




**ASHRAE/ASHE Standard 189.2P**  
*Standard for the Design, Construction & Operation of Sustainable High-Performance Healthcare Facilities*

**55 YEARS**  
 1955-2010  
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### Learning Objectives for this Session

- First Learning Objective: Understand the basic content and structure of proposed ASHRAE Standard 189.2P and how healthcare facilities would be affected by its adoption.
- Second Learning Objective: Identify the changes reflected in Standard 189.2P from the related Standard 189.1.
- Third Learning Objective: Understand the basic content and structure of proposed ASHRAE Standard 189.2P

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### What is Standard 189.2P?

- An ANSI standard being developed in model code language that provides minimum requirements for sustainable high-performance, healthcare facilities
- 189.2 applies to hospitals, nursing homes and outpatient facilities
- Not a design guide, not a rating system

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### What is Standard 189.2P?

- Based on the Standard 189.1 Standard for the Design of High-Performance Green Buildings
- Modifications and enhancements to address the special conditions of a healthcare environment, including

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### Sponsors and Project Committee 189.2

- Consensus process
- Sponsor and co-sponsors:
  - ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
  - ASHE - American Society for Healthcare Engineering
- Project committee: 26 members

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### Recent Adoption of 189.1

Home > Press Room >

#### ASHRAE: Standard 189.1 Adopted as Part of Army Sustainability Policy



For Release:  
Dec. 20, 2010

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**ATLANTA** – ASHRAE leaders recently met with U.S. Army officials regarding a new sustainable design and development policy that incorporates requirements of the green building standard developed by the Society, USGBC and IES.

The U.S. Army has made it a matter of policy to promote sustainability and improve green building standards for its facilities. On Oct. 27, 2010, Katherine Hammack, assistant secretary of the Army for installations, energy and the environment (IE&E), issued a policy memorandum that incorporates ANSI/ASHRAE/USGBC/IES Standard 189.1-2009, *Standard for the Design of High-Performance, Green Buildings Except Low-Rise Residential Buildings*.

The Army's policy sets a new approach to the design and construction of efficient military construction projects and major renovations by using Standard 189.1 as the baseline. The policy requires that facility construction projects follow specified requirements and guidance in the standard. These requirements address siting, energy efficiency, cool roofs, metering, storm water management and indoor and outdoor water consumption.

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## Scope of Standard 189.2

- Applies to ...
  - new buildings and their systems, new portions of buildings and their systems and new systems and equipment in existing buildings

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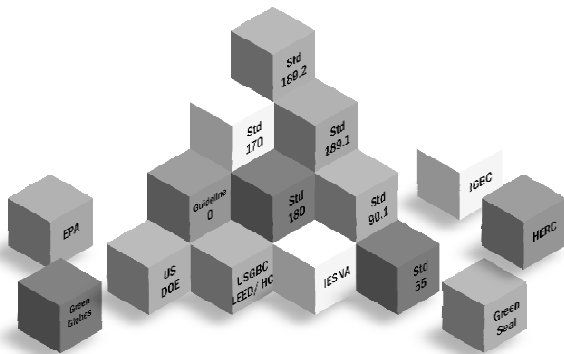
## Goals for Standard 189.2

- Establish mandatory criteria in all topic areas
  - one "challenge" with existing rating systems is that they contain few mandatory provisions
  - consequently, a designer can achieve "points" & claim that they have a "green building", but still make no improvements in some areas
- Provide simple compliance options
- Complement green building rating programs
  - Std 189.2 is not intended to compete with green building rating programs

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## Standard 189.2 Building Blocks



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## Standard 189.2 Chapter Structure

- x.1: Scope
- x.2: Compliance
- x.3: Mandatory  
(required for all projects)
- x.4: Prescriptive option  
(simple option, very few calculations)
- x.5: Performance option  
(more options, but more effort)

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## Standard 189.2 Topic Areas

SS	Site Sustainability
WE	Water Use Efficiency
EE	Energy Efficiency
IEQ	Indoor Environmental Quality
MR	Building's Impact on the Materials and Resources
CO	Construction and Plans for Operation
PC	Emissions, Effluents & Pollution Control

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## Development Process for Standard 189.2

- January 2009: First meeting as a Standard Project Committee
- March-May 2011: Anticipated First Public Review
- June-November 2011: Anticipated Second Public Review
- January-June 2012: Finalization and Approvals for Publication

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## Sustainable Sites Mandatory Provisions

2. Reduce Heat Island Effect
3. Reduction of Light Pollution



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## Sustainable Sites Mandatory Provisions

### 2. Reduce Heat Island Effect

- Site hardscape: 50% to be shaded (within 5 years of planting), or be SRI 29, or shaded by structures
- Walls: to be shaded on at least 30% of east and west walls up to 20 feet above grade within 5 years
- Roofs (climate zones 1-3): to be SRI 78 (low-slope), 29 (steep-slope) or cool roof



**solar reflectance index (SRI):** a measure of a constructed surface's ability to reflect solar heat, as shown by a small temperature rise. A standard black surface (reflectance 0.05, emittance 0.90) is 0 and a standard white surface (reflectance 0.80, emittance 0.90) is 100.

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## Sustainable Sites Mandatory Provisions

### 3. Reduction of Light Pollution

- Outdoor lighting power allowances (Standard 90.1 Addendum i)
- Maximum allowable Backlight, Uplight And Glare (BUG) ratings for luminaires by lighting zone type per ASHRAE 90.1



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## Sustainable Sites Prescriptive Options

### • Site Development

- All sites:  
Minimum 40% of site area to be effective pervious surface (vegetation, green roof, porous pavers) – exceptions for areas with <10 inches annual average rainfall
- Greenfield sites:  
Minimum 20% of area to be native or adapted plants



**greenfield site:** a site of which 20% or less has been previously developed with impervious surfaces.

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## Sustainable Sites Performance Option

- Site Development – Average Annual Rainfall shall be Managed
  - Existing Building: minimum 20%
  - Greyfield Sites: minimum 40%
  - All Other Sites: minimum 50%
  - ...of the average annual rainfall on the development footprint shall be managed through infiltration, reuse, or evapotranspiration

**greyfield site:** a site of which more than 20% is already developed with impervious surfaces.

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## Water Use Efficiency Mandatory Provisions

### • Site Water Use

- Bio-diverse plantings, hydrozoning, & smart irrigation controllers

### • Building Water Use

- Plumbing fixtures & fittings, appliances, HVAC systems & equipment, generally 40% lower than U.S. EPA 1992 (ie: toilets =1.28 gpf or dual flush)
- Disallow once through cooling with potable water – except as back-up use only for medical equipment



**hydrozoning:** to divide the landscape irrigation system into sections in order to regulate each zone's water needs based on plant materials, soil and other factors.

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## Water Use Efficiency Mandatory Provisions



- Water Metering
  - Measurement devices with remote communication capability shall be provided to collect water consumption data
    - Water supply source to the building (Table 5.3.3-1)
    - Key systems (Table 5.3.3-2)

Table 6.3.3-1 Water Supply Source Meter Thresholds.

Water Source	Main Metering Threshold
Potable water	1,000 gal/day ( 3,800 L/day)
Municipally reclaimed water	1,000 gal/day ( 3,800 L/day)
Alternate sources of water	500 gal/day ( 1,900 L/day)

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## Water Use Efficiency Mandatory Provisions



- Water Metering

Table 6.3.3-2 Subsystem Water Measurement Thresholds

Subsystem	Sub-Metering Threshold
Cooling towers (Meter on Make-up water and Blowdown)	Cooling tower flow through tower > 500 gpm (30 L/s)
Evaporative coolers	Makeup water > 0.6 gpm (0.04 L/s)
Steam and hot-water boilers	> 500,000 BTU/h (50 kW) input
Total Irrigated landscape area with controllers	> 25,000 ft <sup>2</sup> (2,500 m <sup>2</sup> )
Separate campus or project buildings	Consumption > 1,000 gal/day (3,800 L/day)
Separately leased or rental space	Consumption > 1,000 gal/day (3,800 L/day)
Any large water using process	Consumption > 1,000 gal/day (3,800 L/day)

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## Water Use Efficiency Prescriptive Option



- Site Water Use
  - Maximum 1/3 of improved landscape can be irrigated with potable water
- Building Water Use Reduction
  - Cooling towers
    - <200 ppm hardness to have minimum 5 cycles of concentration
    - >200 ppm hardness to have minimum 3.5 cycles of concentration
  - Efficient commercial food service and laboratories
- Special Water Features
  - Fountain water must be from alternate source or reclaimed (no potable water)
  - Exception: use potable water if determined necessary by Infection Control

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## Water Use Efficiency Performance Option



- Site Water Use Reduction
  - proposed potable water for irrigation < 35% of baseline evapotranspiration
- Building Water Use
  - proposed water use < mandatory plus prescriptive

**Evapotranspiration (ET):** the sum of evaporation and plant transpiration. Evaporation accounts for the movement of water to the air from sources such as the soil, canopy interception, and water bodies. Transpiration accounts for the movement of water within a plant and the subsequent loss of water as vapor through stomata in its leaves.

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## Energy Efficiency Requirements Overview

- More stringent than Standard 90.1-2007 – with a goal of achieving 30% lower !
- Plug/process loads
- Electric Peak Demand Reduction in 189.1 is NOT INCLUDED
  - 10% peak reduction is required in 189.1
- Energy measurement for verification
- Renewable energy provisions

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## Energy Efficiency Mandatory Provisions



- Meet 90.1 Prescriptive Requirements
  - Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4
- Provide for future on-site renewable energy power systems
  - Building projects design shall show allocated space for installation of on-site renewable energy systems.
  - Minimum rating of 3.7 W/ft<sup>2</sup> or 13 Btu/h-ft<sup>2</sup> (40 W/m<sup>2</sup>) multiplied by the total roof area
  - Exception for areas with incident solar radiation less than 4.0 kWh/m<sup>2</sup>-day

**on-site renewable energy system:** photovoltaic, solar thermal, geothermal energy, and wind systems used to generate energy and located on the building project.

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## Energy Efficiency Mandatory Provisions



### • Energy Consumption Management

- Measurement devices with remote communication capability shall be provided to collect energy consumption data
  - Energy supply source to the building (Table 7.3.3-1)
  - Key systems (Table 7.3.3-2)

Table 7.3.3.1-1 Energy Source Thresholds

Energy Source	Threshold
Electrical service	> 200 kVA
On-site renewable electric power	All systems > 1 kVA (peak)
Gas and district services	> 1,000,000 Btu/h (300 kW)
Geothermal energy	> 1,000,000 Btu/h (300 kW) heating
On-site renewable thermal energy	> 100,000 Btu/h (30 kW)

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## Energy Efficiency Mandatory Provisions



### • Energy Consumption Metering

Table 7.3.3.1-2 System Energy Use Thresholds

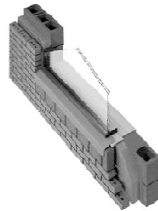
Use (total of all loads)	Sub-System Threshold
HVAC System	Connected electric load > 100kVA
HVAC System	Connected gas or district services load > 500,000 Btu/h (150 kW)
People moving	Sum of all feeders > 50 kVA
Lighting	Connected load > 50 kVA
Process and Plug	Connected load > 50 kVA
Process	Connected gas or district services load > 250,000 Btu/h (75 kW)

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## Energy Efficiency Prescriptive Option



### • CZ-3 Building Envelope (IP)

- Roof Insulation
  - 189.2: R- 25 c.i., R- 49 attic
  - 90.1: R- 20 c.i., R- 38 attic
- Walls
  - 189.2: Steel framed R-13 cavity + R-5 c.i., R-9.5 c.i. mass wall
  - 90.1: Steel framed R-13 cavity + R-3.8 c.i., R-7.6 c.i. mass wall
- Fenestration Assemblies

	90.1	189.1
nonmetal frame	U-0.65	U-0.45
curtainwall	U-0.60	U-0.50
other metal	U-0.65	U-0.55
SHGC	0.25	0.25

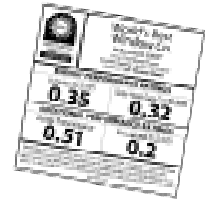
West Coast Location Example

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## Energy Efficiency Prescriptive Option



### • CZ-3 Building Envelope (IP)

#### • Fenestration Assemblies

	90.1	189.1
nonmetal frame	U-0.65	U-0.45
curtainwall	U-0.60	U-0.50
other metal	U-0.65	U-0.55
SHGC	0.25	0.25

West Coast Location Example

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## Energy Efficiency Prescriptive Option

### • Building Envelope

- Vertical fenestration area < 40% of the gross wall area
- W, S & E permanent projections for vertical fenestration (climate zones 1-5)



Projection Factor PF ≥ 0.5

- Fenestration orientation (climate zones 1-4):  
 $(Area_W * SHGC_W + Area_S * SHGC_S) \geq 1.1 * (Area_W * SHGC_W + Area_E * SHGC_E)$

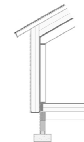
West Coast Location Example

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## Energy Efficiency Prescriptive Option



### • Building Envelope

- Continuous air barrier requirement
  - Using individual materials that have an air permeability ≤ 0.004 cfm/ft² under a pressure differential of 0.3 in. W.C.
  - Using assemblies of materials and components that have an average air leakage ≤ 0.04 cfm/ft² under a pressure differential of 0.3 in. W.C.
  - Testing the completed building and demonstrating that the air leakage rate of the building envelope ≤ 0.4 cfm/ft² under a pressure differential of 0.3 in. W.C.

**continuous air barrier:** the combination of interconnected materials, assemblies and flexible sealed joints and components of the building envelope that provide air-tightness to a specified permeability.

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## Energy Efficiency Prescriptive Option

- On-site renewable energy systems that provide the annual energy production equivalent of 6.0 KBTU/ft<sup>2</sup> of conditioned space
  - Exception for areas with incident solar radiation less than 4.0 kWh/m<sup>2</sup>-day and purchase of green power of 75 kWh/ft<sup>2</sup>-yr for a period not to exceed ten years
- April Fools – Not Required in 189.2 (but this is a requirement in 189.1....)



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## Energy Efficiency Prescriptive Option

- Mechanical
  - Minimum equipment efficiency – either
    - Baseline is EPA efficiencies (Std 90.1)
    - Energy Star / Appendix C efficiencies



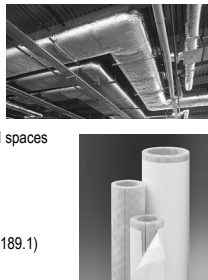
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## Energy Efficiency Prescriptive Option

- Mechanical
  - Demand control ventilation for densely occupied spaces
  - Economizer cycle for units > 33,000 Btuh
  - Seal Level A duct sealing
  - Additional pipe/duct insulation
  - Fan power to meet Standard 90.1 (10% less in 189.1)
  - Exhaust air energy recovery



*densely occupied space:* those spaces with a design occupant density greater than or equal to 25 people per 1000 ft<sup>2</sup>

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## Energy Efficiency Prescriptive Option

- Lighting
  - Occupancy sensor controls
  - Occupancy sensor controls with multi-level switching or dimming
  - Interior lighting power to be 10% less the 90.1-2007 LPD
  - Lighting for building security or emergency egress  $\leq 0.1$  W/ft<sup>2</sup>
  - Automatic controls for lighting in daylight zones
- Lighting Power Density
  - Table of Lighting Power Density Levels based on Medical Use Space



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## Energy Efficiency Prescriptive Option

- Other Equipment
  - Energy Star equipment and appliances if installed prior to issuance of certificate of occupancy



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## Energy Efficiency Performance Option

- Annual Energy Cost
  - Proposed  $\leq$  mandatory plus prescriptive
- Annual Carbon Dioxide Equivalent (CO<sub>2</sub>e)
  - Proposed  $\leq$  mandatory plus prescriptive
- Peak Electric Demand
  - Proposed  $\leq$  mandatory plus prescriptive

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## Indoor Environmental Quality Mandatory Provisions



- Indoor Air Quality
  - Ventilation rates per ASHRAE Standard 170
  - Outdoor air delivery monitoring
    - Outdoor air flow rate monitoring of minimum outside air
  - MERV 8 filter (MERV 13 in PM<sub>2.5</sub> non-attainment areas)
  - Eliminate air bypass around filters
  - No smoking inside building
  - Building entrance entry mat system

IEQ

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## Indoor Environmental Quality Mandatory Provisions



- Thermal Environmental Conditions
  - Comply with ASHRAE Std 55 Section 6.1 Design and 6.2 Documentation
- Acoustical Control
  - Defined STC values for exterior and interior assemblies
- Daylighting by Toplighting (skylights)
  - Targeted for large enclosed spaces in buildings ≤ three stories
- Soil Gas Retarder System
  - Brownfields or radon

IEQ

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## Indoor Environmental Quality Prescriptive Option



- Daylighting by Sidelighting
  - Office spaces and classrooms
  - Minimum effective apertures
  - Minimum interior surface visible light reflectances
  - Minimum shading projection factors

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## Indoor Environmental Quality Prescriptive Option



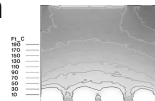
- Materials
  - Emissions and VOC requirements
    - Adhesives and sealants
    - Paints and coatings
    - Floor covering materials
    - Composite wood and agrifiber products
    - Office furniture systems and seating
    - Ceiling and wall systems

IEQ

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## Indoor Environmental Quality Prescriptive or Performance Option



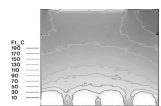
- Daylighting
  - Prescriptive: Defines applicability
    - Office spaces and classrooms
    - Minimum effective apertures
    - Minimum interior surface visible light reflectances
    - Minimum shading projection factors
  - Performance: Physical or computer model, minimum illuminance target: 30 fc (300 lux) on work surfaces, noon equinox
    - Anti-glare rule

IEQ

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## Indoor Environmental Quality Performance Option



- Daylighting
  - Physical or computer model, minimum illuminance target: 30 fc (300 lux) on work surfaces, noon equinox
  - It shall be demonstrated that direct sun does not strike the workplane in any daylit space for more than 20% of the occupied hours during an equinox day in regularly occupied office spaces
- Materials
  - VOC emissions model for building materials per CA/DHS/EHLB/R-174 Section 4.3

IEQ

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## The Building's Impact on Material and Resources - Mandatory Provisions

- Construction waste management
  - A minimum of 50% of non-hazardous construction and demolition waste material shall be diverted
  - Total waste on new building projects shall not exceed 42 cubic yards or 12,000 lbs per 10,000 ft<sup>2</sup> of new building area
- Wood products
- Refrigerants – moved to Section 11
- Storage and collection of recyclables and discarded goods

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## The Building's Impact on the Atmosphere Prescriptive Option

- Reduced Impact Materials
  - Recycled content
  - Bio-based
  - Locally sourced
- Life Cycle Assessment
  - For 2 building material selections



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## The Building's Impact on the Atmosphere Prescriptive Option

- Reduced Impact Materials
  - The sum of post-consumer recycled content plus one-half of the pre-consumer recycled content shall constitute a **minimum of 10%, based on cost**, of the total materials in the building project
  - A **minimum of 5%** of building materials used, based on cost, shall be biobased products
  - A **minimum of 15%** of building materials or products used, based on cost, shall be regionally extracted/harvested/recovered or manufactured within a radius of 500 miles of the project site



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## The Buildings Impact on the Atmosphere Performance Option

- Life Cycle Assessment
  - ISO Standard 14044 of a minimum of two building alternatives
  - The building alternative chosen for the project shall have a 5% improvement over the other building alternative
    - Life cycle inventory (LCI)
    - Compare the two building alternatives using a published third-party impact indicator method
    - Conduct a critical review by an external expert independent of those performing the LCA

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## Construction and Operation Mandatory Provisions

- Plans for Construction
  - Building Acceptance Testing
    - Verify installation and start-up
    - Verify systems manual
  - Building Commissioning
  - Erosion and Sediment Control
  - IAQ Construction Management
  - Moisture Control
  - Construction Activity Pollution Prevention



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## Construction and Operation Mandatory Provisions

- Plans for Construction
- Commissioning (> 5,000 ft<sup>2</sup>)
- IAQ Construction Management Plan
- Plans for Operation



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## Construction and Operation Mandatory Provisions

### • Commissioning (> 5,000 ft<sup>2</sup>)

- Activities prior to building permit
  - Designate commissioning authority
  - Owner Project Requirements
  - Basis of Design
  - Commissioning Plan
- Activities prior to occupancy
  - Verify performance
  - Verify training
  - Commissioning report
- Post-occupancy activities

**commissioning authority (CxA):** An entity identified by the owner who leads, plans, schedules, and coordinates the commissioning team to implement the building commissioning process.

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## Construction and Operation Mandatory Provisions

### • IAQ Construction Management Plan

- Air conveyance materials shall remain clean
- Post-construction, pre-occupancy flush-out
  - Option A - 24-hr flush-out & baseline IAQ testing prior to occupancy
  - Option B - Continuous flush-out

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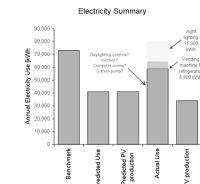
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## Construction and Operation Mandatory Provisions

### • Plans for Operation

- High-Performance Building Operation Plan
  - Site sustainability
  - Track and assess energy and water use
  - Measurement & verification
  - Indoor air quality
  - Green cleaning
- Maintenance plans



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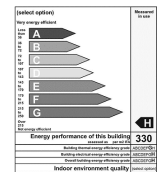
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## Construction and Operation Mandatory Provisions

### • Energy Efficiency Plan for Operation

- Initial measurement & verification
  - After acceptance testing is complete
- Track and assess energy consumption
  - After 12 months but no later than 18 months after certificate of occupancy
  - Energy usage reports (both consumption and demand)
  - Energy Star Portfolio Manager to track performance
  - Assess energy performance

**verification:** The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the owner's project requirements.



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## Emissions, Effluents & Pollution Control Mandatory Provisions

### • Emissions

- Refrigerants
- Boilers
- Medical Waste Incinerator



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## Emissions, Effluents & Pollution Control Mandatory Provisions

### • Mandatory Provisions

- Effluents
  - Hazard Chemical Management for ...
    - Sanitary Sewer Discharge
    - Pharmaceuticals in Sanitary Sewer
    - Sterilization Chemicals
    - Disinfection Chemicals
    - Lab Chemicals
    - Radiology Chemicals
    - Pharmaceuticals
  - Chemical Control – Leaks and Spills
  - Polychlorinated Biphenyl (PCB) Removal
  - Asbestos-Containing Material

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## Emissions, Effluents & Pollution Control Mandatory Provisions

- **Mandatory Provisions**
  - Solid Waste
    - Construction Waste – 25% diversion rate
    - Recycling & Reuse Plan
    - Waste Stream Audit
    - Recycling Program
    - Regulated Medical Waste
    - Universal Waste (ie mercury-containing lamps, CRTs, PCs)

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## Emissions, Effluents & Pollution Control

- **Elective Provisions**
  - Waste Anesthetic Gas Recovery
  - Boiler and Water Heater Emissions
    - increased air quality standards
  - Waste Management Plan, Waste Stream Audit, Regulated Medical Waste
    - Goal-setting and reporting
  - Likely to be included as Informative Appendix

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## Questions



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## Acknowledgements & Further Information

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- Information on ASHRAE standards: [www.ashrae.org](http://www.ashrae.org) then follow "Standards"
- Information on ASHE programs: [www.ashe.org](http://www.ashe.org)

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