pollution areas, where outdoor air requires significant filtration. Outdoor air quality can affect mechanical equipment filtration specifications.
- Determine whether the project is a candidate for natural conditioning. Understand the climate by season, including temperature, humidity, and air quality, to determine optimal times of the year for natural conditioning.
- Determine if project is a medical treatment facility, if so, see the UFC 4-510-01 Design: Medical Military Facilities²¹ for ventilation criteria. Work directly with GBCI to determine compliance path and Documentation Requirements.

Step 2. Select ventilation strategy

- Utilized the current version of the HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS UFC 3-410-01²² to select ventilation strategy
- Determine whether mechanical ventilation, natural ventilation, or a mixed-mode approach is appropriate for the project.
- Review how the building’s form, location, orientation, programming and depth of the floor plate can create opportunities for low-energy, high-quality natural ventilation or mixed-mode systems.
- Utilized the UFC 3-410-01 to determine if mechanical ventilation systems are required in addition to natural ventilation, unless specific exceptions are met.

Step 3. Select conditioning system

- Identify program areas that could be designed to accommodate cross or stack ventilation and review ways they could be organized to create microclimates and to expand annual hours of natural conditioning.

²¹ UFC 4-510-01 Design: Medical Military Facilities <http://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-4-510-01>

²² UFC 3-410-01. HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS <http://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-3-410-01>

Step 4. Categorize spaces

- In accordance with UFC 3-410-01 create a table of all rooms and spaces in the project and identify the following for each:
 - Ventilation strategy
 - Net occupiable space
 - Occupancy category
 - Design occupancy
- It must be appropriate to group rooms or spaces into ventilation zones.

Step 5. For mechanically ventilated spaces, calculate required airflow in accordance with UFC 3-410-01

- Identify the following basic mechanical system features, which will affect the calculation of outdoor air required. Examples are:
 - Single-zone, 100% outdoor air, or multiple-zone systems
 - Underfloor, overhead, or side air distribution and location of return grilles
 - Supply air temperature: cooling only or heating and cooling
 - Variable air volume (VAV) or constant volume (CV) supply
- Determine the minimum amount of outdoor air that must be supplied by each ventilation system.
- Complete a separate ventilation rate procedure calculation for each ventilation system. Verify that the appropriate calculation method is selected.
 - Account for all occupied spaces and perform ventilation rate procedure calculations for worst-case conditions.
 - As applicable, evaluate and document assumptions for all variables.

Step 6. For naturally ventilated spaces, determine required design

- Collect the following information for each naturally ventilated space and add to the table of rooms and spaces:
 - Minimum ceiling height
 - Location of natural ventilation openings (on one side, two opposite sides, or two adjacent sides)
 - Size of the natural ventilation openings (openable area)
- Follow guidance in UFC 3-410-01 to determine the size of openings required in each space and the maximum distance from the openings that can be reviewed as naturally ventilated.

Step 7. Evaluate ventilation design against UFC 3-410-01 requirements

- If the UFC 3-410-01 mechanical or natural ventilation procedures indicate that the preliminary design does not provide enough outdoor air to meet the standard, revise the design and recalculate the minimum amount of outdoor air to confirm compliance.
- Verify that the project will have appropriate filters installed to remove particulate matter and ozone.

Step 8. Airflow monitoring

- Implement airflow monitoring for project as specified by the UFC 3-410-01 Heating, Ventilating, and Air Conditioning Systems.

Documentation Requirements

Design Submittal

Path One:

- Provide a narrative of summary analysis showing compliance with the ventilation requirements as specified by UFC 3-410-01 Heating, Ventilating, and Air Conditioning Systems
- Summarize operational procedures for building system. The analysis narrative must document a summary of all factors considered when making design choices regarding IAQ, including alternative ventilation solutions considered and reasons for the selection of the solution chosen. The analysis must also include a room-by-room breakdown of the anticipated or actual number of occupants, the amount of ventilation air required, and any applicable adjustments such as multiple spaces factor, intermittent or variable occupancy factor, the ventilation effectiveness factor, and any other factors such as high relative humidity
- Document the mechanical designer's basis of design; include design assumptions, including diversity considerations, and HVAC load calculations
- Documentation (e.g. design plans, lists) of all registers and terminal units that includes the type and flow, or radiant value. Additionally, include any elements that significantly affect thermal comfort, indication of spaces outside comfort-controlled areas, and locations of all occupant-adjustable controls

Path Two:

- Demonstrate compliance with [LEED v4 BD+C Eqp Minimum Indoor Air Quality Performance](#) when in accordance with the UFC 3-410-01

Path Three:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-5.1 Part 2 Thermal Comfort

Requirements

Comply with UFC 3-410-01 for thermal comfort criteria. Consider the use of passive (non-mechanical) thermal comfort methods as described in paragraph entitled, “Integrated Design” in this UFC.

Exception: For Medical Treatment Facilities, refer to UFC 4-510-01 Medical Military Facilities for ventilation and thermal comfort criteria.

Compliance

Step 1. Evaluate project site characteristics

- Investigate local outdoor air quality at the project location. Use the results of this analysis to inform decisions made in designing for thermal comfort.
- Determine whether the project is a candidate for natural conditioning. Understand the climate by season, including temperature, humidity, and air quality, to determine optimal times of the year for natural conditioning.
- Determine project is a medical treatment facility, if so see the UFC 4-510-01 Design: Medical Military Facilities²³

Step 2. Design to meet UFC 3-410-01 Heating, Ventilating, and Air Conditioning Systems

- Utilize current version of UFC 3-410-01 Heating, Ventilating, and Air Conditioning Systems to design systems.
- Based on the thermal comfort goals of the project and opportunities/challenges presented by the project site, determine the best system conditioning approach.
- Determine the best thermal comfort controls for the conditioning system(s) selected, based on the type of the project and occupants’ activities.
- Design the project’s conditioning systems to provide the acceptable comfort conditions.
- UFC 3-410-01 requires the design to be within the acceptable comfort range at all combinations of conditions that are expected to occur, including variations in internal loads and the exterior environment, and at both full- and partial-load condition.

Documentation Requirements

Design Submittal

Path One:

- Provide a narrative confirming compliance with the thermal comfort requirements as specified by UFC 3-410-01 Heating, Ventilating, and Air Conditioning Systems. As applicable include the following:
 - Description of weather data used to determine operative temperatures, relative humidity, outdoor temperatures

²³ UFC 4-510-01 Design: Medical Military Facilities <http://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-4-510-01>

- Summarize operational procedures for building systems, including building controls and other environmental control systems and general information, regarding seasonal set point recommendations.
- Document the mechanical designer’s basis of design; include design assumptions (e.g. temperature setpoints, design relative humidity), including diversity considerations, and HVAC load calculations for each unique space type.

Path Two:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
- Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-5.2 Daylighting and Lighting Controls

Requirements

Locate all employee work areas, such as classrooms and offices, on exterior walls or other locations where it is feasible to maximize daylighting. Maximize daylighting in break rooms and other gathering areas where feasible. For those spaces on the exterior of the building where it is feasible to maximize daylighting, meet the requirements of ASHRAE 189.1 Section 8.4.1.2 (Minimum Sidelighting effective Aperture for Office Spaces and Classrooms) or Section 8.5.1.2 (Usable Daylight Illuminance in Office Spaces and Classrooms). Provide automated lighting controls in accordance with UFC 3-530-01.

Exception: For Medical Treatment Facilities, refer to UFC 4-510-01 Medical Military Facilities for additional daylighting criteria.

Compliance

Step 1. Establish design criteria

- During pre-design, work with the project owner to understand lighting and daylighting goals. Specify daylighting criteria in the owner's project requirements (OPR).

Step 2. Examine site and massing

- During schematic design, determine how to best orient the building to allow for passive solar strategies and provide ways to improve daylight penetration and distribution.
- Where feasible, use building orientation to minimize direct beam sunlight. For example, locating the long axis of the building facing directly north and south as north- and south-facing windows provide the most consistent levels of light throughout the day.
- Be sure to weigh the effects of envelope design on energy efficiency. Review incorporating exterior shading to minimize solar heat gains while admitting daylight, especially on the south side of the building.

Step 3. Design to meet ASHRAE 189.1 Section 8.4.1.2 or Section 8.5.1.2

- For those spaces on the exterior of the building where it is feasible to maximize daylighting, meet requirements for ASHRAE 189.1 Section 8.4.1.2 Minimum Sidelighting Effective Aperture for Office Spaces and Classrooms .
- Ensure that the requirements for ASHRAE 189.1 Section 8.4.1.2 a, b, and c are met.

Or

- Meet requirements for ASHRAE 189.1 Section 8.5.1.2 Usable Daylight Illuminance in Office Spaces and Classrooms .
- Design such that the physical or computer model for the building project demonstrates that the required area has a calculated daylight illuminance as specified.

Step 4. Provide automated Lighting Controls in accordance with UFC 03-530-01

Documentation Requirements

Design Submittal

Path One:

- Provide lighting plans showing the required lighting controls
- Provide floor plans identifying all employee work areas
- Provide a narrative justifying why any employee work areas have not been provided with daylighting such as related to scope, mission, or LCC
- If meeting ASHRAE Section 8.4.1.2, provide the following:

Calculations indicating that all north-, south, and east-facing facades have the minimum sidelighting effective aperture as prescribed by climate zone.

For all facades, calculations indicating that the combined width of the primary sidelighted areas are at least 75% of the length of the façade wall.

- Documentation indicating that the opaque interior ceilings, partitions higher than 60 inches, and walls within daylight areas meet the required average visible light reflectance.

-OR-

- If meeting ASHRAE Section 8.5.1.2, provide the following:

Daylight simulation results for employee work areas using the Section 8.5.1.2 guidance.

- Calculations illustrating that at least 75% of employee work areas within one ceiling height of the perimeter walls has a calculated daylight illuminance of at least 25 fc at 9:00am and 3:00pm on the equinox.

Path Two:

- Demonstrate compliance with LEED v4 BD+C EQ Daylight and Views – Daylight

If and/or when in alignment requirements for ASHRAE 189.1 Section 8.4.1.2 Minimum Sidelighting Effective Aperture for Office Spaces and Classrooms and Section 8.5.1.2 Usable Daylight Illuminance

Path Three:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-5.3.1 Indoor Air Quality - Moisture Control

Requirements

Establish and implement a moisture control strategy for controlling moisture flows and condensation to prevent building damage, minimize mold contamination, and reduce health risks related to moisture. Meet the requirements of ASHRAE 189.1 Section 10.3.1.5 (Moisture Control) by including and implementing these requirement in the IAQ construction management plan; UFC 3-410-01, Chapter 3, Sections 3-2 and 3-3 (Ventilation Air); and UFC 3-101-01 Chapter 3 (Building Envelope Requirements). Refer to Appendix B “Protect Indoor Air Quality” for best practices.

Compliance

Step 1. Implement ventilation air design strategies that minimize moisture

- Utilize the UFC 3-410-01²⁴, Chapter 3, Sections 3-2 and 3-3 (Ventilation Air) section to determine requirements for:
- addressing moisture control with dedicated outdoor air system (DOAS)
- energy recovery devices
- DOAS unit system controls & monitoring requirements

Step 2. Design building envelope to meet requirements

- Review the building envelope requirements contained in the UFC 3-101-01²⁵ Chapter 3, Building Envelope Requirements and incorporate these into the building design for the following:
- CONTINUITY OF BARRIERS
- FENESTRATION
- INSULATION
- MOISTURE BARRIER
- AIR BARRIER REQUIREMENTS

Step 3. Protect materials during construction

- Meet the requirements of ASHRAE 189.1 Section 10.3.1.5 (Moisture Control)
- The following items to control moisture shall be implemented during construction:
- a. Materials stored on-site or materials installed that are absorptive shall be protected from moisture damage.
- b. Building construction materials that show visual evidence of biological growth due to the presence of moisture shall not be installed on the building project.

Documentation Requirements

Construction Submittal

²⁴ <https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-3-101-01>

²⁵ <https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-3-101-01>

Path One:

- Narrative detailing how steps 1 through 3 within the compliance section above have been completed
- Moisture control plan documentation
- Design details demonstrating UFC 3-101-01 Chapter 3 (Building Envelope Requirements)

Path Two:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
- Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-5.3.2 Reduce Volatile Organic Compounds (VOC) Low-Emitting Materials

Requirements

Specify materials and products with low or no pollutant emissions, including composite wood products, adhesives, sealants, interior paints and finishes, carpet systems, and furnishings. Meeting the requirements of ASHRAE 189.1 Sections 8.4.2 (Prescriptive Option: Materials).

Exception: Exclude compliance with 8.4.2, first sentence.

Compliance

Step 1. Conduct background

- Review ASHRAE 189.1 Section 8.4.2 Prescriptive Option: Materials to understand the requirements for low-emitting materials applicable to all composite wood, adhesives, sealants, interior paints and finishes, carpet systems, ceilings, wall systems, hard surface flooring, and furnishings used on the project. Applicable materials will meet the category-specific emissions and content thresholds enumerated in this section.

Step 2. Specify low- or non-emitting materials and products

- Use TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements in UFGS 01 33 29²⁶ for minimum material specification requirements (For Navy-only design-build projects: UFGS 01 33 29.05 20²⁷).
- Review project documents to identify all applicable products and specify them as low- or non-emitting.
- Specify any documentation needed by the design team to verify compliance, such as material safety data sheets (MSDS), third-party certificates, or test reports from subcontractors.

Step 3. Perform construction submittal reviews to verify implementation

- During construction, coordinate a review of the construction submittals to demonstrate that selected products meet the thresholds listed in the specifications.
- Any product substitutions must be carefully reviewed by the design team and contractor for compliance.
- Because meeting these requirements is not typical for all construction teams and suppliers, conducting a preconstruction meeting to review material and product needs in detail and stress their importance will aid in successful procurement.

Documentation Requirements

Construction Submittal

²⁶ http://www.wbdg.org/FFC/DOD/UFGS/UFGS_01_33_29.pdf

²⁷ http://www.wbdg.org/FFC/NAVFAC/NDBM/UFGS/01_33_29.05_20.pdf

Path One:

- A list of all products installed in the project that are addressed within ASHRAE 189.1 Section 8.4.2. This includes: composite wood products, adhesives and sealants, interior paints and finishes, carpet systems, and systems furniture and seating
- The minimum emissions or VOC content requirement for each listed product according to the standards indicated for each material section
- The actual emissions or VOC content for each listed product
- Manufacturer or other product information confirming emissions or VOC content requirements have been met (e.g. MSDS, third-party certifications, testing reports)
- An explanation for any excluded materials or products

Path Two:

- While using the TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements in UFGS 01 33 29 for minimum material specification requirements, demonstrate compliance with:
 - LEED v2009 BD+C: NC EQ4.1 Low-emitting materials - adhesives and sealants
 - LEED v2009 BD+C: NC EQ 4.2 - Low emitting materials - paints and coatings
 - LEED v2009 BD+C: NC EQ4.3 Low-emitting materials - flooring system
 - LEED BD+C: NC EQ4.4 Low -emitting materials - composite wood and agrifiber products
 - LEED v2009 BD+C: Schools EQ4.5 Low-emitting materials - furniture and furnishings
 - LEED BD+C: Schools EQ 4.6 Low-emitting materials - wall systems
- LCCA output report for any excluded product.

Path Three:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-5.3.3 Protect Indoor Air Quality during Construction

Requirements

For new construction and for renovation of unoccupied existing buildings, develop and implement an IAQ construction management plan that complies with ASHRAE 189.1 Section 10.3.1.4 (Indoor Air Quality (IAQ) Construction Management), with maximum outdoor air consistent with achieving relative humidity no greater than 60%.

For renovation of occupied existing buildings, comply with ANSI/SMACNA 008-2008, 2nd Edition, *SMACNA IAQ Guidelines for Occupied Buildings Under Construction*. Refer to Appendix B “Protect Indoor Air Quality” for best practices.

Compliance

New Construction/Renovation Unoccupied

Step 1. Manage indoor air quality post-construction, conduct flushout or baseline indoor air quality testing

For projects conducting a flushout

- Develop and implement an IAQ construction management plan to, after construction ends, prior to occupancy and with all interior finishes installed, conduct a postconstruction, preoccupancy building flush-out as described under Section 10.3.1.4(b)(1) steps include but are not limited to the following:
- Determine the supply airflow rate to be used for the flush-out. Maintain relative humidity below 60%.
- Refer to ASHRAE 189.1 Section 10.3.1.4, Equation 10.3.1.4 to calculate the total outdoor air quantity required.
- Note that the minimum rate at which outdoor air must be supplied, per ASHRAE 189.1 Section 10.3.1.4, depends on whether the flush-out is being conducted pre- or post-occupancy.
- Prior to beginning the flush-out or air quality testing, make sure that the following steps have been taken:
- All finishes, furniture, and furnishing have been installed.
- Filters and controls are in place and operating.

For projects conducting baseline indoor air quality testing

- Develop and implement an IAQ construction management plan to, after construction ends, prior to occupancy and with all interior finishes installed, conduct a postconstruction, preoccupancy baseline IAQ monitoring as described under Section 10.3.1.4(b)(2) shall be performed steps include but are not limited to the following:
- Prior to testing, operate the ventilation system within 10% of the design outdoor airflow rate for at least 24 hours.
- Follow the testing protocol enumerated by USEPA Compendium of Methods for the Determination of Toxic Organic Pollutants in Ambient Air, TO-1, TO-11, TO-17 and ASTM Standard Method D 5197.
- Evaluate pollutant concentrations against the maximum allowable concentrations listed in ASHRAE 189.1 Table 10.3.1.4. When one or more pollutants exceed the maximum allowed, conduct additional flush-out with outdoor air and retest until the requirements are met.

Step-By-Step Implementation for Occupied

Step 1. Integrate indoor air quality control measures into project drawings and specifications

- For renovation of occupied existing buildings, comply with ANSI/SMACNA 008-2008, 2nd Edition, SMACNA IAQ Guidelines for Occupied Buildings Under Construction, steps include but are not limited to the following:
- Examine how the SMACNA requirements and guidelines affect design decisions, including finishes such as paints and coatings (e.g., it is best to install low-emitting materials). While SMACNA compliance is required only for occupied existing buildings undergoing a renovation, all buildings must review how and where indoor air quality control measures can be incorporated into the project design. The guidelines relevant to this guiding principle include:
 - HVAC protection
 - Source control
 - Pathway interruption
 - Housekeeping
 - Scheduling
- Incorporate any indoor air quality requirements into specifications. For example, specify that air handlers and ducts be delivered to the site prewrapped in plastic to avoid having to protect equipment after delivery.
- Review the indoor air quality guidelines in detail with all pertinent members of the design and construction team, specifically, the construction manager, general contractor, and mechanical subcontractor(s).

Step 2. Develop indoor air quality plan

- Before construction begins, as determined in Step 1 develop an IAQ management plan. The IAQ plan is typically prepared by the general contractor or construction manager. It includes IAQ management practices implemented during construction and preoccupancy phases and describes how indoor air quality requirements and guidelines will be addressed and managed on the job site, including but not limited to the following:
- Establish a plan for keeping air conveyance materials protected and covered on the construction site.
- Specify that permanent HVAC systems will not be operated during construction, except when start up or testing requires. If permanent HVAC systems are required to operate during construction provide temporary filtration media in air handling units and at all return air intake points with a minimum MERV 8 rating.

Step 3. Implement indoor air quality plan

- The IAQ management plan must be in place before starting above-ground construction, storing materials on site, or roughing in mechanical systems.
- The following best practices support successful implementation of the plan:
- Identify key players and designate someone responsible for implementing the plan, such as the HVAC installer and/or the general contractor. Make sure that they understand the requirements of the plan and help champion its goals.
- Include the IAQ management plan requirements in contract agreements with subcontractors.

- As subcontractors are selected and deployed on site, familiarize them with the plan and how it will affect their daily activities. Hold a subcontractors' orientation meeting to review the plan requirements as a group.
- Include construction IAQ progress check-ins as a regular item in weekly subcontractor and safety meetings.
- Provide a copy of the plan on site, preferably posted in an accessible area. Translate the plan into the languages spoken by subcontractors and their crews.
- General contractors, construction managers, and owners must verify that the IAQ management plan is being followed on job walks, ideally daily, so that issues can be addressed with subcontractors as necessary. Creating a checklist of major items for easy reference is often effective.

Documentation Requirements

Construction Submittal

Path One:

- Written construction IAQ management plan for use during demolition and construction
- Detailed photo log of the construction IAQ management plan practices followed during construction
- For projects completing a flush-out procedure, record of dates, occupancy, outdoor air delivery rates, internal temperature, and humidity, as well as any special considerations
- For projects conducting baseline indoor air quality testing, a copy of the test report

Path Two:

- Demonstrate compliance with [LEED v4 BD+C EQc Construction Indoor Air Quality Management Plan](#) and
- [LEED v4 BD+C EQc Indoor Air Quality Assessment](#)

Path Three:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
- Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-5.3.4 Environmental Tobacco Smoke Control

Requirements

Prohibit smoking* within the building and within a minimum of 50 feet (15.24 meters) of all building entrances, operable windows, and building ventilation intakes. Verify if more stringent facility criteria or Installation policy applies.

*Refer to Service-specific policies:

Army: http://www.army.mil/usapa/epubs/pdf/r600_63.pdf

Navy:

<https://doni.daps.dla.mil/Directives/05000%20General%20Management%20Security%20and%20Safety%20Services/05-100%20Safety%20and%20Occupational%20Health%20Services/5100.13E.pdf>

Air Force: http://static.e-publishing.af.mil/production/1/af_sg/publication/afi40-102/afi40-102.pdf

The Environmental Tobacco Smoke Control Requirement is not reviewed by GBCI as this Requirement is covered by general DOD policy.

2-5.4 Occupant Health and Wellness

Requirements

Promote opportunities for occupants to voluntarily increase physical activity, as part of the Integrated Design Process.

Compliance

Step 1. Occupant Health & Wellness and Integrated Design

- During the Integrated Design and Charrette Process discuss and document options for Occupant Health & Wellness
- Following are strategies to consider:
 - Design stairwells as desirable option for circulation to support active occupants.
 - Include at least one primary staircase that enables occupants to travel between the building entrance floor(s), occupant's own destination floor, and common use floors.
 - Provide accommodations for sit-stand workstations for all occupants.
 - Provide water fountains that include bottle-filling faucets.
 - Install bicycle storage.

Documentation Requirements
Design Submittal

Path One:

- Copy of the section of the charrette report of that addresses consideration of occupant health and wellness.
- Narrative describing the occupant health and wellness elements incorporated into the project's design

Path Two:

- Demonstrate compliance with Path One requirements, and,
- Demonstrate compliance with one of the following LEED credits at a minimum:
 - [LEED BD+C v2009 SSc.4.2 Alternative Transportation – Bicycle Storage and Changing Rooms](#)
 - [LEED BD+C v4 LTc Bicycle Facilities](#)
 - [LEED BD+C v4 Innovation credit - Walkable Project Site](#)
 - [LEED BD+C v4 Innovation credit - Design for Active Occupants](#)

Path Three:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site approaches may be proposed. Documentation must be provided for the specific strategy that demonstrates compliance with the Requirement at the shared site level. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-6. REDUCE ENVIRONMENTAL IMPACT OF MATERIALS

2-6.1 Environmentally Preferable Products

The following require procurement of construction materials and building supplies that have a lesser or reduced effect on human health and the environment over their lifecycle, when compared with competing products or services that serve the same purpose.

2-6.1.1 Recycled Content

Requirements

Use RCRA Section 6002 compliant products that meet or exceed EPA's recycled content recommendations, available on EPA's Comprehensive Procurement Guideline website at <https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program>.

Compliance

Step 1. Conduct background research

- Review project documents to identify all applicable products.
- Review the EPA's Comprehensive Procurement Guidelines (CPG) for recycled content. The CPG provides the minimum amount of recycled content to specify for a particular building material or product.
- Research specific products by looking at product cut sheets and manufacturers' data to see if they contain recycled content. The EPA also provides a directory listing products that meet the minimum recycled content percentages.

Step 2. Specify materials with recycled content

- Specify materials with recycled content based on the project's overall goals and the minimum thresholds recommended by the EPA. Establish a target percent recycled content for each material category included on the project with the involvement of the full project team, ideally including the contractor. For materials not included in the CPG, set minimum thresholds as high as practicable.
- Projects are exempt from meeting the minimum percentages specified by the EPA when:
 - Cost is prohibitive
 - Products are not available in a reasonable time frame
 - Products hinder performance
 - There is little competition

Step 3. Perform construction submittal reviews to verify implementation

- During construction, coordinate a review of the construction submittals to demonstrate that the selected products meet the thresholds listed in the specifications.
- Any product substitutions must be carefully reviewed by the design team and contractor for compliance.

Documentation Requirements

Construction Submittal

Path One:

- Provide a list of products applicable to the project that are included in the EPA's Comprehensive Procurement Guideline and the purchase price is over \$10,000, per RCRA 6002.
- Indicate the minimum recycled content recommended for each product and the actual recycled content of the product installed.
- Provide manufacturer's documentation (such as a letter or cutsheet) stating the recycled content of the product.
- If the recycled content percentage is lower than the minimum, provide an explanation of why the requirement was not met (such as price, availability, or performance).

Path Two:

- Demonstrate compliance with [LEED BD+C v2009 MRc4 Recycled Content](#), one point (must use EPA-designated products to meet credit requirement)
- Narrative that demonstrates EPA-designated products were used
- OR
- Demonstrate compliance with [LEED BD+C: NC v4 MRc Building Product Disclosure and optimization - environmental product Optimization - Environmental Product Declarations](#) (must use EPA-designated products to meet credit requirement)
- Narrative that demonstrates EPA-designated products were utilized

Path Three:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-6.1.2 Biologically-Based Products

Requirements

Per Section 9002 of the Farm Security and Rural Investment Act, specify products composed of the highest percentage of biobased content consistent with the USDA BioPreferred Program, if products meet performance requirements and are available at reasonable cost. Deviation from using biobased product procurement must be documented. A preference for purchasing products with the highest biobased content per USDA recommendations for designated product categories must be included in all applicable solicitations. USDA's biobased product designations and biobased content (which includes certified sustainably-harvested and rapidly renewable resources) recommendations are available on USDA's BioPreferred website at <http://www.biopREFERRED.gov/>.

Compliance

Step 1. Conduct background research

- Review the required minimum thresholds for biobased content, as listed on USDA's BioPreferred website. To date, the USDA has identified 139 product categories (e.g. carpets, cleaners, paints), each of which has an identified minimum threshold. All materials and products used on the project must meet the category-specific minimum thresholds for biobased content, where feasible based on cost, availability, and/or performance requirements. .
- Review project documents to identify all applicable products.
- Research specific products by looking at product cut sheets and manufacturing data to see if they contain biobased content. The USDA also provides a product directory listing products that meet the above minimum biobased content percentages (<http://www.biopREFERRED.gov/BioPreferred/faces/catalog/Catalog.xhtml>) and information on BioPreferred suppliers.
- To quickly identify biobased products that comply with the guiding principle requirements, look for products with the USDA Certified Biobased Product label. These products have been third-party certified to verify that they meet the USDA's minimum thresholds.
- Biobased content includes plant, renewable agricultural, marine, and forestry material. It does not include food, animal feed, fuel, or leather.
- Common products with biobased content include wheatboard, wool, cotton, bamboo, soy oil, and cork.

Step 2. Identify products without biobased content meeting the USDA BioPreferred Program

- If products with the required biobased content are not appropriate for the project, provide the reason for not including them in project design (e.g. lack of availability, price, performance).

Step 3. Perform construction submittal reviews to verify implementation

- During construction, coordinate a review of the construction submittals to verify that selected products meet the thresholds listed in the specifications.
- Any product substitutions must be carefully reviewed by the design team and contractor for compliance.

Documentation Requirements

Construction Submittal

Path One:

- Provide a list of products applicable to the project that are included in the BioPreferred product categories.
- Indicate the minimum biobased content recommended by the BioPreferred Program for each product and the actual biobased content of the product installed.
- Provide manufacturer's documentation (such as a letter or cutsheet) stating the biobased content of the product.
- If the biobased percentage is lower than the minimum, provide an explanation of why the requirement was not met (such as price, availability, or performance).

Path Two

- Demonstrate compliance with [LEED BD+C: NC v2009 MRc6 Rapidly Renewable Materials](#) (must use USDA BioPreferred Designated products to meet credit requirement)
- Plus, demonstrate use of USDA BioPreferred Designated products to help meet credit requirement if possible

OR

- Demonstrate compliance with [LEED BD+C v2009 MRc Building Product Disclosure and Optimization - Sourcing of Raw Materials](#) (must use BioPreferred USDA Designated products to meet credit requirement)
- Plus, demonstrate use of USDA BioPreferred Designated products to help meet credit requirement if possible

Path Three:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Ineligible to be documented at a shared site level. Requirement must be documented for each building. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-6.1.3 Ozone Depleting Substances

Requirements

Meet the requirements of [UFC 1-200-02 2-6.1.3](#): Do not use ozone depleting substances (ODS) or high Global Warming Potential (GWP) chemicals where EPA's Significant New Alternative Policy (SNAP) has identified acceptable substitutes or where other environmentally preferable products are available for use in construction, repair or end-of-life replacement: www.epa.gov/snap.

Exceptions: Refer to UFC 3-600-01 for fire system requirements.

The Ozone Depleting Substances Requirement is not reviewed by GBCI as this Requirement is covered by general DOD policy.

2-6.2.1 Storage and Collection of Recyclables

Requirements

Meet the requirements of ASHRAE 189.1 Section 9.3.4.1 (Storage and Collection of Recyclables – Recyclables), where markets or onsite recycling exist.

Compliance

Step-By-Step Implementation

Step 1. Determine if recycling services are available

Step 2. Design appropriately sized storage areas

- Provide areas(s) that serve the entire building and are dedicated to the collection and storage of nonhazardous materials for recycling.
- The following material types must be accommodated if recycling services are available:
 - Paper
 - Corrugated cardboard
 - Glass
 - Plastics
 - Metals

Documentation Requirements

Design Submittal

Path One:

- If the installation provides recycling services, provide a narrative confirming the status of collection and storage areas dedicated to nonhazardous materials for recycling, including paper, corrugated cardboard, glass, plastics, and metals. Include relevant excerpts of documentation, such as floor plans and site plans, that highlight recycling collection and storage areas.
- If the installation does not provide recycling services or only provides services for select nonhazardous materials, provide a statement from the base civil engineering office or public works office confirming.

Path Two:

- Demonstrate compliance with [LEED BD+C v4 MRp Storage and Collection of Recyclables](#)

Path Three:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Eligible to be documented at the shared site level; shared central recycling facilities are acceptable, provided the space accommodates recycling produced by all buildings served. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

2-6.2.2 Waste Diversion

Requirements

Divert a minimum of 60% of the nonhazardous construction and demolition waste material from landfills.

Compliance

Step 1. Implement UFGS-01 74 19 Construction Waste Management and Disposal

- Review and verify that the guidance in UFGS-01 74 19 Construction Waste Management and Disposal²⁸ is adhered to during the project delivery cycle.
- Create a Construction Waste Management Plan as required by UFGS-01 74 19

Step 2. Verify that diversion rate is at least 60%

- To verify that the 60% threshold will be met, project teams must calculate the diversion rate periodically (e.g. monthly or bimonthly) so that adjustments can be made, if necessary.
- Diversion rate must be calculated by weight. Use the following calculation to determine the construction and demolition waste diversion rate. $\text{Diversion rate} = (\text{Total waste diverted from landfill} / \text{Total waste produced by the project}) * 100$

Step 3. Complete Final Construction Waste Diversion Report

Documentation Requirements

Construction Submittal

Path One:

- Copy of the Construction Waste Management Plan.
- Final Construction Waste Diversion Report identifying constituent materials diverted by weight from disposal and total percentage of waste diverted from landfill disposal during construction
- Haul tickets
- If 60% diversion rate has not been met, meeting minutes with the project delivery team and a copy of the E-sustainability notebook section where the missed Requirement was discussed and documented

Path Two:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Eligible to be documented on a shared site level if buildings are built or renovated under the same construction contract. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.

²⁸ <https://www.wbdg.org/FFC/DOD/UFGS/UFGS%2001%2074%2019.pdf>

2-7 ADDRESS CLIMATE CHANGE RISK

2-7 Address Climate Change Risk

Provide building design solutions responsive to any Government-provided projections of climate change and determination of acceptable risk (typically evaluated and documented in the planning process.)

For a building located in a floodplain of concern, provide design solutions which mitigate both impact on the floodplain and impact of the design flood event on building function and occupants, consistent with mission criticality.

Climate Change: Per DOD Directive 4715.2, “variations in average weather conditions that persist over multiple decades or longer that encompass increases and decreases in temperature, shifts in precipitation, and changing risk of certain types of severe weather events.”

Climate Resiliency: Per E.O 13963, “...prepare for, withstand, respond to, or quickly recover from disruptions due to severe weather events and climate change for the intended life of the asset.”

Compliance

Step 1. Review DD Form 1391

- Determine if DD Form 1391 contains scope for identified risk. If not, select Path Two because the Requirement is “not applicable to scope.”

Step 2. Design to address the DD Form 1391 requirements

- If risks are identified in the DD Form 1391, incorporate into project design and delivery.

Step 3. Document

- Provide design analysis that indicates design elements were incorporated for identified risks.

Documentation Requirements

Design Submittal

Path One:

- Narrative regarding design solutions required to mitigate identified risk.

Path Two:

- Not applicable – for details and documentation requirements refer to section [2-1.3 Applicability and Compliance](#) of this document.
 - Shared Site Approach: Eligible to be documented at a shared site level. For details and documentation requirements refer to section [2-1.7 Shared Site Approach Requirements](#) of this document.