

Sustainable Design Guidelines for Hospitals and Outpatient Facilities

A White Paper



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This publication accompanies the 2014 edition of the *Guidelines
for Design and Construction of Health Care Facilities*.

The Facility Guidelines Institute
350 N. Saint Paul Street, Suite 100
Dallas, TX 75201
info@fgiguilines.org
www.fgiguilines.org

Purpose of This Document

Many organizations have developed or are in the process of developing sustainable building rating systems, standards, or building codes that apply to the health care sector. However, few of these standards include substantial input from health care facility administrators, clinicians, and design professionals who specialize in health care projects. The cyclical revision process for the Facility Guidelines Institute's *Guidelines for Design and Construction of Hospitals and Outpatient Facilities* offers an opportunity to develop minimum guidelines for sustainable design of health care environments that can be vetted by members of the Health Guideline Revision Committee who are stakeholders in the design of acute and ambulatory health care facilities. The guidelines in this paper are intended to help facilities achieve organizational sustainability goals while balancing the needs of patients, visitors, and staff with the fiscal pressures currently affecting the health care industry.

These minimum guidelines, which are intended to apply to both new construction and renovation of existing facilities, will be referenced as a white paper in the 2014 edition of the FGI *Guidelines for Design and Construction of Hospitals and Outpatient Facilities*. Until the white paper is used to inform proposals for the 2018 *Guidelines* revision cycle, it will be posted on the FGI website at www.fgiguideines.org/resources for reference and free download.

Note: The content of this white paper has been written to correlate with the content of the 2014 edition of the FGI *Guidelines for Design and Construction of Hospitals and Outpatient Facilities* and attempts to avoid repeating information found in the *Guidelines*. One example of this is environment of care features, which are discussed in some detail in Chapter 1.2 of the 2014 edition.

An excerpt from the Health Guidelines Revision Committee Operations Manual:

Interim White Papers

White papers are reports prepared at the direction of the HGRC Steering Committee. White papers are usually topics of interest to the health care community and used to provide additional information on a topic in the *Guidelines* (e.g., the PHAMA white paper written during the 2010 revision cycle) or recommendations for changing the content of the *Guidelines* (e.g., the medical oncology white paper prepared during the 2010 cycle). In the latter case, the white paper will be retired once the content has become part of the *Guidelines* document.

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Sustainable Design Guidelines for Hospitals and Outpatient Facilities

A green building, also known as a sustainable or high-performance building, is an environmentally sustainable building that is designed, constructed, and operated to minimize its total environmental impacts. The green building guidelines in this document are applicable to health care facilities (specifically acute care hospitals and ambulatory care facilities) and balance the needs of patients, visitors, and staff with the fiscal pressures in the health care industry and organizational sustainability goals.

This document covers the following specific aspects of sustainable design:

1. Building site
2. Energy use
3. Indoor environmental quality
4. Water supply
5. Airborne emissions, effluent, and pollutant controls
6. Materials and resources
7. Waste

The sections are designed to present mandatory requirements along with two potential paths for further action that allow the user to choose the appropriate path for a specific design and construction project:

- (1) **Mandatory requirements** are items that must be completed for compliance.
- (2) The **performance path** leads to design and construction of a building intended to achieve a specified level of *performance* based on a benchmark minimum and a process of comparison. The goal of the performance approach is to allow maximum flexibility to support achievement of a desired goal in a way that coordinates better with the overall needs and strategies of the health care organization.
- (3) The **prescriptive path** is intended to achieve approximately the same or better result as the performance path, but by complying with a series of *prescriptive* measures rather than using a process to determine how to achieve the desired outcome. The prescriptive path has little flexibility, unless an exception is noted, and users are expected to comply with each specific requirement.

A facility can comply with these guidelines by meeting the mandatory requirements and the requirements for either the performance path or the prescriptive path for each of the eight sections. If the design of a facility follows the performance path, this can be demonstrated with calculations and documentation certified by a licensed professional that verify achievement of the desired level of performance. The benchmark used to calculate the improved performance outcomes of a building shall be clearly outlined in the documentation.

References: The following documents were used for reference in preparation of these guidelines:

- ASHRAE 62.1-2013: *Ventilation for Acceptable Indoor Air Quality*
- ANSI/ASHRAE/IES 90.1-2010: *Energy Standard for Buildings Except Low-Rise Residential Buildings*
- ANSI/ASHRAE/ASHE 170-2013: *Ventilation of Health Care Facilities*

- ASHRAE *Advanced Energy Design Guide for Large Hospitals*
- ASHRAE *Advanced Energy Design Guide for Small Hospitals and Healthcare Facilities*
- California Green Building Code, Hospitals section
- DOE-2, DOE Building Energy Codes Program COMcheck™ tool
- Green Globes® CIEB-HC (Continual Improvement for Existing Buildings – Healthcare)
- Green Globes® NC (New Construction)
- Green Guide for Health Care™
- LEED® for Healthcare
- SPC 189.3P: Proposed Standard for the *Design, Construction and Operation of Sustainable High-Performance Health Care Facilities*

1 BUILDING SITE

In addition to the mandatory requirements, either the performance option (Section 1.2) or the prescriptive option (Section 1.3) shall be implemented.

1.1 Mandatory Requirements

1.1.1 Erosion and sedimentation control plan. An erosion and sedimentation control (ESC) plan shall be prepared for all construction activities associated with the project.

1.1.1.1 The ESC plan shall conform to the erosion and sedimentation requirements of the 2003 EPA Construction General Permit (CGP) *or* local erosion and sedimentation control standards and codes, whichever are more stringent.

1.1.1.2 The plan shall describe the measures to be implemented to accomplish the following objectives:

a. Prevent loss of soil during construction caused by storm water runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.

b. Prevent sedimentation of storm sewer or receiving streams.

c. Prevent pollution of the air with dust and particulate matter.

- The CGP shall outline the provisions necessary to comply with Phase I and Phase II of the National Pollutant Discharge Elimination System (NPDES) program.
- Although the CGP only applies to construction sites greater than one acre, the requirements shall be applied to all projects.

Information about the EPA CGP (including a copy of the document) is available at <http://cfpub.epa.gov/npdes/stormwater/cgp.cfm>.

1.1.2 Site utilization

1.1.2.1 A site access plan shall be completed to minimize site disruption associated with the project's construction phase.

Aspects of site location such as accessibility to patients and proximity to public transportation should be reviewed in evaluating the site utilization plan. The existing built environment should be assessed as part of the site access plan.

1.1.2.2 Temporary construction facilities, designated staging areas, access roads, and construction parking shall be planned within new building and paving footprints to minimize site disturbance.

1.1.2.3 Measures shall be established to protect priority sensitive areas of the site, including prohibiting staging, stockpiling and soil compaction.

1.1.2.4 Disturbance to protected wetlands and habitats of endangered species shall be prevented.

1.1.2.5 Storage shall be provided for fuels, and measures shall be established for handling fuels, to prevent spills and discharge into waterways.

1.1.3 Brownfield remediation. If the site is a brownfield:

1.1.3.1 A Phase 1 environmental site assessment shall be performed as determined by a local, state, or federal agency. See ASTM E1527-05: *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*.

1.1.3.2 Documentation for remediation of the site shall be completed to the residential level as defined in the EPA Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites. (www.epa.gov/region9/superfund/prg).

1.2 Performance Option

1.2.1 Parking capacity. A written plan shall address the following:

1.2.1.1 A combination of programs, such as telemedicine, mailed prescriptions, carpooling, and coordination with local mass transit (including shuttles), to reduce vehicular traffic and encourage pedestrian and cyclist traffic to the site

1.2.1.2 The anticipated number of parking spaces required and the number of spaces reduced based on the services to be provided as outlined in the functional program.

1.3 Prescriptive Option

1.3.1 Parking capacity. Parking capacity shall be sized to meet, but not exceed, minimum local zoning requirements *or* health department regulatory authority for licensing requirements, whichever is the overriding requirement.

Parking needs may vary according to the needs of the functional program and the location of the facility (urban, suburban, or rural sites). Consideration should be given to the following:

Designate 5 percent of a facility's total parking spaces as preferred parking for carpools or vanpools.

Provide electric vehicle charging stations at 1 percent of new parking spaces.

2 ENERGY USE

In addition to the mandatory requirements, either the performance option (Section 2.2) or the prescriptive option (Section 2.3) shall be implemented.

2.1 Mandatory Requirements

2.1.1 Measurement and verification plan

2.1.1.1 A measurement and verification (M&V) plan shall be developed and implemented consistent with one of the following options in the *International Performance Measurement and Verification Protocol* (IPMVP®), Volume III: Applications, Part I: Concepts and Options for Determining Energy Savings in New Construction:

- a. Option D: Whole Building Calibrated Simulation
- b. Option B: ECM (Energy Conservation Measure) Isolation

The January 2006 edition of IPMVP can be found at www.evo-world.org/index.php?option=com_content&view=article&id=272&Itemid=504&lang=en.

2.1.1.2 At minimum, metering that provides consistent and reliable data shall be provided for the following electrical and mechanical systems (as applicable to the scope of the project):

a. Gas

- Main gas line to the site
- Each natural gas boiler
- Kitchen gas

b. Electricity

- Consumption (kWh) and demand (kW) for each source of electricity to the building
- Output from each automatic transfer switch
- Energy consumption for pump and fan for each motor with a variable frequency drive (VFD)

c. Thermal energy

- All steam purchased from off-site sources, including recovered condensate
- Steam produced by each steam boiler
- Hot water produced by each hot water boiler
- Chilled water output for each water chiller

d. Energy source (fuel oil, propane, etc.) for each device listed

- Each steam or hot water boiler
- Each generator not used for emergency purposes only

2.1.2 Interior lighting sensors and controls

2.1.2.1 Occupancy light sensor controls

a. The following spaces shall be equipped with occupant sensor(s) that automatically turn lighting off within 30 minutes of all occupants leaving the space but allow “manual off” control:

- Offices 250 sq. ft. (25 m²) or smaller
- Classrooms of any size
- Lecture, training, or vocational rooms of less than 1,000 sq. ft. (100 m²)
- Multipurpose rooms of less than 1,000 sq. ft. (100 m²)
- Conference rooms and meeting rooms less than 1,000 sq. ft. (100 m²)
- Meeting centers
- Storage, including environmental services room, clean workroom or clean supply room, soiled workroom or holding room, equipment and supply storage rooms, and furniture storage areas.
- Staff lounge facilities or changing areas
- Small toilet rooms
- Examination rooms (except those where patient may lie motionless for observation for an extended period)

- Mechanical, electrical, control, and IT rooms. In some large mechanical/electrical spaces, two levels of lighting shall be provided, only one of which is connected to the motion sensor.

This requirement is to accommodate an employee who may be working steadily in the space without moving and thus will not trigger a motion detector.

- b. All occupancy sensor controls shall be either “manual on” or bi-level “automatic on” and shall be programmed to a low light level combined with multi-level circuitry and “manual on” switching for higher light levels.
- c. Where such occupancy sensors are installed in an area with daylight and daylighting controls are used, the occupancy sensors shall work in conjunction with the daylighting controls.

2.1.2.2 Multilevel lighting controls

- a. The general lighting of any enclosed space 100 sq. ft. or larger shall have multilevel lighting controls.
- b. Multilevel controls shall have at least one control step that is between 30 and 70 percent of design lighting power and allows the power of all lights to be manually turned off.

2.1.2.3 Automatic controls for lighting in daylight zones. Lighting in all daylight zones where the combined daylight zone per enclosed space is greater than 250 square feet (23.22m²), including daylight zones under skylights and daylight zones adjacent to vertical fenestration, shall be provided with controls that automatically reduce lighting power in response to available daylight by *one* of the following methods:

- a. Continuous daylight dimming, or
- b. A combination of stepped switching and daylight-sensing automatic controls, which are capable of incrementally reducing the light level in steps and turning lights off automatically

Note: Perimeter spaces in which patient care is delivered, such as exam rooms, shall have overrides to these lighting controls.

2.1.2.4 Exterior lighting systems. Exterior lighting systems shall comply with the following:

- a. ANSI/ASHRAE/IES Standard 90.1: *Energy Standard for Buildings Except Low-Rise Residential Buildings*
- b. Sections 5.3.3.2 and 5.3.3.3 of ANSI/ASHRAE/USGBC/IES 189.1-2011: *Standard for the Design of High-Performance, Green Buildings Except Low-Rise Residential Buildings*

Exceptions:

- Specialized signal, directional, and marker lighting associated with site wayfinding and transportation
- Advertising signage or directional signage
- Lighting integral to equipment or instrumentation and installed by its manufacturer

- Lighting that is in use for no more than 60 continuous days and is not re-installed any sooner than 60 days after being uninstalled
 - Lighting for material handling, transportation areas, and associated storage areas
 - Roadway lighting required by regulatory authorities
- c. All permanently installed outdoor luminaires employing lamps rated over 100 watts shall have a lamp efficacy of at least 60 lumens per watt.

2.1.3 Controls for outdoor lighting

2.1.3.1 Area lighting. All permanently installed outdoor lighting, including lighting of building facades, parking lots, canopies, and pick-up/drop-off zones, shall be controlled by a photo-control or astronomical time switch that automatically turns off the outdoor lighting when daylight is available.

Exception: Lighting for steps or stairs that require illumination during daylight hours

Exception: Lighting for emergency department entrances and exits

2.1.3.2 Garage lighting. Two levels of lighting shall be provided in parking garages.

- a. Thirty percent of the total fixtures shall be controlled by a daylight sensor.
- b. The balance of the fixtures shall be controlled by a combination of daylight sensor and occupancy sensor.

2.2 Performance Option

Buildings shall be designed to achieve an ENERGY STAR® rating of at least 75, modeled in accordance with Appendix G of ASHRAE 90.1-2010 as modified by the design assumptions in Appendix 1, using the most current version of DOE-2 (www.doe2.com), EnergyPlus (www.energyplus.gov), eQuest (www.doe2.com/equest) software, or other industry-accepted software.

Use EPA Target Finder to estimate energy use for a design project. Target Finder calculates a rating based on a comparison of projected energy use with that of facilities of similar size in the ENERGY STAR database. See www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager.

Note: Notwithstanding this requirement, in no circumstances shall building energy systems be designed to use more energy than allowed by local codes or that conflicts with the needs of the care population being served.

2.3 Prescriptive Option

Buildings shall be designed according to the following climate-specific design strategies that are prescriptive and do not require modeling to demonstrate energy savings:

2.3.1 Roofing materials

2.1.3.1 For buildings of at least 90,000 square feet, roofing shall be provided based on the climate zone as recommended in the American Society for Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) *Advanced Energy Design Guide for Large Hospitals*. Components addressed in the recommendations include insulation and the solar reflectance index (SRI).

2.1.3.2 For buildings of 90,000 square feet or less, roofing shall be provided based on the climate zone as recommended in the ASHRAE *Advanced Energy Design Guide for Small Hospitals and Healthcare Facilities*. Components addressed in the recommendations include insulation and the solar reflectance index (SRI).

2.3.2 Joints and other openings

2.3.2.1 Joints and other openings in the building envelope that are potential sources of air leakage shall be caulked, gasketed, weather-stripped, or otherwise sealed to limit infiltration and exfiltration.

2.3.2.2 Before the building is occupied, the building envelope shall be tested for thermal and airflow leakage and any deficiencies discovered shall be corrected as part of the envelope commissioning process.

2.3.3 Variable speed drives. Individual motors serving variable flow systems and having a motor speed exceeding 3 horsepower shall have controls and/or devices (such as variable speed control) that will result in pump motor demand of no more than 30 percent of design wattage at 50 percent of design flow.

2.3.4 Hydronic variable flow systems. HVAC chilled and hot water pumping shall be designed for variable fluid flow and shall be capable of reducing pump flow rates to no more than the larger of the following:

2.3.4.1 50 percent or less of the design flow rate, *or*

2.3.4.2 The minimum flow required by the equipment manufacturer for the proper operation of equipment served by the system.

2.3.5 Pipe insulation. Pipe insulation shall comply with the requirements of the latest edition of ASHRAE 90.1.

2.3.6 Economizers. Systems shall have air-side or water-side economizers where required for the facility's climate zone in ASHRAE 90.1.

2.3.7 Heat recovery. Air-side heat recovery shall be provided in accordance with the ASHRAE *Advanced Energy Design Guide for Large Hospitals*.

2.3.8 Building commissioning. Building commissioning shall be performed in accordance with the American Society for Healthcare Engineering (ASHE) *Health Facility Commissioning Guidelines*.

2.3.9 Appliance efficiency. All equipment and appliances shall be Energy Star-labeled if Energy Star is applicable to that equipment or appliance.

2.3.10 Equipment efficiency. Equipment shall comply with the provisions for cooling and heating equipment efficiencies in the ASHRAE *Advanced Energy Design Guide for Large Hospitals*.

2.3.11 Lighting power density. Lighting shall comply with the climate zone-specific targets for lighting power density in the ASHRAE *Advanced Energy Design Guide for Large Hospitals*.

3 INDOOR ENVIRONMENTAL QUALITY

Note: There is no prescriptive or performance option for this criterion.

3.1 Mandatory Requirements

3.1.1 HVAC system design. HVAC systems shall be designed and installed using the DOE Building Energy Codes Program COMcheck™ tool (www.energycodes.gov) or a similar program or a life cycle analysis that determines how much energy the system will use.

3.1.2 Ventilation rates

3.1.2.1 Ventilation rates shall meet the minimum requirements of the latest edition of one of the following, whichever is more stringent and applicable to the building type:

- a. Relevant local licensing requirement for ventilation
- b. ASHRAE 62.1: *Ventilation for Acceptable Indoor Air Quality*
- c. ANSI/ASHRAE/ASHE 170: *Ventilation of Health Care Facilities*

3.1.2.2 Mechanical ventilation systems shall be designed using the ventilation rate procedure in ASHRAE 62.1 *or* ventilation requirements of the applicable local code, whichever is more stringent.

- a. Mechanical ventilation systems shall be designed so spaces can be operated with a reduced airflow when they are unoccupied but required differential pressures, temperature, and humidity control can still be maintained.
- b. Mechanical ventilation systems shall have sensors and monitoring to assure adequate ventilation for minimal temperature and moisture control.
- c. Mechanical ventilation systems shall be able to revert to occupied status in a reasonable time frame.

3.1.3 Air distribution system duct sealing for leakage control. Duct sealing and leakage testing shall be performed and comply with the provisions for same in the ASHRAE *Advanced Energy Design Guide for Large Hospitals*.

3.1.4 Dampers for air supply and exhaust equipment. Outdoor air supply and exhaust/relief equipment shall be installed with dampers that automatically close upon fan shutdown.

3.1.5 Indoor air quality. Buildings shall comply with or be below requirements in sections 6 through 8 of ANSI/ASHRAE/ASHE Standard 170.

3.1.5.1 Outdoor air delivery monitoring. A permanently mounted device to measure direct total outdoor airflow shall be provided to measure the system minimum outdoor airflow rate.

- a. The device shall be capable of measuring flow within ± 15 percent of the minimum outdoor airflow rate.
- b. The device shall be capable of being used to send an alarm to the building operator or a signal to a building central monitoring system when flow rates are out of compliance.

Exception: Constant volume air supply systems that use a damper position feedback system are not required to have a direct total outdoor airflow measurement device.

3.1.5.2 Environmental tobacco smoke

- a. Signage stating no smoking is allowed in the building shall be posted within 10 feet

(3 m) of each building entrance.

- b. Any exterior designated smoking areas shall be located a minimum of 25 feet (7.5 m) from building entrances, outdoor air intakes, and operable windows.

3.1.5.3 Building entrances. Main entrances and service entrances shall employ an entry mat system that reduces the intrusion of particulate matter into the interior environment.

3.1.5.4 VOC emission requirements for adhesives and sealant, paints, coatings, and primers, floor covering materials, patient room furniture and ceiling and wall systems

- a. Acceptable emissions levels shall be determined in accordance with the California Department of Public Health *Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers*, Version 1.1, and shall meet the limit requirements therein. The determination of emissions shall be based on:

See www.calrecycle.ca.gov/greenbuilding/specs/section01350 for the CDPH *Standard Method* cited.

- Minimum room volume, clear floor area, natural light, and window area to floor area ratio of a private patient room as prescribed in the *FGI Guidelines for Design and Construction of Hospitals and Outpatient Facilities*
 - Provision of outside air at a rate of 2.0 air changes per hour as prescribed in Table 7-1 of ANSI/ASHRAE/ASHE 170: *Ventilation of Health Care Facilities*
- b. Office furniture systems and seating installed prior to occupancy shall be tested in accordance with, and shall not exceed the VOC limit requirements in Section 7.6.2 of ANSI/BIFMA e3: *Furniture Sustainability Standard and Tools* (www.bifma.org/?page=e3standard).
- c. Composite wood, wood structural panel, and agrifiber products shall not contain any added urea-formaldehyde resins.

Composite wood and agrifiber products are defined as particleboard, medium-density fiberboard, wheatboard, strawboard, panel substrates, and door cores.

3.1.6 Lighting control. For requirements, see Section 2.1.2 (Lighting sensors and controls) under Mandatory Requirements for Energy Use.

3.1.7 Acoustics. For acoustic planning and design requirements, see the *FGI Guidelines for Design and Construction of Hospitals and Outpatient Facilities*, 2014 edition.

4 WATER USE

In addition to the mandatory requirements, either the performance option (5.2) or the prescriptive option (5.3) shall be implemented.

4.1 Mandatory Requirements

4.1.1 Medical equipment. Potable water shall not be used for once-through cooling for any medical equipment.

4.1.2 Irrigation water. Irrigation systems shall be designed to use only captured rainwater, recycled wastewater, recycled gray water, or water treated and conveyed by a public agency specifically for non-potable uses for irrigation.

Exception: Use of irrigation systems to establish landscaping when first planted shall be permitted.

Use of xeriscaping should be considered to avoid the need for irrigation.

4.1.3 Measurement and verification plan

4.1.3.1 A measurement and verification plan shall be developed and implemented consistent with one of the following options as specified in volumes cited of the *International Performance Measurement and Verification Protocol (IPMVP®)* to provide for long-term continuous measurement of potable cold water uses in the facility.

- a. Option D: Whole Building Calibrated Simulation, Savings Estimation Method 2 in IPMVP Volume III (April 2003)
- b. Option B: Retrofit Isolation in IPMVP Volume I: Concepts and Options for Determining Energy and Water Savings (January 2012)

4.1.3.2 The following water uses (as applicable to the project) shall be metered:

- a. Main water to site
- b. Fire suppression water system
- c. Special deduct meters, including those for cooling tower makeup, boiler system makeup, boiler blowdown, other hydronic loop makeup, irrigation, and emergency medical equipment cooling

4.2 Performance Option

4.2.1 Plumbing fixtures and fittings and water reduction

4.2.1.1 Aggregate water consumption shall be reduced by 20 percent based on consumption of all fixtures and fittings in the building.

4.2.1.2 The following shall be used as baseline benchmarks for consumption:

- | | |
|--------------------------------|--|
| a. Toilet | 1.6 gpf (6 lpf) |
| b. Urinal | 1.0 gpf ((3.8 lpf) |
| c. Hand-washing station faucet | 2.2 gpm at 60 psi (8.3 lpm at 415 kPa) |
| d. Showerhead | 2.5 gpm at 80 psi (9.5 lpm at 550 kPa) |

4.3 Prescriptive Option

4.3.1 Plumbing fixtures and fittings and water reduction. Plumbing fixtures (toilets and urinals) and fittings (faucets and showerheads) shall comply with the following:

4.3.1.1 Toilets—flushometer valve

- a. For single-flush fixtures, maximum flush volume as determined in accordance with ASME A112.19.2 shall be 1.28 gal (4.8 L).
- b. For dual-flush fixtures, effective flush volume as determined in accordance with

ASME A112.19.14: *Six-Liter Water Closets Equipped with a Dual Flushing Device* and the draft U.S. EPA [WaterSense Specification for Flushometer Valve Toilets](#) shall be 1.28 gal (4.8 L).

4.3.1.2 Toilets—tank type: Tank-type toilets shall comply with the performance criteria of the U.S. EPA [WaterSense Specification for Tank-Type Toilets](#).

4.3.1.3 Urinals: Maximum flush volume as determined in accordance with ASME A112.19.2 shall be 0.5 gal (1.9 L).

a. Non-water urinals shall comply with ASME A112.19.19: *Vitreous China Nonwater Urinals* or IAPMO Z124.9: *Plastic Urinal Fixtures* as appropriate.

b. Equip all urinals (but not toilets or bedpan washers) with sensor operators.

4.3.1.4 Public sink faucets: Maximum flow rate shall be 0.5 gpm (1.9 L/min) when tested in accordance with ASME A112.18.1/CSA B125.1: *Plumbing Supply Fittings*.

4.3.1.5 Public metering self-closing faucet: Maximum water use shall be 0.25 gal (1.0 L) per metering cycle when tested in accordance with ASME A112.18.1/CSA B125.1.

4.3.1.6 Patient toilet room sink faucets: Maximum flow rate shall be 1.5 gpm (5.7 L/min) when tested in accordance with ASME A112.18.1/CSA B125.1.

4.3.1.7 Patient toilet room and staff showerheads: Maximum flow rate shall be 2.0 gpm (7.6 L/min) when tested in accordance with ASME A112.18.1/CSA B125.1.

4.3.1.8 Hand-washing station sink faucets: Maximum flow rate shall be 2.2 gpm (8.3 L/min) when tested in accordance with ASME A112.18.1/CSA B125.1

4.3.2 Vacuum pumps and air compressors. No potable water shall be used for vacuum pumps and air compressors.

4.3.3 Sterilizers. Sterilizers shall be provided with water recovery provisions.

5 AIRBORNE EMISSIONS, EFFLUENT, AND POLLUTANT CONTROLS

Note: There is no prescriptive or performance option for this criterion.

5.1 Mandatory Requirements

5.1.1 Bi-products of combustion. All combustion systems shall be designed using processes that comply with the local jurisdiction's air quality management district regulations.

5.1.2 Oil interceptors. Oil interceptors shall be established at all drains from parking areas and central plant areas as described in one of the following, whichever is more stringent:

5.1.2.1 Technologies and strategies described in this section for waste water discharge, spill prevention, and hazardous waste containment; or

5.1.2.2 Local regulations for waste water discharge, spill prevention, and hazardous waste containment

5.1.3 Wastewater discharge. Systems shall be designed to allow testing of wastewater discharge.

5.1.4 Spill prevention. To minimize the risk of leakage and spills, above- and below ground containment areas that comply with the following regulations shall be provided for storage of fuels and chemicals:

5.1.4.1 U.S. EPA Spill Prevention, Control, and Countermeasures (SPCC) rule

(www.epa.gov/oem/content/spcc)

5.1.4.2 All applicable state and local administrative codes pertaining to storage tanks

5.1.5 Hazardous waste containment. All outdoor hazardous waste holding areas shall be designed in accordance with 40 CFR Part 264: *Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities* (EPA Resource Conservation and Recovery Act).

5.1.5.1 Secondary containment systems shall be provided for all generators, whether otherwise required or not, to prevent spills and migration of waste to soil and ground or surface water.

5.1.5.2 Covered enclosures shall be provided to prevent precipitation from increasing the risk of contaminated liquids migrating to the soil and ground or surface water.

6 MATERIALS AND RESOURCES

In addition to the mandatory requirements, either the performance option (7.2) or the prescriptive option (7.3) shall be implemented.

6.1 Mandatory Requirements

6.1.1 Areas for recyclables

6.1.1.1 For new building projects, there shall be designated spaces that serve the entire building and are dedicated to the collection and storage of non-hazardous materials for recycling, including paper, corrugated cardboard, glass, plastics, and metals at both the point of service and pickup area(s).

6.1.1.2 The size and functionality of the recycling areas shall be coordinated with the anticipated collection services to maximize the effectiveness of the dedicated areas.

6.1.2 Reduced impact materials. Calculations for compliance shall only include materials permanently installed in the project.

6.1.2.1 The building assembly shall comply with either the performance or prescriptive option for specification of products and materials.

6.1.2.2 The interior fit-out shall comply with either the performance or prescriptive option for specification of products and materials.

6.2 Performance Option

6.2.1 Life cycle assessment (LCA)

6.2.1.1 Life cycle assessment for building assembly

a. A minimum of two alternatives that conform to the owner's project requirements shall be developed for the structural system and building envelope in accordance

with the following:

- ISO 14040 (*Environmental management -- Life cycle assessment -- Principles and framework*)
 - ISO 14044 (*Environmental management -- Life cycle assessment -- Requirements and guidelines*)
- b. Each building structure and envelope alternative shall have a common design, including building size and use; common construction requirements; and materials appropriate for the locale.
- c. The assemblies shall include all structural elements, insulation, and sheathing/envelope, roof/ceiling, and intermediate floors (including interstitial space).

Examples of life cycle assessment tools suitable for completing building assembly LCAs include the following:

- Athena Impact Estimator for Buildings, Version 4.2 or later (www.athenasmi.org/our-software-data/impact-estimator/)
- GaBi (www.gabi-software.com/america/solutions/building-lca/)
- SimaPro (www.simapro.co.uk/)
- CMLCA (<http://cml.leiden.edu/software/software-cmlca.html>)

Building service life and maintenance should be considered when evaluating a building assembly.

6.2.1.2 Life cycle assessment for interior fit-out

- a. This assessment shall be performed in accordance with ISO Standards 14040 and 14044 for a minimum of two alternative interior fit-outs (including finishes and furnishings) that conform to the owner's project requirements.
- b. Each interior fit-out alternative shall provide building service life compliant with the owner's project requirements.

The interior fit-out should include all finishes, furnishings, interior non-bearing partitions, millwork/casework, and interior doors, windows, and openings.

Building service life and maintenance should be considered when evaluating an interior fit-out.

6.3 Prescriptive Option

6.3.1 Building assembly (including structure and envelope)

6.3.1.1 Based on the building application and specification of comparable products (based on cost), 10 percent or more of the material and product specifications for the building assembly shall comply with one or more of the following:

- a. **Environmental Product Declarations (EPDs).** Any EPD® used shall recognize Product Category Rules; conform to ISO Standards 14040, 14044, 14025 (*Environmental labels and declarations – Type III environmental declarations – Principles and procedures*) and 21930 (*Sustainability in building construction -- Environmental declaration of building products*), or EN 15804 (*Sustainability of*

construction works – Environmental product declarations – Core rules for the product category of construction products); at minimum include cradle-to-gate scope; and conform to the requirements for either industry-wide or product-specific EPDs:

- **Industry-wide (generic) EPD.** Products specified for the building assembly shall have third-party verified Type III EPDs, including external verification in which the manufacturer is explicitly recognized as a participant by the program operator.
 - **Product-specific EPD.** Products used for the building assembly shall have publicly available product-specific, third-party verified Type III EPDs, including external verification. “Product-specific” means manufacturer-specific for a product family.
- b. **Third-party certifications.** Products specified shall meet the requirements of multiple-attribute standards developed by an approved standard development organization using a consensus process. Examples of such standards include:
- NSF Sustainability Assessment Standards (http://www.nsf.org/business/sustainability_ncss/index.asp?program=SustainabilityNcs)
 - UL Environment Standards (<http://www.ul.com/global/eng/pages/solutions/standards/accessstandards/sustainabilitystandards/>)
 - Sustainable Forestry Initiative certifications (<http://www.sfiprogram.org/getting-certified/benefits-of-sfi-certification/>)
- c. **Product life cycle**
- Products specified shall have a third-party certified life cycle product assessment based on ISO 14040 and 14044 and minimally covers cradle-to-gate scope.
 - Compliance documentation shall include the life cycle assessment completed by a manufacturer or third party with results verified and/or certified by a third party.

6.3.2 Interior fit-out (including interior finishes and furniture)

6.2.3.1 Based on the building application and specification of comparable products (based on cost), 10 percent or more of the materials and products specified for the interior fit-out assembly shall comply with one or more of the following:

- a. **Environmental Product Declarations.** These shall be EPDs that use recognized Product Category Rules; conform to ISO Standards 14040, 14044, 14025, and 21930 or EN 15804; at minimum include cradle-to-gate scope; and conform to the requirements for industry-wide or product-specific EPD:
- **Industry-wide (generic) EPD.** Products specified for the interior fit-out shall be third-party, certified Type III Environmental Product Declarations (EPDs), including external verification where the manufacturer is explicitly recognized as a participant by the program operator.
 - **Product-specific declaration.** Products specified for the interior fit-out shall be products with a publicly available product specific third-party, certified Type III EPDs, including external verification.

“Product-specific” means manufacturer-specific for a product family.

b. **Third-party certifications.** Products specified shall be based on a multiple-attribute standard developed by an approved standard development organization using a consensus-based process. Examples include:

- NSF Sustainability Assessment Standards
- UL Environment Standards
- Sustainable Forestry Initiative certifications

c. **Product life cycle**

- Products specified shall have a third-party certified life cycle product assessment based on ISO 14040 and 14044 and minimally covers cradle-to-gate scope.
- Compliance documentation shall include the life cycle assessment completed by a manufacturer or third party with results verified and/or certified by a third party.

7 WASTE

Note: There is no prescriptive or performance option for this criterion.

7.1 Mandatory Requirements

7.1.1 Mercury reduction and waste. Building products that contain intentionally added mercury shall not be specified. When there is no alternative, products that minimize mercury content shall be specified.

7.1.1.1 In facilities delivering dental care, amalgam separation devices shall be installed that meet or exceed the requirements of ISO-11143: *Dentistry – Amalgam separators*.

7.1.1.2 An area shall be provided for storing mercury-containing products (e.g., lamps) to be recycled.

7.1.1.3 All illuminated exit signs shall be Energy Star-qualified, UL-certified LED lamps.

7.1.1.4 All fluorescent lamps shall be low-mercury lamps.

Fluorescent lamps other than compact fluorescent lamps (CFLs) should have armor sleeves to reduce and contain breakage.

Maximum Mercury Content of Lamps

<i>Lamp</i>	<i>Maximum content</i>
T-8 fluorescent, 8-foot	10 mg mercury
T-8 fluorescent, 4-foot or shorter	3.5 mg mercury
T-8 fluorescent, U-bent	6 mg mercury
T-5 fluorescent, linear	2.5 mg mercury
T-5 fluorescent, circular	9 mg mercury
Compact fluorescent, non-integral ballast	3.5 mg mercury
Compact fluorescent, integral ballast	3.5 mg mercury, ENERGY STAR-qualified
High-pressure sodium, up to 400 watts	10 mg mercury
High-pressure sodium, above 400 watts	32 mg mercury

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7.1.2 Construction waste management. A construction waste management plan shall be developed and implemented.

7.1.2.1 At minimum, materials shall be identified that can be recovered, reused, and/or recycled and plan to divert them from disposal in landfills or incinerators.

7.1.2.2 The disposal method shall be identified for each material, and whether materials will be sorted or co-mingled on-site shall be determined.

7.1.2.3 At least 50 percent of non-hazardous construction and demolition debris shall be recovered, reused, recycled, and/or salvaged.

7.1.3 Hazardous waste

7.1.3.1 For requirements, see Section 5.1.5 (Hazardous waste containment) under Airborne Emissions, Effluent, and Pollution Controls in this document.

7.1.3.2 Management of hazardous waste disposal shall comply with all applicable state and federal regulations.

7.1.3.3 Certification shall be made that waste minimization activities have been undertaken as stated in 40 CFR 262.27 (Waste minimization certification).