TECHNICAL GUIDE

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 Buildings[1] 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.

[1] Guiding Principles for Sustainable Federal Buildings and Associated Instructions https://www.whitehouse.gov/sites/default/files/docs/guiding_principles_for_sustainable_federal_buildings_and_associated_instructions_february_2016.pdf Determining Compliance with the Guiding Principles for Sustainable Federal Buildings https://www.whitehouse.gov/sites/default/files/docs/determining_compliance_with_the_guiding_principles_for_sustainable_federal_buildings_february_2016.pdf

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 facilities[2]. The Guiding Principles 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 the UFC 1-200-02[3]. The UFC 1-200-01 DoD Building Code (General Building Requirements)[4] provides clarification for projects eligible for this version of the program. Questions and requests for clarification can be directed to: GuidingPrinciplesAssessment@gbci.org

TECHNICAL GUIDANCE

2-1. OVERVIEW

These requirements apply to all New Construction, New Addition and Renovation projects. [See the UFC 1-200-02 Appendix D for project requirements impacted by historic buildings, historic districts and those near historic facilities, view sheds and other designated cultural resources.]

Technical Guidance Overview

The Requirements noted for each of the following are directly quoted from the UFC 1-200-02 dated 01Dec16 with change 01 dated 01Oct17.

There are Guiding Principle Requirements that are addressed in the UFC 1-200-02 in Chapter 3 Assessment of Existing Buildings for High Performance and Sustainable Building (HPSB) Compliance that are intentionally excluded from this Building Design and Construction assessment. For example, Benchmarking, Environmental Tobacco Smoke Control, Integrated Pest Management and Radon are requirements covered by DoD policy at later project stages.

Life Cycle Cost Analysis

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 stated in this document. An LCCA is required for the following:

[2] Department of Defense (DOD) UNIFIED FACILITIES CRITERIA PROGRAM http://www.wbdg.org/ffc/dod
[3] UFC 1-200-02 dated 01Dec16 change 1 01Oct17 http://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-1-200-02
[4] UFC 1-200-01 http://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-1-200-01

1. Energy consuming systems (e.g.: HVAC systems)[5]
2. Renewable energy generating systems (ex: 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).

The LCCA methodology may also be used to evaluate multiple options, such as selecting the building construction type and comparing compliant materials; and is at the discretion of the project team.

1-7.1 LCCA Format. Prepare the LCCA in accordance with CFR Title 10 Part 436, Subpart A and NIST Handbook 135 "*Life-Cycle Costing Manual for the Federal Energy Management Program*". The LCCA must be prepared using the Building Life-Cycle Costing (BLCC) program, available from the National Institute of Standards and Technology (http://energy.gov/eere/femp/building-life-cycle-cost-programs). The implied long-term inflation rate and discount rates identified in the Annual supplement to NIST Handbook 135 must be used. A link to BLCC can also be found at the Department of Energy's building energy tools web site: http://energy.gov/eere/femp/building-life-cycle-cost-programs. When needed, refer to UFC 3-410-01 for requirements to obtain weather data.

1-7.2 LCCA Building-Level Analysis Any building-level LCCA must be calculated using a maximum of a 40-year building life and equipment lives based on accepted industry averages. Individual components or systems life expectancies must be reflected by inclusion of appropriate replacement and salvage values in the appropriate year of this analysis.

1-7.3 LCCA Individual Component or System Alternatives Analysis. LCCAs comparing at least three individual component or system alternatives must use the estimated life of the mutually exclusive alternative having the longest life, not to exceed 40 years from the beginning of beneficial use or the lowest common multiple of the expected lives of the alternatives. Include the appropriate replacement and salvage values for each of the other alternatives. A number of tools comparing energy system alternatives and evaluating specific efficiency measures may be of benefit in performing energy efficiency calculations.

Perform this analysis based on the actual conditions expected over the life of the facility including anticipated occupancies, scheduled hours of operation and process loads. Include realistic energy usage and efficiencies, maintenance cost and repairs renovations, all costs or savings associated with the utilization of recovered energy, solar heat, solar photovoltaic energy and other renewable or waste heat applications. Credit any alternative funding such as rebates in the LCCA. Use UFC 3-410-01 Appendix E.

[5] In addition to the new building requirements, all existing building large capital energy investments (all projects for which the cost of the systems that impact energy consumption exceeds $250K, which constitutes a capital investment, per National Defense Authorization Act) employ the most energy efficient designs, systems, equipment, and controls that are life cycle cost effective.

Project Team Definitions

Owner Organization: The "Owner Organization" is the building owner organization or the DOD department that will own and occupy after construction (US Army, US Air Force, US Navy or US Marine Corps)

Owner Name: The "Owner Name" is the name of the person within the Owner Organization responsible for the project.

Primary Contact Organization: The "Primary Contact Organization" is the DOD department that is executing project for Owner Organization (US Army, US Air Force, US Navy or US Marine Corps).

Primary Contact Name: The "Primary Contact Name" is the name of the person within the Primary Contact Organization responsible for the project.

Project Administrator Organization: "The Project Administrator Organization" is often the non-DoD organization hired to manage project execution for the Primary Contact Organization.

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

Projects Outside of United States

If working with a project outside of the United States review excerpts from the UFC and contact GBCI with any questions or concerns:

FORWARD: All construction outside of the United States is also governed by Status of Forces Agreements (SOFA), Host Nation Funded Construction Agreements (HNFA), and in some instances, Bilateral Infrastructure Agreements (BIA.) Therefore, the acquisition team must ensure compliance with the most stringent of the UFC, the SOFA, the HNFA, and the BIA, as applicable.

Compliance with federal requirements

4-2 COMPLIANCE WITH FEDERAL REQUIREMENTS. Not applicable – the requirement is not applicable, based on LCCE (e.g., LCCE excludes use of Alternate Water); mission exclusion (e.g., no daylighting in a theater or a SCIF); location/regional exclusion (e.g., Host Nation Agreement or no local recycling facility); or locale exclusion (e.g., there is no steam to meter), and is marked "Not Applicable" with justification.

Note, in instances where a requirement is only partially applicable, 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. If requirements are only partially applicable, (i.e. Daylighting not permitted in select secure areas of the building), it is expected that the project comply in other portions of the project and provide documentation delineating the portions of the project that are in compliance versus those that are not applicable.

4-3.2 SUSTAINABLE THIRD PARTY CERTIFICATION. TPC is not required for buildings being constructed by or for use by the United States under the laws, codes, rules and regulations of a Host Nation, but may need to comply with similar requirements of the Host Nation, as applicable international agreements provide. Incorporate sustainable development strategies and features to the greatest extent practical.

Definition of Terms

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 for 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.

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.

DD Form 1391: A programming document used by the Department of Defense to submit requirements and justifications in support of funding requests for military construction to Congress.

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 stake-holders 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

Integrated Design (2-2.1): Incorporate the following planning and evaluation into the integrated design, as described in ASHRAE 189.1 Informative Appendix F (Integrated Design). Follow the steps of design optimization, as applicable, in ASHRAE 189.1 Section F1.1.1 (Charrette Process).

The Integrated Design requirements are addressed by the Enacted DD1391 coordination from Base to Congress, prior to delivery to project team.

Compliance

Step-By-Step Implementation

Step 1. Review ASHRAE 189.1 Requirements & DD1391

- Obtain the Enacted DD1391 form to understand the owner's project goals and any department, base or other requirements provided by the Owner
- If possible obtain the design charrette process information from the Owner that would have been created as part of the creation and approval of the "Enacted DD1391"

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 DD1391, the UFC 1-200-02 and/or any Owner specific goals and targets.
- If practical use natural systems for energy conservation, lighting, ventilation, and passive heating and cooling are maximized 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.

- Use building information modeling (BIM) software, design tools, and the experience of the design team if practical 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
- Narrative description of project teams process for distributing and incorporating the results from the DD1391 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 is requiring goals more specific or beyond what is required in the UFC 1-200-02 generate a narrative document including the goals and how the team addressed them

Path Two:

- Demonstrate compliance with LEEDv4 BD+C IPc Integrative process
- Copy of Enacted DD1391 Form
- Narrative description of project teams process for distributing and incorporating the results from the DD1391 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 is requiring goals more specific or beyond what is required in the UFC 1-200-02 generate a narrative document including the goals and how the team addressed them

Path Three:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

2-2.1.1 Integrated Planning

Requirements

Integrated Planning (2-2.1.1): 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 the design and lifecycle of the building, including deconstruction.

(The requirements noted above "to establish performance goals for siting" and "Ensure incorporation of these goals through the ……lifecycle of the building, including deconstruction" are addressed by the 1391 coordination from Base to Congress, prior to project team)

Compliance

Step-By-Step Implementation

Step 1. Performance goals

- Performance goals will have been established by the Enacted DD1391 as well as the work completed to meet Integrated Design (2-2-.1) requirement as described in ASHRAE 189.1 Appendix F.
- Ensure that all stages of the building's life cycle, including deconstruction, are considered while incorporating the performance goals into the final design and construction of the project.

Step 2. Documentation

- Maintain a log dedicated to tracking discussions and decisions related to the Integrated Planning.

Documentation Requirements

Design Submittal

Path One:

- Narrative regarding how the project team ensured that all stages of the building's life cycle, including deconstruction, were considered while incorporating the performance goals into the final design and construction of the project.
- Copy of Integrated Planning Log

Path Two:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement

2-2.1.2 Evaluation for Design Strategies

Requirements

Evaluation for Design Strategies (2-2.1.2): 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. Take into account site attributes, including climate and local and regional context, which impact the design of the building.

Compliance

Step-By-Step Implementation

Step 1. Leverage Integrated Design and Integrated Planning

- While working the Integrated Design and Planning requirements and within the context of the DD1391, 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.

Path Two:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

2-2.1.3 Evaluation of the Site

Requirements

Evaluation of the Site (2-2.1.3): During the site selection process, meet the requirements of UFC 2-100-01.

Compliance

Step-By-Step Implementation

Step 1. Implement DD1391

- Usually the evaluation and site selection has been addressed and incorporated into the DD1391. If this is not the case utilize UFC 2-100-01.

Documentation Requirements

Design Submittal

Path One:

- Copy of DD1391 and narrative regarding items implemented.

Path Two:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

2-2.1.4 Site Integration and Design of the Building

Requirements

Site Integration and Design of the Building (2-2.1.4): 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 into the design of 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-By-Step Implementation

Step 1. Identify site characteristics

- Determine which portions of the site have been previously developed, if any.
- Additionally, for each site that is under consideration, examine the following factors, enumerated in the requirements and summarized below:
  - 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 from UFC 3-201-02

- 1-4 Critical Design Requirements: The designer shall address the following critical design issues:
  - Planting and Irrigation Establishment Period
    - Typical time: 1-year warranty and maintenance
    - Periodic inspections: Establishment start, completion, and as directed by the designer.

Documentation Requirements

Design Submittal

Path One:

- Narrative that addresses actions and/or considerations taken when selecting project site as it relates 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.
  - 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 SSc1 Site selection
- Provide narrative confirming details related to meeting the Landscape Design Requirements from UFC 3-201-02 1-4 Critical Design Requirements
  OR
- Demonstrate compliance with LEED v4 BD+C SSc Site assessment
- 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 to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

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 complex[6], commissioning can be tailored as determined by the DoD Component AHJ[7].
- "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. /1/

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

Step-By-Step Implementation

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 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[3].
- The owner, with the help of the design team and other stakeholders, must develop the initial owner's project requirements (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.
- In the schematic design phase, the design team will create a basis of design (BOD) – the project team's interpretation of the OPR – to provide clear technical guidance for the project. Update the BOD throughout the design and construction process.

[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.

Step 2. Engage a commissioning authority with relevant experience

- "Provide a Commissioning Firm that is certified in commissioning by one of the following: the AABC Commissioning Group (ACG); the National Environmental Balancing Bureau (NEBB); the International Certification Board/Testing, Adjusting, and Balancing Bureau (ICB/TABB), the Building Commissioning Association (BCA); the Association of Energy Engineers (AEE).[The Commissioning Firm may employ a commissioning professional certified by the University of Wisconsin-Madison or the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) as required in paragraph LEAD COMMISSIONING SPECIALIST as an alternative to certification of the Commissioning Firm.] The Commissioning Firm must be certified in all systems to be commissioned to the extent such certifications are available from the certifying body. Describe any lapses in certification or disciplinary action taken by the certifying body against the proposed Commissioning Firm or Lead Commissioning Specialist in detail. Any firm or commissioning professional that has been the subject of disciplinary action by the certifying body within the five years preceding contract award is not eligible to perform any duties related to commissioning. " UFGS-01 91 00.15 (May 2016)

Step 3. Commission all required systems

- Work with the CxA to determine the systems that need to be commissioned for compliance with the OPR, and include the requirements in 189.1 and UFGS-01 91 00.15 (May 2016):

  When included in the building project, the following systems must be commissioned:

  a. Heating, ventilating, air-conditioning, IAQ, and refrigeration systems (mechanical and/or passive) and associated controls. Control sequences to be verified for compliance with construction documentation as part of verification.
  b. Building envelope systems, components, and assemblies to verify the thermal and moisture integrity.
  c. Building envelope pressurization to confirm air-tightness if included in BOD requirements.
  d. Lighting systems.
  e. Fenestration control systems: Automatic controls for shading devices and dynamic glazing.
  f. Irrigation.
  g. Plumbing.
  h. Domestic and process water pumping and mixing systems.
  i. Service water heating systems.
  j. Renewable energy systems.
  k. Water measurement devices, as required in 189.1 Section 6.3.3.
  l. Energy measurement devices, as required in 189.1 Section 7.3.3.

Step 4 CxA 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 5. 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 6. Incorporate commissioning requirements into construction documents

- Incorporate commissioning requirements into construction documents per 189.1 and UFGS 01 91 00.15, Total Building Commissioning[8]

Step 7. Confirm that the CxA reviews design documents

- Construction documents and project specifications must meet the requirements of the OPR and BOD, the CxA need to review and supply feedback on these documents twice:
  - At 50% design completion
  - Prior to hand-off to contractor

Step 8. Develop construction checklists

- Construction checklists must be generated and completed for all equipment, assemblies, and systems included in the CxA 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 CxA, design team, or contractor must prepare the construction checklists. Generally, contractors are responsible for completing them and returning to the CxA.

Step 9. Confirm that the CxA reviews submittals

- Verify that the CxA reviewed project submittals for construction quality control and specification conformance.

Step 10. Conduct prefunctional inspections

- The CxA conducts site visits as determined and scheduled in Cx plan as indicated in the Cx 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 11. Execute functional testing

- CxA to provide 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.
- CxA to perform functional performance testing once all system components are installed, energized, programmed, balanced, and otherwise ready for operation under part- and full-load conditions.

Step 12. 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.

[8] https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-01-91-00-15

- 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

Step 13. Conduct warranty period & after occupancy review

- CxA reviews current building operation by 10 months warranty period to find any discrepancies between actual and design performance and identify any repairs.

Step 14. 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 CxA 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:

- CxA previous experience narrative
- Confirmation of OPR and BOD contents
- List of systems to be commissioned
- Verification of CxA activities and reviews
- Cx plan
- Documentation of testing and verification
- CFR, O&M plan
- Cx report

Path Two:

- Demonstrate compliance with LEED v2009 BD+C EAp1 Fundamental commissioning of building energy systems

- Provide CxA previous experience narrative
- Clarification that the following systems were included during the commissioning process: irrigation systems, building envelope, process water and meters

OR

- Demonstrate compliance with LEED v4 BD+C EAp Fundamental commissioning and verification
- Provide CxA 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 to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

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.

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 (LCCE[9]), 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:

Percentage improvement = 100 x ((Baseline building consumption - Receptacle and process loads) - (Proposed building consumption - Receptacle and process loads)) / (Baseline building consumption - Receptacle and process loads)[10]

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

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

Compliance

Step-By-Step Implementation:

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

[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.

- Utilize current version of ASHRAE Standard 90.1. “Design the building to achieve at least 30% energy consumption reduction from ASHRAE 90.1 baseline.”
- Follow all applicable guidance in the UFC 3-410-01 1 HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS, WITH CHANGE 3. Be sure to utilize the step by step instructions in the UFC 3-410-01 Appendix E: HVAC System Selection Flow Chart[11]
  - Image of Appendix E: HVAC System Selection Flow Chart include for reference only, utilize interactive source document.
  - Ensure that step 3, “Develop three energy-efficient solutions for each individual building energy system.” is completed
  - Use the following formula to calculate the percentage improvement = 100 x ((Baseline building consumption - Receptacle and process loads) - (Proposed building consumption - Receptacle and process loads)) / (Baseline building consumption - Receptacle and process loads)[12]
  - 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[13]), 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”4 along with the “Annual Supplement to Handbook 135, Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis”5.

[11] UFC 3-410-01 1 HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS, WITH CHANGE 3 https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-3-410-01

[12] 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.

[13] See Reference section at end of document for description and definition for LCCE and LCCA.

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APPENDIX E – HVAC SYSTEM SELECTION FLOW CHART

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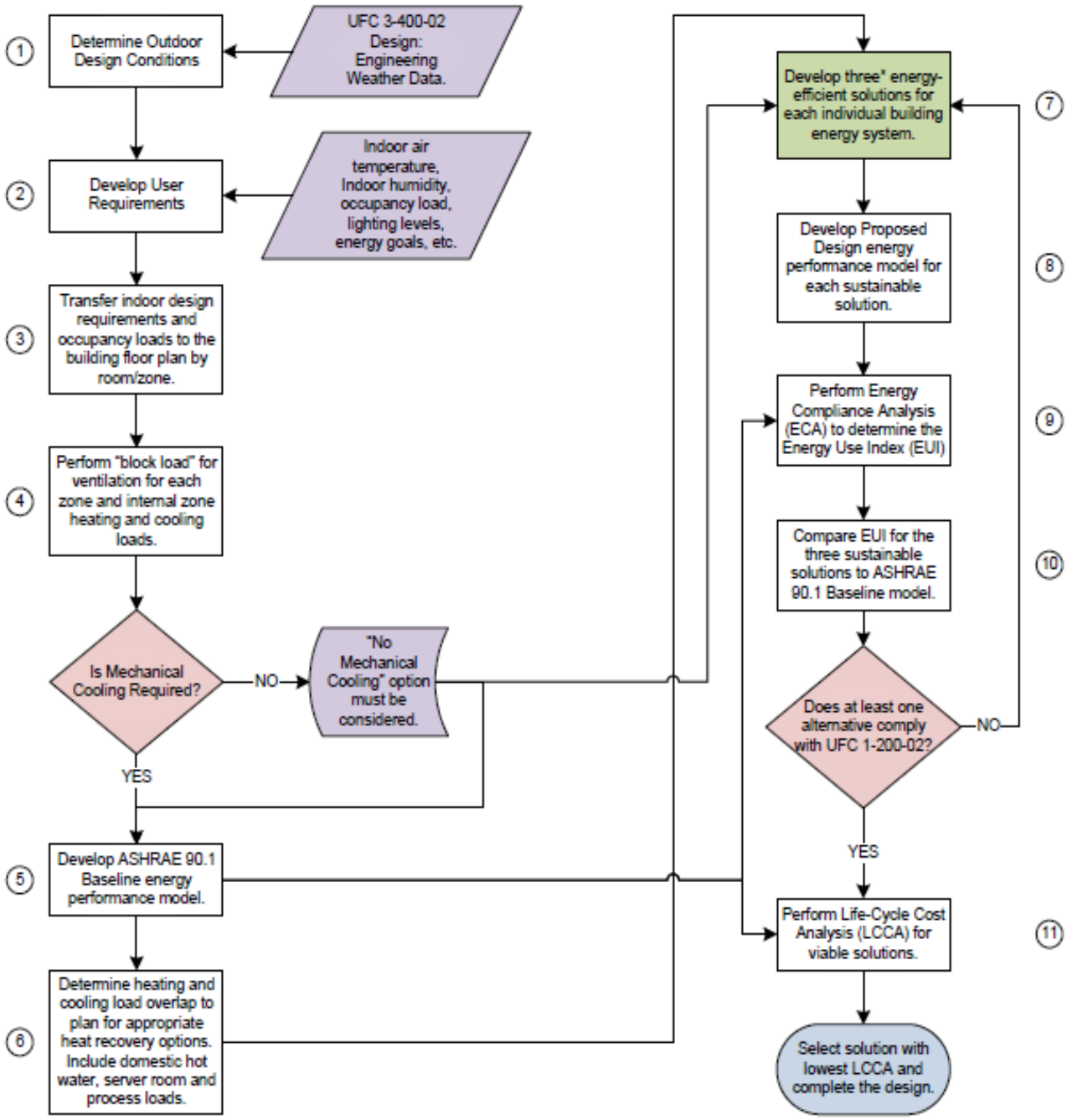

Documentation Requirements

Design Submittal

Path One:

- If achieved target
  - Energy model
  - LCCA
  - Summary of how target was achieved, and the three energy-efficient solutions reviewed for each individual building energy system
- If target not achieved
  - Energy model
  - 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 to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement

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 this UFC. The LCCA includes a minimum of three energy efficient alternatives to the baseline standard (ASRHAE 90.1, IECC, etc.).

Compliance

Step-By-Step Implementation:

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

- Utilize current 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, WITH CHANGE 3. Be sure to utilize the step by step instructions in the UFC 3-410-01 Appendix E: HVAC System Selection Flow Chart[14],
  - Image of Appendix E: HVAC System Selection Flow Chart include for reference only, utilize interactive source document.
  - 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[15]), 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"4 along with the "Annual Supplement to Handbook 135, Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis"5.

[14] UFC 3-410-01 1 HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS, WITH CHANGE 3
https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-3-410-01
[15] See Reference section at end of document for description and definition for LCCE and LCCA.

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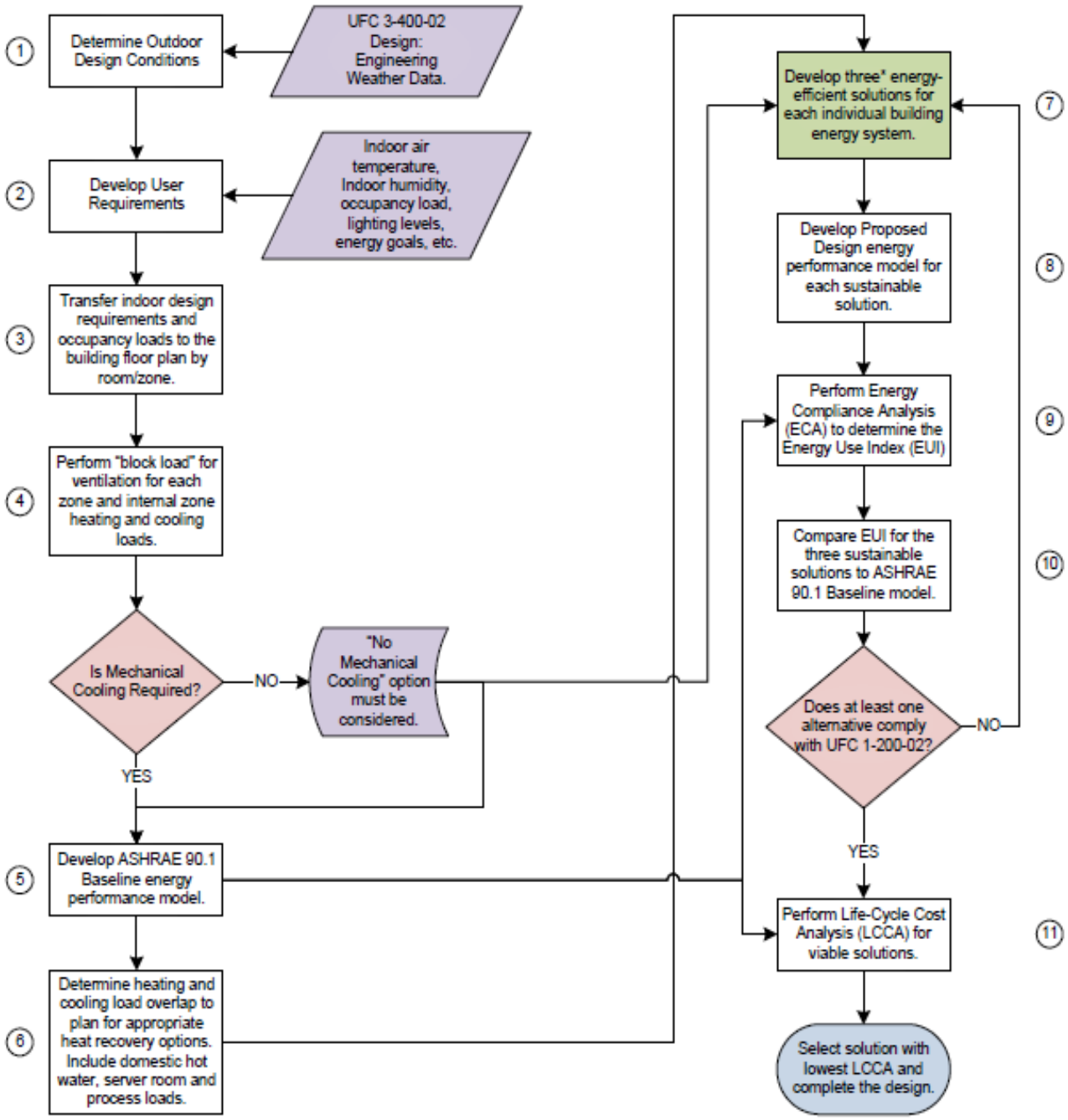

Documentation Requirements

Design Submittal

Path One:

- If achieved target
  - Energy model
  - LCCA
  - Summary of how target was achieved, and the three energy-efficient solutions reviewed for each individual building energy system
- If target not achieved
  - Energy model
  - 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 to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

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 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 20% compared to the ASRHAE 90.1 baseline building design.

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. The LCCA includes a minimum of three energy efficient alternatives to the baseline standard (ASRHAE 90.1, IECC, etc.).

Compliance

Step-By-Step Implementation:

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 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 20% compared to the ASRHAE 90.1 baseline building design.

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, WITH CHANGE 3. Be sure to utilize the step by step instructions in the UFC 3-410-01 Appendix E: HVAC System Selection Flow Chart[16],

[16] UFC 3-410-01 1 HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS, WITH CHANGE 3
https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-3-410-01

- Image of Appendix E: HVAC System Selection Flow Chart include for reference only, utilize interactive source document.
- 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 x ((Baseline building consumption - Receptacle and process loads) - (Proposed building consumption - Receptacle and process loads)) / (Baseline building consumption - Receptacle and process loads)[17]
- 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[18]), 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"4 along with the "Annual Supplement to Handbook 135, Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis"5.

[17] 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.

[18] See Reference section at end of document for description and definition for LCCE and LCCA.

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APPENDIX E – HVAC SYSTEM SELECTION FLOW CHART

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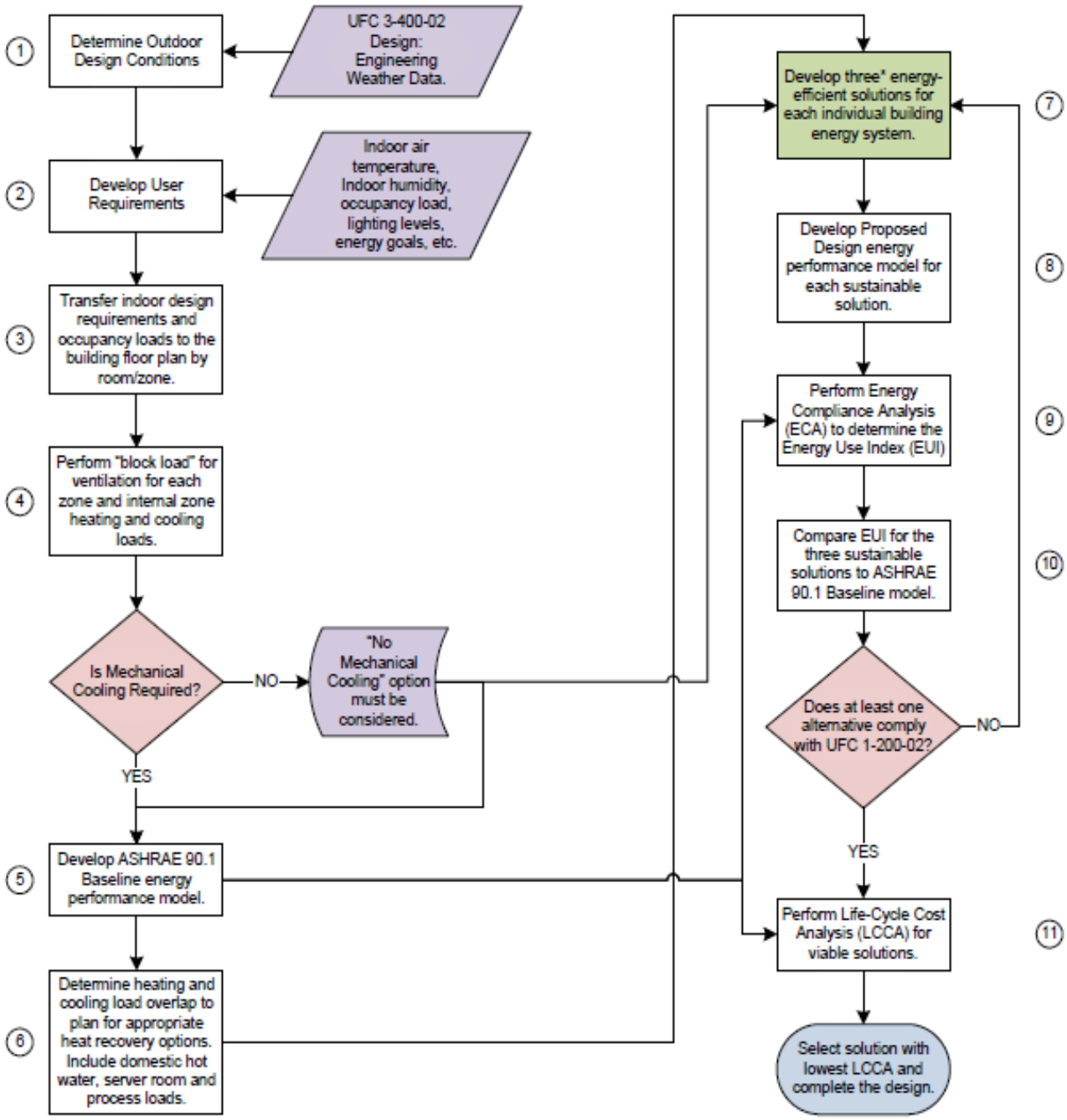

Documentation Requirements

Design Submittal

Path One:

- If achieved target
  - Energy model
  - LCCA
  - Summary of how target was achieved, and the three energy-efficient solutions reviewed for each individual building energy system
- If target not achieved
  - Energy model
  - 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 to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

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. Select products based on life cycle cost, not initial cost. Link to EPA sites: http://www.energystar.gov/ or https://energy.gov/eere/femp/federal-energy-management-program

Compliance

Step-By-Step Implementation

Step 1. Specify energy efficient products in construction documents when applicable and part of project scope

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 construction specifications.

- Document any required product substitutions.

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 where applicable
- Narrative regarding exclusions or substitutions

Path Two:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

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-By-Step Implementation

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.

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:

- Narrative with confirmation that specified and installed products will use no more than 1 watt in their standby mode

Path Two:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

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. /1/ 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 if a building-level solution is not LCCE.
- Components may choose centralized renewable energy development in lieu of building by building application. Meet the requirements of UFC 3-540-08.

Compliance

Step-By-Step Implementation

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 with in the last 3-5 years, is available and applicable teams can utilize to inform LCCE decisions.
- According to EPAct 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 SYSTEMS[19].
- FEMP supported resources to support research:
  - FEMP Screening maps https://maps.nrel.gov/femp/#/?aL=0&bL=groad&cE=0&lR=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

[19] UFC 3-440-01 FACILITY-SCALE RENEWABLE ENERGY SYSTEMS https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-3-440-01

Step 2. Conduct LCCE cost analysis

- Determine the projected energy demand and cost for the project.
- Conduct LCCE cost analysis for renewable systems. "When available, utilize Installation-specific studies to determine LCCE renewable energy systems. Studies must be dated within five years of project design start."

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 OPR and 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/m^2) * 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 report if installed renewable energy elements or projects were not lifecycle cost effective

Path Two:

- Demonstrate compliance with LEED v2009 BD+C EAc2 On-site renewable energy, minimum of 1 point
  OR
- Demonstrate compliance with LEED v4 BD+C EAc Renewable energy production, minimum of 1 point and must include renewable energy generated on-site

Path Three:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

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-By-Step Implementation

Step 1. Conduct LCCE cost 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.

Step 4. If LCCE determines SDHW is not cost effective

- If LCCE is not cost effective, do not include solar domestic hot water heater in project design.

Documentation Requirements

Design Submittal

Path One:

- For LCCE cost effective project, copies of relevant 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
- Report with results of the LCCE analysis
  OR
- Report with results of the LCCE analysis, the lifecycle calculations demonstrating that providing 30% of hot water demand through the installation of solar hot water heaters is not cost effective

Path Two:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

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.

A utility meter must be installed at each building, for each utility serving the building (e.g. district steam, district hot and chilled water, electricity, natural gas, fuel oil, etc.) in the standard units of the measure (i.e. kWh, kW, cf, gallons, etc.). Meters must be connected to a base wide energy and utility monitoring and control system (if installed) using the installation's advanced metering protocols. The installation of meters is required per DODI 4170.11, (Installation Energy Management) and as amended by DOD Utilities Meter Policy, 16 April 2013.

Compliance

Step-By-Step Implementation

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 Meters[20], UFGS 26 27 14.00 20 Electricity Meters and Accessories[21] and UFGS 33 51 13.00 30 Natural-Gas Metering[22].

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 Policy[23] to implement the following as applicable:
  - If the project uses multiple sources of energy, verify meter is designed to read all sources.
  - If the project shares utility meters with other buildings or includes energy sources that are not metered by the supplier, install submeters that will provide monthly data.
  - If a base wide energy and utility monitoring and control system is in place connect meters using the installation's advanced metering protocols

[20] https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-26-27-13-10-30
[21] https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-26-27-14-00-20
[22] https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-33-51-13-00-30
[23] http://www.denix.osd.mil/references/dod/policy-guidance/16-apr-13-odusd-policy-memo-on-utilities-metering-policy/

Documentation Requirements

Design Submittal

Path One:

- Location of all meters
- 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
- Confirmation that all applicable policies have been met.

Path Two:

- Demonstrate compliance with LEED v4 BD+C EAp Building-level energy metering (except do not share metered data, per DOD Waiver[24])
- 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:

- Requirement is not applicable to project (already installed or separate contract in progress)
- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

[24] https://www.wbdg.org/FFC/NAVFAC/dod_waiver_leed_wep_eap.pdf

2-4. PROTECT AND CONSERVE WATER

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

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-By-Step Implementation

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. Where possible, use WaterSense-labeled products,
- When included in the project scope, clothes washers and dishwashers must meet the current program requirements of ENERGY STAR (as per ASHRAE 189.1 Section 6.3.2.2).

Table 1

Fixture	Maximum Water Use (as per ASHRAE 189.1 Section 6.3.2.1)	EPA WaterSense Standards
Water closet (toilet) (includes single flush, dual flush, and tank-type)	1.28 GPF (4.8 LPF)*	1.28 GPF
Urinal	0.5 GPF (1.9 LPF)	0.5 GPF
Public lavatory faucet	0.5 GPM (1.9 LPM) 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 LPM) at 60 psi	1.5 GPM at 60 psi
Residential kitchen faucet	2.2 GPM (8.3 LPM) at 60 psi	

Residential showerhead or shower compartment	2.0 GPM (7.6 LPM) at 80 psi**	2.0 GPM at 80 psi

* Maximum Water Use for renovations is 1.6 GPF (6.1 LPF)

** Where the area of a shower compartment exceeds 2600 in^2 (1.7 m^2), an additional flow of 2.0 GPM (7.6 LPM) shall be permitted for each multiple of 2600 in^2 (1.7 m^2) of floor area or fraction thereof.

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 showing the water consumption rates, manufacturer, and model of each fixture and fitting, cutsheets or fixture schedules
- The fixture documentation 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.

Path Two:

- Demonstrate compliance with LEED v4 BD+C WEp Indoor water use reduction Compliance Path 1 Prescriptive Achievement

Path Three:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

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-By-Step Implementation

Step 1. Review relevant DOD metering policy

- Review and follow guidance included in the DoD Utilities Meter Policy, 16 April 2013 and UFGS 33 12 33.00 30 Water Meters[25]

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

- If the project is not served by a public water supply, or if the project uses multiple sources of potable water, additional meters will be required. A single meter installed downstream of multiple potable water supply systems must be used if it is upstream of all project water uses.
- Project teams must elect to use multiple meters to gain additional information on water use. Determine metering subsystems that consume the most water, are the most expensive to operate, or most closely align with the goals of the building management.
- Select locations with easy access for reading and maintenance.

Documentation Requirements

Design Submittal

Path One:

- Provide excerpt of design drawing highlighting the location for the project indoor potable water meter

[25] https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-33-12-33-00-30

Path Two:

- Demonstrate compliance with LEED v4 BD+C WEp Building-level water metering (except do not share metered data, per DOD Waiver https://www.wbdg.org/FFC/NAVFAC/dod_waiver_leed_wep_eap.pdf)

Path Three:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

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 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

Step-By-Step Implementation – ***for projects with permanent irrigation system (no system means compliant, select Path 3)***

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 professional will be responsible for safety, sustainability, accessibility, and cost effectiveness of the project site, along with compliance with the Outdoor Water guiding principle requirements.

Documentation Requirements

Design Submittal

Path One:

- Site plan showing vegetated areas
- Narrative for plant species and water requirements
- Site plan showing location and size of landscape zones
- Water Budget Tool calculations and report that demonstrates reduction of outdoor potable water consumption by at least 50%

Path Two:

- Demonstrate compliance with LEED v4 BD+C WEp Outdoor water use reduction
- LEED v4 BD+C WEc Outdoor water use reduction minimum 2 points

Path Three:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

2-4.2 Outdoor Water Meter

Requirements

For existing irrigation system 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

Step-By-Step Implementation

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:

- Location of all meters
- Meter ownership
- Systems metered

Path Two:

- Demonstrate compliance with LEED v4 BD+C WEp Building-level water metering

Path Three:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope

2-4.3 Alternative Water

Requirements

Outdoor Water - Alternative Water: Where life-cycle is cost-effective and permitted by local laws and regulations, use alternative water sources.

1\Alternate 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 alternate water sources must comply with applicable codes and standards. /1/

Compliance

Step-By-Step Implementation

Step 1. Determine if applicable to project

- No permanent irrigation system means Compliant.

Step 2. 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 include but are not limited to: reclaimed wastewater, graywater, swimming pool backwash filter, refrigeration system condensate, captured rainwater, stormwater and foundation drain water, steam system condensate, fluid cooler discharge, food steamer discharge, combination oven discharge, industrial process water, fire pump test water, municipally supplied treated wastewater, and ice machine condensate.

Documentation Requirements

Design Submittal

Path One:

- Alternative water source and controls calculations if applicable

Path Two:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

2-4.3.1 Stormwater Management

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

Compliance

Step-By-Step Implementation

Step 1. Meet all low impact development requirements

- Utilize UFC 3-210-10[26], Low impact development, meet all conditions that apply to project
- Document strategies implemented and percent change in runoff volume achieved.

Documentation Requirements

Design Submittal

Path One:

Report inclusive of the following:

- Runoff volume calculations
  - Results of percent change in runoff volume (increase or decrease)
  - Rainfall data
  - Rainfall events calculator or calculations for the chosen percentile storm
- LID features implemented to reduce run off
  - Vegetative roofs, bioretention, infiltration trenches, re-vegetation, quantity of reduced impervious area, cisterns, permeable pavers, roof leader disconnection, dry wells, porous concrete, soil amendments, grass buffers, rain barrels, tree boxes, grass swales, rain gardens, tree preservation, etc.
- If the run off volume was increased relevant technical constraints
  - Non-potable water demand (i.e., irrigation, toilets, and wash-water) is too small to warrant water; harvesting and reuse system; retaining stormwater on-site would adversely impact receiving water flows; site has shallow bedrock; site has contaminated soils; site has high groundwater table; site has underground facilities or utilities; site is too small to infiltrate significant volume; soil infiltration capacity is limited; state or local regulations restrict water harvesting; state or local regulations restrict use of green infrastructure or lid; structural, plumbing, and other modifications to existing building to manage stormwater are infeasible; etc.

Path Two:

- Demonstrate compliance with LEED BD+C 2009 SSc6.1 Stormwater design - quantity control
  OR
- Demonstrate compliance with LEED v4 BD+C WEc Rainwater management

[26] https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-3-210-10

- LEED v4 BD+C SSp Construction activity pollution prevention

Path Three:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

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-By-Step Implementation

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 Facilities[27] 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 3-410-01[28] 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.

[27] UFC 4-510-01 Design: Medical Military Facilities http://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-4-510-01
[28] 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:
  - 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. If applicable to project the Minimum Indoor Air Quality Performance Calculator available for download here http://www.usgbc.org/resources/minimum-indoor-air-quality-performance-calculator, can be used for projects to demonstrate compliance. This calculator accommodates all ventilation types (multiple zone, single-zone, 100% outside air) in one spreadsheet.
- 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 v2009 BD+C EQp1 Minimum indoor air quality performance when in accordance with the UFC 3-410-01
  OR
- 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 to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

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-By-Step Implementation

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 Facilities[29] thermal comfort criteria. Work directly with GBCI to determine compliance path and Documentation Requirements.

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.

Step 3. Conduct a thermal comfort analysis

- Select the appropriate methodology from UFC 3-410-01 and perform a thermal comfort analysis as described in the guidance.
- This analysis will be an iterative process in which thermal comfort conditions are revised or refined to meet UFC 3-410-01 requirements.

Step 4. Design project's conditioning systems

- Based on the results of the thermal comfort analysis, 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.

[29] UFC 4-510-01 Design: Medical Military Facilities http://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-4-510-01

Documentation Requirements

Design Submittal

Path One:

- Provide a narrative of summary analysis showing 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
  - Plots or calculation results verifying that design parameters meet the UFC 3-410-01
  - Document the owner's project requirements and intended comfort criteria for the building and state assumptions regarding activity level and occupant clothing.
  - 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, including diversity considerations, and HVAC load calculations.
  - Include any elements that significantly affect thermal comfort, indication of spaces outside comfort-controlled areas, and locations of occupant-adjustable controls.

Path Two:

- Demonstrate compliance with LEED v2009 BD+C EQc7.1 Thermal comfort - design when in accordance with the UFC 3-410-01
  OR
- Demonstrate compliance with LEED v4 BD+C EQc Thermal comfort when in accordance with the UFC 3-410-01

Path Three:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

2-5.2 Daylighting and Lighting Controls.

Requirements

Locate all regularly occupied spaces, such as classrooms and offices, on exterior walls or other locations where it is feasible to provide 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-By-Step Implementation

Step 1. Establish design criteria

- During predesign, 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.
- Use building orientation to minimize direct beam sunlight, for example, by putting the long axis of the building facing directly north and south. 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 and glare while admitting daylight, especially on the south side of the building.

Step 3. Design to meet ASHRAE 189.1 Section 8.4.1.2

- Meet requirements for ASHRAE 189.1 Section 8.4.1.2 Minimum Sidelighting Effective Aperture for Office Spaces and Classrooms.
- Meet minimum sidelighting effective aperture for all façades,
- Follow guidance for any opaque interior surfaces in daylight areas shall have
- See exceptions for spaces with tasks that requires dark conditions, daylight areas where the height of existing adjacent structures above the window is at least twice the distance between the window and the adjacent structures, measured from the top of the glazing.

Step 4. Design to meet ASHRAE 189.1 Section 8.5.1.2

- 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 shall demonstrate that the required area has a calculated daylight illuminance as specified.
- The simulation need not include storage racks or internal obstructions other than walls and permanent partitions.

- Computer models shall use daylight simulation software based on the ray-tracing or radiosity methodology.
- Simulation and normalized physical model results shall be based on external daylight illuminance using either the CIE Overcast Sky Model or the CIE Clear Sky Model for the location of the project.
- See exceptions for spaces with tasks that requires dark conditions, daylight areas where the height of existing adjacent structures above the window is at least twice the distance between the window and the adjacent structures, measured from the top of the glazing.

Documentation Requirements

Design Submittal

Path One:

- Develop documentation—such as floor plans, sections, and elevations—showing the glare control methods used on the project.
- Maintain documentation—such as floor plans, sections, and elevations—showing the location of regularly occupied spaces with a qualifying amount of daylight.
- To account for changes in design, develop a spreadsheet documenting the daylight factors outlined in the Calculations section.
- If using daylight simulation, update the computer model as the design progresses

Path Two:

- Demonstrate compliance with LEED v2009 BD+C EQc8.1 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 in Office Spaces and Classrooms
  OR
- Demonstrate compliance with LEED v4 BD+C EQc Daylight, minimum of 2 points and/or 75% of regularly occupied areas
  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 in Office Spaces and Classrooms.

Path Three:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

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 requirements 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-By-Step Implementation

Step 1. Implement ventilation air design strategies that minimize moisture

- Utilize the UFC 3-410-01[30], 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 3-101-01[31] 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
  - ACOUSTICS - OUTSIDE TO INSIDE NOISE CONTROL

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

[30] https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-3-101-01
[31] 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

Path Two:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

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-By-Step Implementation

Step 1. Conduct background

- Review ASHRAE 189.1 Section 8.4.2 Prescriptive Option: Materials to understand 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 will meet the category-specific emissions and content thresholds enumerated in this section where feasible.

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

- Utilize TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements in UFGS 01 33 29[32] for minimum material specification requirements (For NAVY-ONLY FOR DESIGN-BUILD: UFGS 01 33 29.05 20[33]:
- 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

[32] http://www.wbdg.org/FFC/DOD/UFGS/UFGS 01 33 29.pdf
[33] http://www.wbdg.org/FFC/NAVFAC/NDBM/UFGS/01_33_29.05_20.pdf

Path One:

- Specifications demonstrating that products with low pollutant emissions are installed in the project for composite wood products, adhesives, sealants, interior paints and finishes carpet systems
- Product information (e.g., MSDS, third-party certifications, testing reports)

Path Two:

While using the TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements in UFGS 01 33 29[34] *for minimum material specification requirements (For NAVY-ONLY FOR DESIGN-BUILD: UFGS 01 33 29.05 20*[35]*)* 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

OR

While using the TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements in UFGS 01 33 29 for minimum material specification requirements (For NAVY-ONLY FOR DESIGN-BUILD: UFGS 01 33 29.05 20), demonstrate compliance with:

- LEED v4 BD+C EQc Low-emitting materials, Option 2 Budget Calculation Method

Path Three:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

[34] http://www.wbdg.org/FFC/DOD/UFGS/UFGS 01 33 29.pdf
[35] http://www.wbdg.org/FFC/NAVFAC/NDBM/UFGS/01_33_29.05_20.pdf

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

Step-By-Step Implementation for New Construction/Renovation Unoccupied

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

For projects conducting a flush-out

- 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 the project 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.

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.
- Maintain a written construction IAQ management plan.
- For projects completing a flush-out procedure, record dates, occupancy, outdoor air delivery rates, internal temperature, and humidity, as well as any special considerations.
- For projects conducting baseline indoor air quality testing provide a copy of the report

Path Two:

- Demonstrate compliance with LEED v2009 BD+C IEQc3.1 Construction IAQ management plan - during construction
- LEED v2009 BD+C IEQc3.2 Construction IAQ management plan - before occupancy
  OR
- Demonstrate compliance with LEED v4 BD+C EQc Construction indoor air quality management plan
- LEED v4 BD+C EQc Indoor air quality assessment

Path Three:

Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

2-5.3.4 Environmental Tobacco Smoke Control.

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 environment 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-By-Step Implementation

Step 1. Occupant Health & Wellness and Integrated Design

- During the Integrated Design and Charrette Process discuss options for Occupant Health & Wellness
- Following are occupant health and wellness strategies to consider:

Circulation 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. Access to floors may be restricted by use of security devices, such as card keys, codes or other access devices.
- For primary staircase(s):
  - Classify all regularly occupied floors for re-entry, allowing all building users to have access to and from these floors. Service floors do not need access for all users.
  - Make accessible staircases visible from the corridor by providing one of the following:
    - transparent glazing at stair doors or at a side light
    - magnetic door holds on all doors leading to the stairs
    - unenclosed stairs
  - Locate a main staircase to be visible from main building lobby and within 25-foot (7.5 meters) walking distance from any edge of the lobby. Ensure that no turns or obstacles prevent visibility of or accessibility to the qualifying staircase from the lobby.
  - Locate a main staircase to be visible before an occupant visually encounters any motorized vertical circulation (elevator/escalator). The staircase must be visible from the principal point of entry at each building floor.
  - Install architectural light fixtures that provide a level of lighting in the staircase(s) consistent with or better than what is provided in the building corridor.
  - Provide daylighting at each floor/roof level of the stair(s) using either windows and/or skylights of at least 8 square feet (1 square meter) in size.
- Place signage encouraging stair use for health and other benefits at all elevator call areas, next to escalators and outside stairwells on each floor.
- Use inviting sensory stimulation such as artwork and/or music in stairwells.

Active workstations for consideration:

- Provide exercise equipment or exercise opportunities for at least 5% of FTE occupants that can be used at employee workstations to allow workers opportunities for physical activity while working at their desks. Examples of appropriate exercise equipment include but are not limited to tread-desks, desk stationary bicycles, exercise ball chairs, desk stepper and others. A checkout system can be put in place to allow employees to check out equipment.

Fitness center strategies for consideration:

- Provide a dedicated or multi-use space to act as an on-site exercise room, which includes a variety of exercise equipment, for use by at least 5% of FTE occupants.

Options for bicycle commuter facilities:

- Identify bicycle network and eligible destinations
- Select bike-friendly project location
- Gather occupant count information
- Determine number of bicycle storage spaces required
- Determine number of shower and changing facilities required
- Install bicycle storage
- Ensure safe access to school buildings
- Institute programs to support bicycling use

Strategies that support occupant health:

- Considering options such as providing convenient access to
  - healthy dining options
  - ensure project provides access to potable water, conduct periodic water quality testing & filter systems as needed
  - plants

Documentation Requirements

Design Submittal

Path One:

- Copy of the section of the charrette report of that addresses consideration of these requirements
- Narrative regarding if the Occupant Health and Wellness elements were incorporated into project design and if which ones.

Path Two:

- Demonstrate compliance with one of the following LEED credits at a minimum:
  - LEED v2009 SSc.4.2 Alternative transportation – bicycle storage and changing rooms
  - LEEDv4 BD+C LTc Bicycle facilities
  - LEEDv4 BD+C Innovation credit - Walkable project site
  - LEEDv4 BD+C Innovation credit - Design for active occupants

Path Three:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

2-6. REDUCE ENVIRONMENTAL IMPACT OF MATERIALS

2-6.1 Environmentally Preferable Products

The following requirements 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.

Environmentally Preferable Products: Products or services having a lesser or reduced effect on human health and the environment when compared with competing products or services serving the same purpose. This comparison may consider raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, or product or service disposal.

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 web site at https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program

Compliance

Step-By-Step Implementation

Step 1. Conduct background research

- Postconsumer recycled content is derived from materials that can no longer be used for their original purpose, and preconsumer recycled content consists of raw material diverted from the waste stream during the manufacturing process. Although the use of both types of recycled content is encouraged, postconsumer recycled content is more highly valued environmentally because of its increased environmental benefit over the life cycle of the product.
- Review project documents to identify all applicable products.
- Review the EPA's Comprehensive Procurement Guidelines (CPG) for recycled content. The CPG is a good source for understanding 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 product directory listing products that meet the above minimum recycled content percentages.
- Many commonly used products are available with recycled content, including metals, concrete, masonry, gypsum wallboard, acoustic tile, carpet, ceramic tile, rubber flooring, wall base and insulation.
- Generate report with results of background research, inclusive of print screens vetting CPG site, plus other products not on website and how addressing recycled content.

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.
- When a cost estimate for the project is available, evaluate the feasibility of meeting the recycled content targets and revise these targets as necessary. 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.
- Conduct a preconstruction meeting to review material and product needs in detail, to stress their importance will aid in successful procurement. Track progress towards goals on a regular basis.

Step 4. Verify that minimum percent recycled content is met
- For each material with recycled content used on the project, calculate its recycled content value according to the following equation. It is recommended that project teams use the LEED NC v2009 BD+C Material and Resource Calculator:
- Recycled content value ($) = (% Postconsumer recycled content * Material cost) + 0.5 * (% Preconsumer recycled content * Material cost)
- Then, perform the following calculation to determine the overall percentage of recycled content used on the project. The resulting value must be at least 10% for the project to comply with the guiding principle requirements:
  - Percentage recycled content = (Total recycled content value / Total materials cost) * 100

Documentation Requirements

Construction Submittal

Path One:

- Report of research conducted
- Record of product names, manufacturers' names, costs, percentage postconsumer content, and percentage preconsumer content.
- Cut sheets or manufacturers' letters to document the listed products' recycled content.
- Where appropriate, maintain a list of actual materials costs, excluding labor and equipment for CSI Division 03–10, 31 (Section 31.60.00 Foundations) and 32 (Sections 32.10.00 Paving, 32.30.00 Site Improvements, and 32.90.00 Planting) only; including Division 12 is optional.

Path Two:

- Demonstrate compliance LEED NC v2009 MRc4 Recycled content, 1 point (must use EPA-designated products to meet credit requirement)
- Narrative that demonstrates EPA-designated products were utilized
  OR
- Demonstrate compliance LEED NC v4 MRc Building product disclosure and 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 to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

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. Exceptions taken to 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 web site at http://www.biopreferred.gov/.

Compliance

Step-By-Step Implementation

Step 1. Conduct background research

- Review the required minimum thresholds for biobased content, as listed on USDA's BioPreferred website. The USDA has identified 97 product categories (e.g., carpets, cleaners, paints), each of which has an identified minimum threshold. All materials and products used on the project will meet the category-specific minimum thresholds for biobased content, where cost feasible.
- 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.
    - Utilize print screens to document results of searches that result in decision to not include BioPreffered products. Include print screens in narrative that will be submitted for review if needing to explain why available products didn't meet project requirements.
- 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. If back ground research does not yield positive results generate a report

- If appropriate biobased products are not discovered generate a report indicative of reason not including in project design (lack of availability, price, performance etc.). Report needs to include results of background research, inclusive of print screens vetting BioPreffered website.

Step 3. If research yields positive results specify biobased products

- If research generated positive results specify the biobased products and incorporate into project.

Step 4. 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.
- Conduct a preconstruction meeting to review material and product needs in detail, to stress their importance will aid in successful procurement. Track progress towards goals on a regular basis.

Documentation Requirements

Construction Submittal

Path One:

- Summary list and cutsheets for biologically-based products included in project if applicable
- Report of background research; If not able to include BioPreffered in products as part of project design, explaining why available products didn't meet project requirements with relevant print screens that document results of searches.

Path Two:

- Demonstrate compliance with LEED v2009 BD+C NC 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 v4 BD+C 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 to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

2-6.1.3 Ozone Depleting Substances

Requirements

Meet the requirements of ASHRAE 189.1 Section 9.3.3 (Refrigerants), if equipment or systems using ozone depleting substances are included in the project. Do not use ozone depleting substances (ODS) or high Global Warming Potential (GWP) chemicals where EPAs 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 replacements: www.epa.gov/snap.

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

Compliance

Step-By-Step Implementation

Step 1. Determine eligibility

- Determine if project equipment or systems will include ozone depleting substances. If yes review the following guidance. If project does not include generate a narrative documenting to provide during project review.

Step 2. Review and design to meet requirements of ASHRAE 189.1 Section 9.3.3

- Do not use Chlorofluorocarbon (CFC) based refrigerants in HVAC&R systems
- For fire suppression systems are review exceptions in the UFC 3-600-01.

Step 3. EPA SNAP acceptable substitutes to CFCs and HCFCs

- Under the Significant New Alternatives Policy (SNAP), which is designed to implement section 612 of the amended Clean Air Act of 1990, the EPA provides a list of substitutes for ozone-depleting substances. These are organized into the following categories: acceptable, acceptable subject to narrow use, acceptable subject to use, and unacceptable. Review the requirements of this list, available at http://www.epa.gov/ozone/snap/lists/index.html.

Step 4. Inventory existing HVAC&R equipment (for major renovations)

- For projects that are major renovations, inventory all existing HVAC&R equipment in the project and determine whether any items use CFC or 'unacceptable' HCFC refrigerants.
- Older or retrofit equipment with higher efficiency ratings are the most likely to have CFCs, but it is important to check the refrigerant type for all new equipment.
- Any equipment using compounds designated as 'unacceptable' under SNAP must be replaced or retrofitted before the project's completion.
- Note: For the fire suppression equipment see UFC 3-600-01 for fire system requirements.

Step 5. Select new equipment that minimizes the use of ozone-depleting substances

- To the maximum extent feasible, use acceptable substitutes for ozone-depleting substances according to the SNAP program. Where substances fall into the 'acceptable subject to narrow use' and 'acceptable subject to use' categories, comply with SNAP requirements.
- Do not use any compounds designated as 'unacceptable' under SNAP.
- The installation of new Halon 1301 fire suppression systems is prohibited except in cases where special approval has been granted by the Authority Having Jurisdiction (AHJ).

- In addition to the SNAP list, project teams will also take into account considerations such as cost, compatibility with equipment system components, possibilities for recycling and/or reclamation, flammability, availability, and other environmental effects (such as global warming potential).
- Note that the mechanical engineer is typically responsible for specifying this equipment.

Documentation Requirements

Construction Submittal

Path One:

- List base building systems containing refrigerants and the associated type of refrigerant.
- Retain manufacturer's documentation, indicating the type and quantity of refrigerant used.

Path Two:

- Demonstrate compliance with LEED v2009 BC+C EAp3 Fundamental refrigerant management
- LEED v2009 BC+C EAc4 Enhanced refrigeration management
- Demonstrate using the calculator in the credit form that the ODP is zero
  OR
- Demonstrate compliance with LEED v4 BD+C EAp Fundamental refrigerant management
- LEED v4 BD+C EAc Enhanced refrigerant management
- Demonstrate using the calculator in the credit form that the ODP is zero

Path Three:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

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

- Determine if the installation provides recycling services

Step 2. Design appropriately sized disposal areas

- Determine method for which recycled materials will be removed from the building
- Provide a central collection and storage space with sufficient capacity for all non-hazardous recyclables, include the area project design documents.
- The following material types must be accommodated by recycling services:
  - Paper
  - Corrugated cardboard
  - Glass
  - Plastics
  - Metals

Documentation Requirements

Design Submittal

Path One:

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

Path Two:

- Demonstrate compliance with LEED v2009 BD+C MRp1 Storage and collection of recyclables

OR

- Demonstrate compliance with LEED v4 BD+C MRp Storage and collection of recyclables

Path Three:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

2-6.2.2 Waste Diversion

Requirements

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

Compliance

Step-By-Step Implementation

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

- Review and verify that the guidance in the UFGS-01 74 19 Construction and Demolition Waste Management[36] is adhered to during the project delivery cycle.

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

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

Documentation Requirements

Construction Submittal

Path One:

- Waste Management Plan
- Total percentage of waste diverted from landfill disposal during construction
- Haul tickets

Path Two:

- Demonstrate compliance with LEED v2009 BD+C MRc2 Construction waste management, minimum 1 point with at least a 60% diversion rate

OR

- Demonstrate compliance with LEED v4 BD+C MRc Construction and demolition waste management, Option 1 – minimum 1 point with at least a 60% diversion rate

Path Three:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.

[36] 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 projection and determination of acceptable risk.

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-By-Step Implementation

Step 1. Review DD1391

- Determine if project DD1391 contains scope for identified risk. If not, the requirement is "N/A" due to "not applicable to scope" and select Path Two.

Step 2. Design to address the DD1391 requirements

- If risks are identified in the DD1391, 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:

- Copy of DD 1391
- Narrative regarding steps taken to meet requirements.

Path Two:

- Not applicable to project. Provide written justification for missed targets as relates to mission, location, LCCA, non-applicable to scope, or other reason specific to requirement.