

## **Proposed revision to International Green Construction Code (IgCC) for inclusion of low-rise residential structures (with complete IgCC references)**

**Commenter's Reason:** We propose reintroducing residential structures to the scope of the IgCC. The striking of point 1 in section 101.2 allows that to happen and also paves the way for other portions of our comment, which is a collection of existing IgCC code provisions that are commonly accepted as a minimum standard of care for higher-performance low-rise residential structures. These provisions reference existing language in the IgCC that is applicable to and appropriate for low-rise residential buildings.

The time is now long overdue to provide helpful and meaningful guidance for **all** buildings. Structures have an impact on human and environmental health, but the industry has access to many mainstream technologies and methods that can slow or reverse the cumulative impacts of our built environment. Such actions are an important recognition of our responsibility to future generations.

### **102.4.13**

This proposal provides the I-Codes foundation for residential occupancies under the scope of the International Residential Code (IRC), which will now be covered under the scope of the IgCC under the proposed changes here to Sections 102.1 and 105.4.13. This is necessary because the IgCC is an overlay code and the coverage which the IRC provides, including building, plumbing, structural, electrical, etc., is critical to support "green" building practices.

### **New Chapter X**

We believe there is strong support within both the building and energy efficiency community for code requirements for residential structures that embrace and advance green building technologies, materials and methods. One can easily look at states like North Carolina, Vermont and Oregon to see examples of collaboration in the name of sustainability within the residential building community. While GG-2 was recommended for disapproval in Dallas, it was clear that the Hearing Committee's recommendation was based on the technical content of certain sections, not a philosophical rejection of the scope and coverage of a green construction code that embraces, guides and governs low-rise residential occupancies.

### **The Development Committee's technical concerns have been addressed in this revised proposal.**

To do that, we assembled a volunteer group of industry experts to create a common sense, simple approach to reintroducing residential into the IgCC. With technical support and input from the Southern Nevada Water Authority and code officials in multiple states, we feel this proposal is in line with the philosophies of the public hearing committees in both Chicago and Dallas.

Many jurisdictions are looking to the ICC for guidance on code language that can incorporate a broader set of protections from common risks to human and environmental health in residential structures. Some have had to take the bold step of creating their own guidelines in the absence of such national codes or standards. The IgCC provides that answer for commercial buildings, and this proposal extends achievable and applicable code provisions to low-rise residential buildings.

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Proposed code language (Public Comment #1 on GG2-11) begins on next page. See the official proposal at:

<http://www.usgbc.org/ShowFile.aspx?DocumentID=10303>

Read two authors' articles about the proposal at:

<http://usgbcblog.blogspot.com/2011/09/code-guidance-for-greener-homes-one.html>

<http://gbco.convio.net/site/PageServer?pagename=ActionAlerts#Alerts>

## Public Comment 1:

**Mike Collignon, Green Builder® Coalition, Jeremy Sigmon, U.S. Green Building Council, and R. Christopher Mathis, MC2 Mathis Consulting Company request Approval as Modified by this Public Comment.**

**Modify the proposal as follows:**

**101.2 Scope.** The provisions of this code shall apply to the design, construction, *addition, alteration, change of occupancy*, movement, enlargement, replacement, *repair*, equipment, location, maintenance, removal and demolition of every *building or structure* or any appurtenances connected or attached to such *buildings or structures* and to the site of which the *building* is located. Occupancy classifications shall be determined in accordance with the *International Building Code*. This code shall not apply to equipment or systems that are used primarily for industrial or manufacturing processes.

**102.4.13 Residential occupancies.** The provisions of the International Residential Code shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of detached one- and two-family dwellings and multiple single-family dwellings (townhouses) not more than three stories above grade plane in height with a separate means of egress and their accessory structures.

~~**105.4.3 Alternative residential compliance.** Detached one and two family dwellings and multiple single family dwellings (townhouses) not more than three stories in height with a separate means of egress, and Group R-2, R-3 and R-4 occupancies not more than three stories in height, that comply with other alternative residential green construction programs, rating systems or standards that the code official finds are equivalent in application and effectiveness, shall be approved in lieu of compliance with the requirements of this code. In determining equivalency, the code official shall consider the following subject areas:~~

- ~~1. Energy efficiency~~
- ~~2. Indoor environmental quality~~
- ~~3. Sustainable site planning & management~~
- ~~4. Material and resource efficiency~~
- ~~5. Water efficiency~~

**Add new chapter as follows:**

### **CHAPTER X SPECIAL DETAILED REQUIREMENTS BASED ON USE AND OCCUPANCY**

**X01.1 Special residential construction.** One- and two family dwellings and townhouses not more than three stories in height with a separate means of egress and their accessory structures shall comply with Sections X01.1.1 through X01.1.6. Compliance with other provisions of this code shall not be required except where other sections are specifically referenced in these sections.

**X01.1.1 Site development and land use.** Building site development and land use shall be in accordance with the following.

1. Where provided, landscape irrigation shall be in accordance with Sections 402.3.3, 402.3.3.1 and 402.3.3.2, except that nonpotable water irrigation systems shall be permitted only where allowed by the jurisdiction.

*[Language extracted from IgCC PV-2.0]*

*402.3.3 Landscape irrigation systems. Irrigation of exterior landscaping shall comply with Sections 402.3.3.1 and 402.3.3.2.*

*402.3.3.1 Water for outdoor landscape irrigation. Water used for outdoor landscape irrigation shall be non-potable and shall comply with Section 406.2.*

*Exceptions: Potable water is permitted to be used as follows:*

1. *During the establishment phase of newly planted landscaping. The establishment phase shall be not longer than the following:*

- 1.1.3 years for trees
- 1.2.2 years for shrubs
- 1.3.1 year for herbaceous cover plants

- 2. To irrigate food production.
- 3. To supplement non-potable water irrigation of shade trees provided in accordance with Section 404.2.3.
- 4. Potable water is permitted for landscape irrigation where approved by local ordinance or regulation.

**402.3.3.2 Irrigation system design and installation.** Landscape irrigation systems shall be designed and installed to provide the minimum amount of irrigation required for maintenance of vegetation in the landscaping of the building site. The systems shall utilize one or more of the following: drip irrigation, subsurface, subsoil and surface irrigation. The irrigation system shall be divided into zones based on the water needs of the plant materials. Landscape irrigation systems shall not direct water onto building exterior surfaces, foundations or exterior paved surfaces.

2. Building site construction waste management shall be in accordance with Section 402.3.6. [now 406.2, per May 2011 approval of GG166-11]

[Language extracted from IgCC PV-2.0]

**402.3.6 Building site waste management plan.** A building site waste management plan shall be developed and implemented to recycle or salvage not less than 75 percent of the land-clearing debris and excavated soils. Land-clearing debris includes rock, trees, stumps and associated vegetation. The plan shall include provisions that address all of the following:

- 1. Materials to be diverted from disposal by efficient usage, recycling or reuse on the building site shall be specified. Documentation supplied by the recycling or reuse facility collecting materials shall be provided as proof of compliance with this code.
- 2. Diverted materials shall not be sent to sites that are agricultural land, flood hazard areas or greenfield sites where development is prohibited by Section 402.2.
- 3. The effective destruction and disposal of invasive plant species.
- 4. Where contaminated soils are removed, the methods of removal and location where the soils are to be treated and disposed.
- 5. The amount of materials to be diverted shall be specified and shall be calculated by weight or volume, but not both.
- 6. Where the site is located in a federal or state designated quarantine zone for invasive insect species, building site vegetation management shall comply with the quarantine rules.

Construction materials and waste and hardscape materials removed during site preparation shall be managed in accordance with Section 502.1.

5. Heat island mitigation shall be in accordance with Section 404.

[Language extracted from IgCC PV-2.0]

**SECTION 404  
HEAT ISLAND MITIGATION**

**404.1 General.** The heat island effect of building and building site development shall be mitigated in accordance with Sections 404.2 and 404.3.

**404.2 Site Hardscape.** In climate zones 1 through 6, as established in the International Energy Conservation Code, not less than 50 percent of the site hardscape shall be provided with one or any combination of options described in Sections 404.2.1 through 404.2.4. For the purposes of this section, site hardscape shall not include areas of the site covered by solar photovoltaic arrays or solar thermal collectors.

**404.2.1 Site hardscape materials.** Hardscape materials shall have a minimum initial Solar Reflectance Index of 29 when determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h-ft<sup>2</sup> (12 W/m<sup>2</sup>\*k).

**Exception:** Pervious concrete pavements shall be allowed to be considered as a hardscape material that is deemed to comply with the criteria for solar reflectance and need not be tested in accordance with ASTM E1980.

**404.2.2 Shading structures.** Where shading is provided by a building or structure or an element or component thereof, such building, structure, component or element shall comply with all of the following:

- 1. Where open trellis-type free standing structures such as, but not limited to, covered walkways, and trellises or pergolas, are covered with native plantings, the plantings shall be designed to achieve mature coverage within five years;
- 2. Parking shading structures shall comply with Section 404.3;
- 3. Shade provided onto the hardscape by an adjacent building or structure located on the same lot shall be calculated and credited toward compliance with this section based on the projected peak sun angle on the summer solstice.

**404.2.3 Shade by trees.** Where shading is provided by trees, such trees shall be selected and placed in accordance with all of the following:

1. Trees selected shall be those that are native to, or non-invasive and adaptive to, the region and climate zone in which the project site is located. Plantings shall be selected and sited to produce a hardy and drought resistant vegetated area;
2. Construction documents shall be submitted that show the planting location and anticipated ten year canopy growth of all trees and that show the contributions of existing tree canopies; and;
3. Shading calculations shall be shown on the construction documents demonstrating compliance with this section and shall include only those hardscape areas directly beneath the trees based on a ten year growth canopy. Duplicate shading credit shall not be granted for those areas where multiple trees shade the same hardscape.

**404.2.4 Pervious and permeable pavement.** Pervious and permeable pavements including open grid paving systems and open-graded aggregate systems shall have a percolation rate not less than 2 gallons per minute per square foot (100 L/min x m<sup>2</sup>) and shall have not less than 6 inches (152 mm) of open graded base below the pavement or pavers. Pervious and permeable pavement shall be permitted where the use of these types of hardscapes does not interfere with fire and emergency apparatus or vehicle or personnel access and egress, utilities, or telecommunications lines. Aggregate used shall be of uniform size.

**404.3 Roof coverings.** Not less than 75 percent of the roof surfaces of buildings located in climate zones 1 through 3, as established in the International Energy Conservation Code, shall be in compliance with Section 404.3.1 or 404.3.2, or a combination of both methods.

**Exception:** Portions of roof surfaces where solar thermal collectors, solar photovoltaic systems, roof penetrations and associated equipment, portions of the roof used to capture heat for building energy technologies, rooftop decks or walkways, or vegetative roofing systems are provided shall be permitted to be deducted from the roof surface required to comply with this section.

**404.3.1 Roof solar reflectance and thermal emittance.** Where roof coverings are used for compliance with Section 404.3, roof coverings shall comply with Section 404.3.1.1 or 404.3.1.2. The values for solar reflectance and thermal emittance shall be determined by an independent laboratory accredited by a nationally recognized accreditation program. Roof products shall be labeled and certified by the manufacturer demonstrating compliance.

**404.3.1.1 Roof products testing.** Roof products shall be tested for a minimum three-year aged solar reflectance in accordance with ASTM E1918, ASTM C1549 or Test Method One of CRRC-1 Standard and thermal emittance in accordance with ASTM C1371 or ASTM E408, and shall comply with the minimum values in Table 404.3.1.

**404.3.1.2 Solar reflectance index.** Roof products shall be permitted to use a Solar Reflectance Index (SRI) where the calculated value is in compliance with Table 404.3.1 values for Minimum Aged SRI. The SRI value shall be determined using ASTM E1980 with a convection coefficient of 2.1 Btu/h-ft<sup>2</sup> (12 W/m<sup>2</sup>\*k) based on three-year aged roof samples tested in accordance with the test methods in Section 404.3.1.1

**TABLE 404.3.1  
REFLECTANCE AND EMITTANCE**

| Roof Slope      | Minimum Aged Solar Reflectance | Minimum Aged Thermal Emittance | Minimum Aged SRI |
|-----------------|--------------------------------|--------------------------------|------------------|
| Less than 2:12  | 0.55                           | 0.75                           | 60               |
| 2:12 or greater | 0.30                           | 0.75                           | 25               |

**404.3.2 Vegetative roofs.** Roofs shall be covered with either an extensive or intensive vegetative roof. Vegetative roofs shall comply with Section 406.6.

**X01.1.2 Material resource conservation and efficiency.** Building material resource conservation and efficiency shall be in accordance with the following:

1. Construction material and waste management shall be in accordance with Section 502.  
[Language extracted from IgCC PV-2.0]

**SECTION 502  
MATERIAL AND WASTE MANAGEMENT**

**502.1 Construction material and waste management plan.** Not less than 50 percent of non-hazardous construction waste shall be diverted from landfills, except where other percentages are indicated in Table 302.1. A Construction Material and Waste Management Plan shall be developed and implemented to recycle or salvage construction materials and waste. The Construction Material and Waste Management Plan shall comply with all of the following:

1. The location where the collection, separation and storage of recyclable construction waste materials such as wood, paper, plastic, aluminum, steel, iron, gypsum board, carpet, mineral fiber, acoustical ceiling tile, glass and concrete, shall be indicated.
2. Materials to be diverted from disposal by efficient usage, recycling, reuse on the project, or salvage for future use or sale shall be specified.

3. The amount of materials to be diverted shall be specified and shall be calculated by weight or volume, but not both.

For the purpose of this section, construction and waste materials shall not include land clearing debris, excavated soils and fill and base materials such as, but not limited to, topsoil, sand and gravel. Land-clearing debris shall include trees, stumps, rocks, and vegetation. Excavated soil, fill material and land-clearing debris shall be managed in accordance with Section 402.3.6.

**502.2 Recycling areas for waste generated post certificate of occupancy.** Waste recycling areas for use by building occupants shall be provided in accordance with one of the following:

1. Waste recycling areas shall be designed and constructed in accordance with the jurisdiction's laws or regulations;
2. Where laws or regulations do not exist or where limited recycling services are available, waste recycling areas shall be designed and constructed to accommodate recyclable materials based on the availability of recycling services;
3. Where recycling services are not available, waste recycling areas shall be designed and constructed to accommodate the future recycling of materials in accordance with an approved design. The approved design shall meet one of the following:
  - 3.1 The approved waste recycling area design shall be based on analysis of other regional recycling services, laws or regulations.
  - 3.2 The approved waste recycling area shall be designed to meet the needs of the occupancy, facilitate efficient pick-up, and shall be available to occupants and haulers.

**502.3 Storage of lamps, batteries and electronics.** Storage space shall be provided for fluorescent lamps, HID lamps, batteries, electronics, and other discarded items requiring special disposal by the jurisdiction.

2. Material selection shall be in accordance with Section 503.  
[Language extracted from IgCC PV-2.0]

#### **SECTION 503 MATERIAL SELECTION**

**503.1 Material selection and properties.** Building materials shall conform to Sections 503.2 and 503.3.

**Exception:** Electrical, mechanical, plumbing, security and fire detection, and alarm equipment and controls, automatic fire sprinkler systems, elevators and conveying systems shall not be required to comply with Section 503.

**503.2 Material selection.** Not less than 55 percent of the total building materials used in the project, based on mass or cost, shall comply with Section 503.2.1, 503.2.2, 503.2.3, 503.2.4 or 503.2.5. Compliance shall be demonstrated in accordance with those sections singularly or in combination. Materials regulated by Sections 503.2.2, 503.2.3, 503.2.4 and 503.2.5 shall have a design life that is equal to or greater than that indicated in the building service life plan in accordance with Section 505.1.

**503.2.1 Used materials.** Used materials shall comply with the provisions for such materials in accordance with the applicable code referenced in Section 102.4 and the applicable requirements of this code.

**503.2.2 Recycled content building materials.** Recycled content building materials shall comply with one of the following:

1. Contain not less than 25 percent combined post-consumer and pre-consumer recovered material, and shall comply with Section 503.2.3.
2. Contain not less than 50 percent combined post-consumer and pre-consumer recovered material.

The pre-consumer recycled content shall be counted as one-half of its actual content in the material.

**503.2.3 Recyclable building materials.** Building materials shall be manufactured for recyclability with a minimum recovery rate of not less than 30 percent through recycling and reprocessing.

**503.2.4 Bio-based materials.** Bio-based materials shall be those materials that comply with one or more of the following:

1. Contain not less than 25 percent combined post-consumer and pre-consumer recovered material, and shall comply with Section 503.2.3. The bio-based content is not less than 50 percent as determined by testing in accordance with ASTM D6866.
2. Wood and wood products used to comply with this section, other than salvaged or reused wood products, shall be labeled in accordance with the SFI Standard, FSC Indicators of Sustainable Forestry, PEFC Council Technical Document or equivalent fiber procurement system. As an alternative to an on-product label, a Certificate of Compliance indicating conformance with the fiber procurement system shall be permitted. Manufacturer's fiber procurement systems shall be audited by an accredited third-party.
3. The requirements of USDA 7CFR Part 2902.

**503.2.5 Indigenous materials.** Indigenous materials or components shall be composed of resources that are recovered, harvested, extracted and manufactured within a 500 mile (800 km) radius of the building site. Where only a portion of a

material or product is recovered, harvested, extracted and manufactured within 500 miles (800km), only that portion shall be included. Where resources are transported by water or rail, the distance to the building site shall be determined by multiplying the distance that the resources are transported by water or rail by 0.25, and adding that number to the distance transported by means other than water or rail.

3. Moisture control and material storage and handling shall be in accordance with Section 506.

[Language extracted from IgCC PV-2.0]

**SECTION 506**

**MOISTURE CONTROL AND MATERIAL STORAGE AND HANDLING**

**506.1 Storage and handling of materials.** Materials stored and handled on-site during construction phases shall comply with applicable manufacturer's recommendations. Where the manufacturer's recommendations are not available, approved standards or guidelines shall be followed.

**506.2 Construction phase moisture control.** Porous or fibrous materials and other materials subject to moisture damage shall be protected from moisture during the construction phase. Material damaged by moisture during the construction phase shall be cleaned and dried or, where damage cannot be corrected by such means, shall be removed and replaced.

**506.3 Moisture control preventative measures.** Moisture preventative measures shall be inspected in accordance with Sections 902 and 903 for the categories listed in Items 1 through 5. Inspections shall be executed in a method and at a frequency as listed in Table 903.1. Inspections shall be conducted by an approved agency that shall report to the code official based on the approved pre-determined frequency schedule. Discrepancies shall be brought to the attention of the code official prior to the completion of that work. A final inspection report documenting required testing and corrections of any discrepancies noted in prior inspections shall be submitted at a point in time agreed upon by the code official for purposes of demonstrating compliance.

1. Foundation sub-soil drainage system.
2. Foundation damp-proofing and water-proofing.
3. Flashings: Windows, exterior doors, skylights, wall flashing and drainage systems.
4. Exterior wall coverings.
5. Roof coverings, roof drainage, and flashings.

**X01.1.3 Energy conservation, efficiency and atmospheric quality.** Energy use and conservation requirements shall comply with the Residential Provisions of the 2012 IECC, or shall comply with Chapter 6 of this code.

Find the code at [www.ICCSafe.org](http://www.ICCSafe.org): **2012 International Energy Conservation Code® (IECC®)**

**The Department of Energy developed the following overview of residential building energy efficiency gains from the 2012 IECC:**

The purpose of the 2012 IECC is to substantially improve the energy performance of residential buildings that comply with the IECC. The 2012 IECC is one part of an effort by DOE and other stakeholders to improve the energy efficiency of the IECC by 30% compared to the 2006 edition of the code. DOE recognizes that recent federal legislation, potential new legislation, movements in numerous state and local building code jurisdictions, and general environmental concerns dictate an unquestionable call for substantial reductions in the energy consumption of residential buildings. The 2012 IECC addresses that need via improvements to several key areas of the IECC, while minimizing the extent of structural/format change in the code, an important consideration for maximizing returns on past investments in training and infrastructure by code jurisdictions.

There are four key areas of improvement in the 2012 IECC:

1. **Reduced leakage in duct systems and building envelopes, verified by testing.** The 2012 IECC requires that all ductwork be inside conditioned space, sets new leakage limits on the ductwork, and adds a new requirement for testing the air tightness of the building envelope. As an alternative, homes with high-efficiency HVAC equipment are exempted from the requirement for ducts inside the conditioned space and are subject to less stringent duct and whole-house testing requirements.

Several studies of recently built residences in states with the IECC code or other codes that require building envelope sealing show a distribution of air leakage rates, varying from low to high leakage. Based on these studies, DOE believes the proposed maximum leakage rates are already being achieved in well-sealed homes. The main effect of the proposed leakage rate limits will be to improve the considerable share of homes that have higher leakage rates.

The 2012 IECC would allow the code official to permit sampling (of not less than 1 in 7 buildings) for air tightness testing from a specific builder. The idea is that once the code official has gained confidence that the builder has a good track record of sealing properly to code, the sampling could be permitted to lower costs associated with the air leakage testing. The code official would still be required to do a visual inspection of air sealing in every new building.

2. **Improved envelope insulation.** Fenestration U-factors (including skylights) are reduced in most zones. The proposed U-factors for fenestration other than skylights in zones 2 and 3 match those that were approved by the IECC committee in the 07/08 cycle though these improvements were ultimately overturned at the final action hearings. Wood-frame wall insulation is increased from R-13 to R-20 in zone 4 and ceiling insulation levels are increased on zones 3 and 5.
3. **New provisions to limit energy loss from domestic hot water pipes.** The IECC and IRC currently have minimal requirements for energy efficiency related to water heating. This pipe insulation requirement represents a modest initial investment that will save energy for the life of the home, even through water heating equipment changeouts. The new

requirements are structured to encourage “short and skinny” pipe runs that will minimize energy losses due to stranded water in pipes. Hot water pipes that are longer and/or larger in diameter will require insulation. Either way, these requirements help save water and limit the energy wasted when a faucet or appliance is turned off and the pipes are left full of hot water.

4. **Larger fraction of high efficacy lighting.** The 2012 IECC increases the fraction of lamps that must be high-efficacy from 50% to 75%, a reasonable improvement given the advances in efficient lighting and the approaching Federal standards that will require efficient lighting by 2014.

The 2012 IECC has a number of other more minor changes to improve and clarify code language and save energy.

**The Energy Efficient Codes Coalition developed the following overview of residential building energy efficiency gains from the 2012 IECC:**

**Based on estimates of the measures that were approved by ICC’s Government Membership, the 30% threshold of energy savings of the 2012 IECC beyond the 2006 IECC was met or surpassed. Significant changes to the IECC include:**

1. **A better thermal envelope – i.e., window, door, insulation – in all Climate Zones.** In 2006, the number of climate zones in the IECC was reduced to eight in an effort to shorten the IECC, make it easier to use and employ a common map for both commercial and residential codes. The simplified map (*shown for the continental US*) replaced many pages of maps and commercial envelope tables and allowed IECC users to easily determine the requirements that apply anywhere in the US. *Note: Hawaii, Guam, Puerto Rico and the Virgin Islands are in Climate Zone 1; Alaska is in Climate Zones 7/8).*

**Final changes to insulation & fenestration component requirements are listed below (improvements over 2009 IECC are shaded in green):**

| Insulation*   | Ceiling R-value |           | Wood Frame R-value |               | Basement R-value |           | Crawl Space R-value |           |
|---------------|-----------------|-----------|--------------------|---------------|------------------|-----------|---------------------|-----------|
|               | 2009 IECC       | 2012 IECC | 2009 IECC          | 2012 IECC     | 2009 IECC        | 2012 IECC | 2009 IECC           | 2012 IECC |
| 1             | 30              | 30        | 13                 | 13            | 0                | 0         | 0                   | 0         |
| 2             | 30              | 38        | 13                 | 13            | 0                | 0         | 0                   | 0         |
| 3             | 30              | 38        | 13                 | 20 or 13+5**  | 5/13***          | 5/13      | 5/13                | 5/13      |
| 4 exc. Marine | 38              | 49        | 13                 | 20 or 13+5    | 10/13            | 10/13     | 10/13               | 10/13     |
| 4 Marine & 5  | 38              | 49        | 20 or 13+5         | 20 or 13+5    | 10/13            | 15/19     | 10/13               | 15/19     |
| 6             | 49              | 49        | 20 or 13+5         | 20+5 or 13+10 | 15/19            | 15/19     | 10/13               | 15/19     |
| 7 & 8         | 49              | 49        | 21                 | 20+5 or 13+10 | 15/19            | 15/19     | 10/13               | 15/19     |

\* Floor and Slab insulations levels remain unchanged.

\*\* Commonly available insulation in 2x6 cavity (R20) or in 2x4 cavity with sheathing (R13+x)

\*\*\* R5 continuous insulation or R13 for framed cavity insulation

| Fenestration  | Window U-Factor |           | Skylight U-Factor |           | Window SHGC |           |
|---------------|-----------------|-----------|-------------------|-----------|-------------|-----------|
|               | 2009 IECC       | 2012 IECC | 2009 IECC         | 2012 IECC | 2009 IECC   | 2012 IECC |
| 1             | 1.20            | 0.65      | 0.75              | 0.75      | 0.30        | 0.25      |
| 2             | 0.65            | 0.40      | 0.75              | 0.65      | 0.30        | 0.25      |
| 3             | 0.50            | 0.35      | 0.65              | 0.55      | 0.30        | 0.25      |
| 4 exc. Marine | 0.35            | 0.35      | 0.60              | 0.55      | NR          | 0.40      |
| 4 Marine & 5  | 0.35            | 0.32      | 0.60              | 0.55      | NR          | NR        |
| 6             | 0.35            | 0.32      | 0.60              | 0.55      | NR          | NR        |
| 7 & 8         | 0.35            | 0.32      | 0.60              | 0.55      | NR          | NR        |

2. **Less duct leakage in HVAC distribution systems.** As with the 2009 IECC, duct leakage testing is mandatory unless HVAC equipment and ducts are within the thermal envelope. The 2012 IECC requires total duct leakage testing (unless ducts and air handler are located within building thermal envelope), instead of leakage to the outside. Building cavities are prohibited from being used as ducts or plenums. The leakage limits have been reduced with the 2012 IECC, as follows:

| Construction Phase                        | Total Duct Leakage<br>CFM25 per 100 ft <sup>2</sup> CFA |              |
|---|---|--------------|
|   | 2009<br>IECC  | 2012<br>IECC |
| Post-Construction                         | 12  | 4            |
| Rough-in                                  | 6   | 4            |
| Rough-in if air-handler not yet installed | 4   | 3            |

**Note: Duct Leakage is measured in cubic feet per minute (CFM) at a pressure of 25 Pascals for every 100 square feet of conditioned floor space (CFA)**

**3. Tighter thermal envelopes through:**

- **Stronger home air leakage rate testing requirements.** Unlike the 2009 IECC, the 2012 IECC will require all homes to have substantially reduced air leakage demonstrated by testing. Air leakage is required not to exceed 5 ACH50 (Air Changes per Hour at 50 Pascals) for climate zones 1-2 and 3 ACH50 for the remaining climate zones.
- **Improved thermal enclosure system.** These requirements are similar to the Fully-Aligned Air Barriers and Air Sealing sections of EPA's ENERGY STAR Homes checklist. Some noteworthy requirements include: a continuous air barrier, insulated headers, insulated corners, sill-plate sealing, top-plate sealing, and wind baffles.

**4. Hot water piping must be insulated to at least R-3 if the piping falls in one of the following groups:**

- Piping is larger than 3/4" in nominal diameter,
- Piping serves more than one dwelling unit,
- Piping runs from water heater to kitchen outlets,
- Piping is located outside of conditioned space,
- Piping runs from water heater to a distribution manifold,
- Piping is located under a floor slab,
- Piping is buried,
- Supply and return piping is in recirculation systems other than demand recirculation systems
- Piping run lengths exceed the following maximum run lengths for a nominal pipe diameter:

|  |       |       |       |        |
|--|-------|-------|-------|--------|
| Nominal diameter of largest pipe diameter in run | 3/8"  | 1/2"  | 3/4"  | > 3/4" |
| Max run length                                   | 30 ft | 20 ft | 10 ft | 5 ft   |

**5. 75% of lighting must be energy efficient (CFLs or equivalent).** Increased from 50% in 2009 IECC.

- 6. Additional information to initial and future homeowners** Builders or design professional must complete and post a certificate that includes results from duct system and air leakage tests in addition to current requirement for insulation R-values, fenestration U-factors & SHGCs, and heating equipment type & efficiency.

**X01.1.4 Water resource conservation and efficiency.** Building water resource conservation and efficiency shall comply with the following:

- Fixtures, fittings, equipment and appliances shall comply with Section 704.  
[Language extracted from IgCC PV-2.0]

**SECTION 704  
WATER TREATMENT DEVICES AND EQUIPMENT**

**704.1 Water softeners.** Water softeners shall comply with Sections 704.1.1 through 704.1.4.

**704.1.1 Demand initiated regeneration.** Water softeners shall be equipped with demand- initiated regeneration control systems. Such control systems shall automatically initiate the regeneration cycle after determining the depletion, or impending depletion of softening capacity.

**704.1.2 Water consumption.** Water softeners shall have a maximum water consumption during regeneration of 5 gal (18.9 L) per 1000 grains of hardness removed as measured in accordance with NSF 44.

**704.1.3 Waste connections.** Waste water from water softener regeneration shall not discharge to reclaimed water collection systems and shall discharge in accordance with the International Plumbing Code.

**704.1.4 Efficiency and listing.** Water softeners that regenerate in place, that are connected to the water system they serve by piping not exceeding 1 ¼ inch in diameter, or that have a volume of 3 cubic feet (0.085 m3) or more of cation exchange media shall have a rated salt efficiency of not less than 4,000 grains of total hardness exchange per pound of salt (477 g of total hardness exchange per kg of salt), based on sodium chloride equivalency and shall be listed as compliant with NSF/ANSI 44. All other water softeners shall have a rated salt efficiency of not less than 3,500 grains of total hardness exchange per pound of salt (477 g of total hardness exchange per kg of salt), based on sodium chloride equivalency.

**704.2 Reverse osmosis water treatment systems.** Point-of-use reverse osmosis treatment systems shall comply with NSF 58. The discharge pipe from a reverse osmosis drinking water treatment unit shall connect to the building drainage system in

accordance with Section 611.2 of the International Plumbing Code. Point-of-use reverse osmosis systems shall be equipped with an automatic shutoff valve that prevents the production of reject water when there is no demand for treated water.

2. Where permitted by the jurisdiction, non-potable water, rainwater collection, graywater and reclaimed water systems shall be in accordance with Sections 706, 707, 708 and 709, respectively.  
 [Language extracted from IgCC PV-2.0]

**SECTION 706  
NON-POTABLE WATER REQUIREMENTS**

**706.1 Scope.** The provisions of this section shall govern the use of non-potable water and the construction, installation, and design of systems utilizing non-potable water. The use and application of non-potable water shall comply with laws, rules and ordinances applicable in the jurisdiction.

**706.2 Signage required.** Where non-potable water is used for a water use application, signage shall be provided that reads as follows: "Non-potable water is utilized for [application name]. Caution: non-potable water. DO NOT DRINK." The words shall be legibly and indelibly printed on a sign constructed of corrosion-resistant waterproof material. The letters of the words shall be not less than 0.5 inches in height and of a color in contrast to the background on which they are applied. In addition to the required wordage, the pictograph shown in Figure 706.2 shall appear on the signage required by this section. The required location of the signage and pictograph shall be in accordance with the applicable section of this code that requires the use of non-potable water.

**706.3 Water quality.** Non-potable water for each end use application shall meet the minimum water quality requirements as established for the application by the laws, rules and ordinances applicable in the jurisdiction.

**TABLE 705.2.1  
METERING REQUIREMENTS**

| <b>APPLICATION</b>              | <b>REQUIREMENTS</b>  |
|---------------------------------|--|
| Irrigation                      | Irrigation systems that are automatically controlled shall be metered.   |
| Tenant Spaces                   | Tenant spaces that consume water shall be metered individually.  |
| Onsite Water Collection Systems | The makeup water lines supplying onsite water collection systems shall be metered.   |
| Ornamental Water Features       | Ornamental water features with a permanently installed water supply shall be required to utilize a meter on makeup water supply lines. |
| Pools and Spas                  | Indoor and outdoor pools and spas shall be required to utilize a meter on makeup water supply lines.                                   |
| Cooling Towers                  | Cooling towers or groups of towers shall be required to utilize a meter on makeup water and blow-down water supply lines.              |
| Steam Boilers                   | The makeup water supply line to steam boilers having a rating of 1,000,000 BTU/h or greater shall be metered.                          |
| Industrial Processes            | Industrial processes consuming more than 1,000 gallons per day on average shall be metered individually.                               |
| Evaporative Coolers             | Evaporative coolers supplying in excess of 0.6 gpm, on average, makeup water shall be.   |
| Fluid Coolers and Chillers      | Water-cooled fluid coolers and chillers that do not utilize closed-loop recirculation shall be metered.                                |
| Roof Spray Systems              | Roof spray systems for irrigating vegetated roofs or thermal conditioning shall be metered.  |



**Figure 706.2 Pictograph – DO NOT DRINK**

**SECTION 707  
RAINWATER COLLECTION AND DISTRIBUTION SYSTEMS**

**707.1 Scope.** The provisions of this section shall govern the construction, installation, alteration, and repair of rainwater collection and conveyance systems.

**707.2 Permits.** Permits shall be required for the construction, installation, alteration, and repair of rainwater collection and conveyance systems. Construction documents, engineering calculations, diagrams, and other such data pertaining to the rainwater collection and conveyance system shall be submitted with each application for permit.

**707.3 Potable water connections.** Where a potable system is connected to a rainwater collection and conveyance system, the potable water supply shall be protected against backflow in accordance with Section 608 of the International Plumbing Code.

**707.4 Non-Potable water connections.** Where non-potable water from different sources is combined in a system, the system shall comply with the most stringent of the requirements of this code that are applicable to such sources.

**707.5 Installation.** Except as provided for in this section, all systems shall be installed in compliance with the provisions of the International Plumbing Code and manufacturer's instructions.

**707.6 Applications.** Untreated rainwater shall be utilized in accordance with Section 702 and local codes. Treated rainwater shall be utilized in accordance with Section 706 or potable water provisions of the International Plumbing Code, as applicable, and as permitted by local codes.

**707.7 Approved components and materials.** Piping, plumbing components, and materials used in the collection and conveyance systems shall be manufactured of material approved for the intended application and compatible with any disinfection and treatment systems used.

**707.8 Insect and vermin control.** Inlets and vents to the system shall be protected to prevent the entrance of insects and vermin into storage tanks and piping systems. Screens installed on vent pipes, inlets, and overflow pipes shall have an aperture of not greater than 1/16 inch and shall be close-fitting. Screen materials shall be compatible with contacting system components and shall not accelerate corrosion of system components.

**707.9 Drainage.** Water drained from the roof washer or debris excluder shall not be drained to the sanitary sewer. Such water shall be diverted from the storage tank and discharge in a location that will not cause erosion or damage to property. Roof washers and debris excluders shall be provided with an automatic means of self draining between rain events, and shall not drain onto roof surfaces.

**707.10 Freeze protection.** Where sustained freezing temperatures occur, provisions shall be made to keep storage tanks and the related piping from freezing.

**707.11 Trenching requirements.** All water service piping, including piping containing rainwater, shall be separated from the building sewer by 5 feet (1524 mm) of undisturbed or compacted earth. Water service pipes, potable and non-potable, shall not be located in, under or above cesspools, septic tanks, septic tank drainage fields or seepage pits. Buried rainwater collection and distribution piping shall comply with the requirements of Section 306 of the International Plumbing Code for support, trenching, bedding, backfilling, and tunneling.

**Exceptions:**

1. The required separation distance shall not apply where the bottom of the water service pipe within 5 feet (1524 mm) of the sewer is a minimum of 12 inches (305 mm) above the top of the highest point of the sewer and the pipe materials shall comply with the International Plumbing Code for such applications.
2. Water service pipe is permitted to be located in the same trench with a building sewer, provided such sewer is constructed of materials that comply with the International Plumbing Code for such installations.
3. The required separation distance shall not apply where a potable or non-potable water service pipe crosses a sewer pipe provided the water service pipe is sleeved to at least 5 feet (1524 mm) horizontally from the sewer pipe centerline on both sides of such crossing with pipe materials that comply with the International Plumbing Code for such applications.
4. Irrigation piping located outside of a building and downstream of the backflow preventer is not required to meet the trenching requirements where rainwater is used for outdoor applications.

**707.12 Rainwater catchment and collection systems.** The design of rainwater collection and conveyance systems shall conform to accepted engineering practice.

**707.12.1 Collection surface.** Rainwater shall be collected only from above-ground impervious roofing surfaces constructed from approved materials. Collection of water from vehicular parking or pedestrian surfaces shall be prohibited except where the water is used exclusively for landscape irrigation. Overflow and bleed-off pipes from roof-mounted appliances including but not limited to evaporative coolers, water heaters, and solar water heaters shall not discharge onto rainwater collection surfaces.

**707.12.1.1 Potable water applications.** Where collected water is to be treated to potable water standards, wood or cedar shake roofing materials, roofing materials treated with biocides, and lead flashing is prohibited on collection surfaces. Painted surfaces are acceptable only where paint has been certified to ensure that the toxicity level of the paint is acceptable for drinking water contact. Lead, chromium or zinc based paints are not permitted on rainwater collection surfaces. Flat roofing products shall be certified to NSF P151. Rainwater shall not be collected from vegetated roof systems.

**707.12.2 Debris excluders.** Downspouts and leaders shall be connected to a roof washer and shall be equipped with a debris excluder or equivalent device to prevent the contamination of collected rainwater with leaves, sticks, pine needles and similar material. Debris excluders and equivalent devices shall be self-cleaning.

**707.12.3 Roof gutters and downspouts.** Gutters and downspouts shall be constructed of materials that are compatible with the collection surface and the rainwater quality for the desired end use. Joints shall be made water-tight. Where the collected rainwater is to be used for potable applications, gutters and downspouts shall be constructed of materials approved for drinking water applications and flashing and joints shall not be made of lead.

**707.12.3.1 Slope.** Roof gutters, leaders, and rainwater collection piping shall slope continuously toward collection inlets and shall be free of leaks. Gutters and downspouts shall have a slope of not less than 1/8 inch per foot along their entire length, and shall not permit the collection or pooling of water at any point.

**Exception:** Siphonic drainage systems installed in accordance with the manufacturer's installation instructions shall not be required to have slope.

**707.12.3.2 Size.** Gutters and downspouts shall be installed and sized in accordance with Section 1106.6 of the International Plumbing Code and local rainfall rates.

**707.12.3.3 Cleanouts.** Cleanouts shall be provided in the water conveyance system so as to allow access to all filters, flushes, pipes and downspouts.

**707.12.4 Collection pipe materials.** In buildings where rainwater collection and conveyance systems are installed, drainage piping approved for use within plumbing drainage systems shall be utilized to collect rainwater and convey it to the storage tank. Vent piping approved for use within plumbing venting systems shall be utilized for all vents within the rainwater system. Drains to a storm water discharge shall use approved waste piping.

**707.12.4.1 Joints.** Collection piping conveying rainwater shall utilize joints approved for use with the distribution piping and appropriate for the intended applications as specified in the International Plumbing Code.

**707.12.4.2 Size.** Collection piping conveying rainwater from collection surfaces shall be sized in accordance with local Chapter 11 of the International Plumbing Code and local rainfall rates.

**707.12.4.3 Labeling and marking.** Additional marking of rainwater collection piping shall not be required beyond that required for sanitary drainage, waste, and vent piping by the International Plumbing Code.

**707.12.5 Filtration.** Collected rainwater shall be filtered to the level required for the intended end use. Filters shall be accessible for inspection and maintenance.

**707.12.6 Disinfection.** Where the intended application and initial quality of the collected rainwater requires disinfection or other treatment or both, the collected rainwater shall be treated as needed to ensure that the required water quality is delivered at the point of use.

**707.12.7 Storage tank.** The design of the storage tank shall be in accordance with Sections 707.12.7.1 through 707.12.7.11.

**707.12.7.1 Location.** Storage tanks shall be installed either above or below grade. Above grade storage tanks shall be protected from direct sunlight and shall be constructed using opaque, UV resistant materials including, but not limited to, heavily tinted plastic, lined metal, concrete, wood, or painted to prevent algae growth, or shall have specially constructed sun barriers including but not limited to installation in garages, crawlspaces, or sheds. Storage tanks and their manholes shall not be located directly under any soil or waste piping or any source of contamination. Rainwater storage tanks shall be located with a minimum horizontal distance between various elements as indicated in Table 707.12.7.1.

**TABLE 707.12.7.1**

**LOCATION OF RAINWATER STORAGE TANKS**

| <b>Element</b>                              | <b>Minimum Horizontal Distance from Storage Tank (feet)</b> |
|---|---|
| Critical root zone (CRZ) of protected trees | 2   |
| Lot line adjoining private lots             | 5   |
| Seepage pits                                | 5   |
| Septic tanks                                | 5   |

**707.12.7.2 Materials.** Where water is collected onsite, it shall be collected in an approved tank constructed of durable, nonabsorbent and corrosion-resistant materials. Where collected water is to be treated to potable water standards, tanks shall not be constructed of recycled materials and shall be constructed of materials in accordance with the International Plumbing Code. Storage tanks shall be constructed of materials compatible with the type of disinfection system used to treat water upstream of the tank and used to maintain water quality within the tank.

**707.12.7.2.1 Wooden tanks.** Wooden storage tanks shall not be required to have a liner. Where a tank is lined and used for potable water, the liner shall be NSF approved. Where unlined tanks are used, the species of wood shall be decay resistant and untreated.

**707.12.7.3 Foundation and supports.** Storage tanks shall be supported on a firm base capable of withstanding the storage tank's weight when filled to capacity. Where earthquake loads are applicable in accordance with the International Building Code, above-ground collection tank supports shall be designed and installed for the seismic forces in accordance with the International Building Code.

**707.12.7.3.1 Ballast.** Where the soil can become saturated, an underground storage tank shall be ballasted, or otherwise secured, to prevent the tank from floating out of the ground when empty. The combined weight of the tank and hold down ballast shall meet or exceed the buoyancy force of the tank. Where the installation requires a foundation, the foundation shall be flat and shall be designed to support the storage tank weight when full, consistent with bearing capability of adjacent soil.

**707.12.7.3.2 Structural support.** When installed below grade, storage tank installations shall be designed to withstand earth and surface structural loads without damage and with minimal deformation when filled with water or empty.

**707.12.7.4 Makeup water.** Where an uninterrupted supply is required for the intended application, potable or municipally supplied reclaimed or recycled water shall be provided as a source of makeup water for the storage tank. The potable or reclaimed or recycled water supply shall be protected against backflow by means of an air gap not less than 4 inches (102 mm) above the overflow or an approved backflow device in accordance with the International Plumbing Code. There shall be a full-open valve located on the makeup water supply line to the storage tank. Inlets to storage tank shall be controlled by fill valves or other automatic supply valves installed so as to prevent the tank from overflowing and to prevent the water from dropping below a predetermined level.

**707.12.7.5 Overflow.** The storage tank shall be equipped with an overflow pipe having the same or larger area as the sum of the areas of all tank inlet pipes. The overflow pipe shall be trapped and shall be discharged in a manner consistent with storm water runoff requirements of the jurisdiction and at a sufficient distance from the tank to avoid damaging the tank foundation. The overflow drain shall not be equipped with a shutoff valve. A minimum of one cleanout shall be provided on each overflow pipe in accordance with Section 708 of the International Plumbing Code.

**707.12.7.6 Access.** A minimum of one access opening shall be provided to allow inspection and cleaning of the tank interior. All access openings to storage tanks and other vessels shall have an approved locking device or shall otherwise be protected from unauthorized access. Below grade storage tanks, located outside of the building, shall be provided with either a manhole not less than 24 inches (610 mm) square or a manhole with an inside diameter of not less than 24 inches (610 mm). Manholes shall extend not less than 4 inches above ground or shall be gasketed and bolted to prevent water infiltration. Finish grade shall be sloped away from the manhole to divert surface water from the manhole. Each manhole cover shall have an effective locking device. Service ports in manhole covers shall be not less than 8 inches (203 mm) in diameter and shall be a minimum of 4 inches (102 mm) above the finished grade level. The service port shall have an effective locking cover or a brass cleanout plug.

**Exception:** Storage tanks having a volume of less than 800 gallons and installed below grade shall not be required to be equipped with a manhole where provided with a service port that is not less than 8 inches (203 mm) in diameter.

**707.12.7.7 Venting.** Tanks shall be provided with a vent sized in accordance with the International Plumbing Code and based on the diameter of the tank influent pipe. Tank vents shall not be connected to sanitary drainage system vents.

**707.12.7.8 Inlets.** Storage tank inlets shall be designed to introduce water into the tank with minimum turbulence, and shall be located and designed to avoid agitating the contents of the storage tank.

**707.12.7.9 Outlets.** Outlets shall be located at least 4 inches (102 mm) above the bottom of the storage tanks and shall not skim water from the surface.

**707.12.7.10 Drain.** A drain shall be located at the lowest point of aboveground storage tanks and shall discharge in a manner consistent with the storm water runoff requirements of the jurisdiction and at a sufficient distance from the tank to avoid damaging the tank foundation. A minimum of one cleanout shall be provided on each drain pipe in accordance with Section 708 of the International Plumbing Code.

**707.12.7.11 Labeling and signage.** Each storage tank shall be labeled with its rated capacity and the location of the upstream bypass valve. Storage tanks shall bear signage that reads as follows: "CAUTION: NON-POTABLE WATER – DO NOT DRINK." Where an opening is provided that could allow the entry of personnel, the opening shall bear signage that reads as follows: "DANGER – CONFINED SPACE." Markings shall be indelibly printed on a tag or sign constructed of corrosion-resistant waterproof material mounted on the tank or shall be indelibly printed on the tank. The letters of words shall be not less than 0.5 inches in height and shall be of a color that contrasts with the background on which they are applied.

**707.12.8 Valves.** Valves shall be supplied in accordance with Sections 707.12.8.1 and 707.12.8.2.

**707.12.8.1 Influent diversion.** A means shall be provided to divert storage tank influent to allow maintenance and repair of the storage tank system.

**707.12.8.2 Backwater valve.** Backwater valves shall be installed on each overflow and tank drain pipe. Backwater valves shall be installed so that access is provided to the working parts for service and repair.

**707.12.9 Roof washer.** A sufficient amount of rainwater shall be diverted at the beginning of each rain event, and not allowed to enter the storage tank, to wash accumulated debris from the collection surface. The amount of rainfall to be diverted shall be field adjustable as necessary to minimize storage tank water contamination. The roof washer shall not rely on manually operated valves or devices, and shall operate automatically. Diverted rainwater shall not be drained to the roof surface, and shall be discharged in a manner consistent with the storm water runoff requirements of the jurisdiction. Roof washers shall be accessible for maintenance and service.

**707.12.10 Vent piping.** Storage tanks shall be provided with a vent in accordance with the requirements of Section 707.12.7.7. Vents shall be sized in accordance with the International Plumbing Code, based on the aggregate diameter of storage tank influent pipe(s). Vents shall be protected from contamination by means of a U-bend installed with the opening directed downward or an approved cap. Vent outlets shall extend a minimum of 4" above grade, or as necessary to prevent

surface water from entering the storage tank. Vent openings shall be protected against the entrance of vermin and insects in accordance with the requirements of Section 707.8.

**707.12.11 Pumping and control system.** Mechanical equipment including pumps, valves and filters shall be easily accessible and removable in order to perform repair, maintenance and cleaning. Where collected rainwater is to be treated to potable water standards, the pump and all other pump components shall be listed and approved for use with potable water systems. Pressurized water shall be supplied at a pressure appropriate for the application and within the range specified by the International Plumbing Code. Where water could be supplied at an excessive pressure, a pressure-reducing valve shall be installed in accordance with the requirements of the International Plumbing Code.

**707.12.11.1 Standby power.** Where required for the intended application, automatically activated standby power, capable of powering all essential treatment and pumping systems under design conditions shall be provided.

**707.12.11.2 Inlet control valve alarm.** Make-up water systems shall be fitted with a warning mechanism that alerts the user to a failure of the inlet control valve to close correctly. The alarm shall activate before the water within the storage tank begins to discharge into the overflow system.

**707.12.11.3 Water-pressure reducing valve or regulator.** Where the rainwater pressure supplied by the pumping system exceeds 80 psi (552 kPa) static, a pressure-reducing valve shall be installed to reduce the pressure in the rainwater distribution system piping to 80 psi (552 kPa) static or less. Pressure-reducing valves shall be specified and installed in accordance with Section 604.8 of the International Plumbing Code.

**707.12.12 Distribution pipe.** Distribution piping shall comply with Sections 707.12.12.1 through 707.12.12.4.

**707.12.12.1 Materials.** Distribution piping conveying rainwater shall conform to the standards and requirements specified by the International Plumbing Code for non-potable or potable water, as applicable.

**707.12.12.2 Joints.** Distribution piping conveying rainwater shall utilize joints approved for use with the distribution piping and appropriate for the intended applications as specified in the International Plumbing Code.

**707.12.12.3 Size.** Distribution piping conveying rainwater water shall be sized in accordance with the International Plumbing Code for the intended application or.

**707.12.12.4 Labeling and marking.** Non-potable rainwater distribution piping shall be of the color purple and shall be embossed or integrally stamped or marked with the words: "CAUTION: NONPOTABLE WATER – DO NOT DRINK" or shall be installed with a purple identification tape or wrap. Identification tape shall be at least 3 inches wide and have white or black lettering on purple field stating "CAUTION: NON-POTABLE WATER – DO NOT DRINK". Identification tape shall be installed on top of non-potable rainwater distribution pipes, fastened at least every 10 feet to each pipe length and run continuously the entire length of the pipe. Lettering shall be readily observable within the room or space where the piping is located.

**Exception:** Piping located outside of the building and downstream of the backflow preventer is not required to be purple where rainwater is used for outdoor applications.

**707.13 Tests and inspections.** Tests and inspection shall be performed in accordance with Sections 707.13.1 through 707.13.10.

**707.13.1 Drainage and vent tests.** The testing of rainwater collection piping, overflow piping, vent piping and storage tank drains shall be conducted in accordance with Section 312 of the International Plumbing Code.

**707.13.2 Drainage and vent final test.** A final test shall be applied to the rainwater collection piping, overflow piping, storage tank, and tank vent piping in accordance with Section 312.4 of the International Plumbing Code.

**707.13.3 Water supply system test.** The testing of makeup water supply piping and rainwater distribution piping shall be conducted in accordance with Section 312.5 of the International Plumbing Code.

**707.13.4 Inspection and testing of backflow prevention assemblies.** The testing of backflow preventers and backwater valves shall be conducted in accordance with Section 312.10 of the International Plumbing Code.

**707.13.5 Inspection vermin and insect protection.** All inlets and vents to the system shall be inspected to ensure that each is protected to prevent the entrance of insects or vermin into storage tank and piping systems in accordance with Section 707.8.

**707.13.6 Roof gutter inspection and test.** Roof gutters shall be inspected to verify that the installation and slope is in accordance with Section 707.12.3. Gutters shall be tested by pouring a minimum of one gallon of water into the end of the gutter opposite the collection point. The gutter being tested shall not leak and shall not retain standing water.

**707.13.7 Roofwasher test.** Roofwashers shall be tested by introducing water into the gutters. Proper diversion of the first quantity of water in accordance with the requirements of Section 707.12.9 shall be verified.

**707.13.8 Storage tank tests.** Storage tanks shall be tested in accordance with the following:

1. Storage tanks shall be filled with water to the overflow line prior to and during inspection. All seams and joints shall be left exposed and the tank shall remain water tight without leakage for a period of 24 hours.

2. After 24 hours, supplemental water shall be introduced for a period of 15 minutes to verify proper drainage of the overflow system and verify that there are no leaks.
3. Following a successful test of the overflow, the water level in the tank shall be reduced to a level that is at 2 inches below the makeup water trigger point by using the tank drain. The tank drain shall be observed for proper operation. The makeup water system shall be observed for proper operation, and successful automatic shutoff of the system at the refill threshold shall be verified. Water shall not be drained from the overflow at any time during the refill test.

**707.13.9 Supply pressure test.** The static water pressure at the point of use furthest from the supply shall be verified to be within the range required for the application, in accordance with Section 707.12.11.

**707.13.10 Water quality test.** The quality of the water for the intended application shall be verified at the point of use in accordance with the requirements of the jurisdiction.

**707.14 Operation and maintenance manuals.** Operations and maintenance materials shall be supplied in accordance with 707.14.1 through 707.14.4.

**707.14.1 Manual.** A detailed operations and maintenance manual shall be supplied in hardcopy form with all rainwater collection systems.

**707.14.2 Schematics.** The manual shall include a detailed system schematic, the locations of all system components, and a list of all system components including manufacturer and model number.

**707.14.3 Maintenance procedures.** The manual shall provide a maintenance schedule and procedures for all system components requiring periodic maintenance. Consumable parts including filters shall be noted along with part numbers.

**707.14.4 Operations procedures.** The manual shall include system startup and shutdown procedures. The manual shall include detailed operating procedures for the system.

**707.15 System abandonment.** If the owner of a rainwater collection and conveyance system elects to cease use of, or fails to properly maintain such system, the system shall be abandoned and shall comply with the following:

1. All system piping connecting to a utility-provided water system shall be removed or disabled.
2. The rainwater distribution piping system shall be replaced with an approved potable water supply piping system. Where an existing potable pipe system is already in place, the fixtures shall be connected to the existing system.
3. The storage tank shall be secured from accidental access by sealing or locking tank inlets and access points, or filling with sand or equivalent.

**707.16 Potable water applications.** Where collected rainwater is to be used for potable water applications, all materials contacting the water shall comply with NSF 61.

**707.16.1 Water quality testing.** Collected rainwater water shall be tested. Accumulated water to be tested shall be the result of not less than two rainfall events. Testing shall be in accordance with Sections 707.16.1.1 through 707.16.1.3.

**707.16.1.1 Test methods.** Water quality testing shall be performed in accordance with the latest edition of Standard Methods for the Examination of Water and Wastewater published by the American Public Health Association.

**707.16.1.1.1 Tests required.** Accumulated rainwater shall be tested for *Escherichia coli*, total coliform, heterotrophic bacteria and cryptosporidium.

**707.16.1.2 Test frequency.** The testing of accumulated rainwater shall be performed prior to the rainwater system being connected to potable rainwater distribution system and annually thereafter.

**707.16.1.3 Test records.** Test records shall be retained for not less than two years.

## **SECTION 708 GRAYWATER SYSTEMS**

**708.1 Scope.** The provisions of this section shall govern the construction, installation, alteration, and repair of graywater reuse systems.

**708.2 Permits.** Permits shall be required for the construction, installation, alteration, and repair of graywater systems. Construction documents, engineering calculations, diagrams, and other such data pertaining to the graywater system shall be submitted with each application for permit in accordance with the laws, rules and ordinances applicable in the jurisdiction.

**708.3 Potable water connections.** Where a potable water system is connected to a graywater system, the potable water supply shall be protected against backflow in accordance with Section 608 of the International Plumbing Code.

**708.4 Non-potable water connections.** Where non-potable water from different sources is combined in a system, the system shall comply with the most stringent of the requirements of this code that are applicable to such sources.

**708.5 Installation.** Except as provided for in this section, all systems shall be installed in compliance with the provisions of the International Plumbing Code and manufacturer's instructions, as applicable.

**708.6 Applications.** Untreated graywater shall be utilized in accordance with Section 702 and local codes. Treated graywater shall be utilized in accordance with Section 706 and as permitted by local codes.

**708.7 Approved components and materials.** The piping, plumbing components, and materials used in graywater systems shall be manufactured of material approved for the intended application and compatible with any disinfection and treatment systems used.

**708.8 Insect and vermin control.** The inlets and vents to the system shall be protected to prevent insects and vermin from entering storage tanks and piping systems. Screens installed on vent pipes and overflow pipes shall have an aperture not greater than 1/16 inch and shall be close-fitting. Screen materials shall be compatible with contacting system components and shall not accelerate corrosion of system components

**708.9 Freeze protection.** Where sustained freezing temperatures occur, provisions shall be made to keep storage tanks and the related piping from freezing.

**708.10 Trenching requirements.** Water service piping, including piping containing graywater, shall be separated from the building sewer by 5 feet (1524 mm) of undisturbed or compacted earth. Graywater piping shall be separated from potable water piping underground by 5 feet (1524 mm) of undisturbed or compacted earth. Non-potable water service pipes shall not be located in, under or above cesspools, septic tanks, septic tank drainage fields or seepage pits. Buried graywater piping shall comply with the requirements of Section 306 of the International Plumbing Code for support, trenching, bedding, backfilling, and tunneling.

**Exceptions:**

1. The required separation distance shall not apply where the bottom of the graywater service pipe within 5 feet (1524 mm) of the sewer is a minimum of 12 inches (305 mm) above the top of the highest point of the sewer and the pipe materials comply with the requirements of the International Plumbing Code for such applications.
2. The required separation distance shall not apply where the bottom of the potable water service pipe within 5 feet (1524 mm) of the graywater pipe is a minimum of 12 inches (305 mm) above the top of the highest point of the graywater pipe and the pipe materials comply with the requirements of the International Plumbing Code for such applications.
3. Water service pipe is permitted to be located in the same trench with a building sewer, provided that such sewer is constructed of materials that comply with the requirements of the International Plumbing Code for such applications.
4. The required separation distance shall not apply where a potable or non-potable water service pipe crosses a sewer pipe provided that the water service pipe is sleeved to at least 5 feet (1524 mm) horizontally from the sewer pipe centerline on both sides of such crossing with pipe materials that comply with the requirements of the International Plumbing Code for such applications.
5. The required separation distance shall not apply where a potable water service pipe crosses a graywater pipe provided that the potable water service pipe is sleeved for a distance of at least 5 feet (1524 mm) horizontally from the centerline of the graywater pipe on both sides of such crossing with pipe materials that comply with the requirements of the International Plumbing Code for such applications.
6. Irrigation piping located outside of a building and downstream of the backflow preventer is not required to meet the trenching requirements where graywater is used for outdoor applications.

**708.11 System abandonment.** If the owner of a graywater system elects to cease use of, or fails to properly maintain such system, the system shall be abandoned and shall comply with the following:

1. All system piping connecting to a utility-provided water system shall be removed or disabled.
2. Storage tanks shall be secured against accidental access by sealing or locking tank inlets and access points, or filling with sand or equivalent.

**708.12 Graywater systems.** The design of the graywater system shall conform to accepted engineering practice.

**708.12.1 Graywater sources.** Graywater reuse systems shall collect waste discharge from only the following sources: bathtubs, showers, lavatories, clothes washers, and laundry trays. Water from other approved non-potable sources including swimming pool backwash operations, air conditioner condensate, rainwater, cooling tower blow-down water, foundation drain water, steam system condensate, fluid cooler discharge water, food steamer discharge water, combination oven discharge water, industrial process water, and fire pump test water shall also be permitted to be collected for reuse by graywater systems, as approved by the code official and as appropriate for the intended application.

**708.12.1.1 Prohibited graywater sources.** Wastewater containing urine or fecal matter shall not be diverted to graywater systems and shall discharge to the sanitary drainage system of the building or premises in accordance with the International Plumbing Code. Water from reverse osmosis system reject water, water softener discharge water, kitchen sink wastewater, dishwasher wastewater, and wastewater discharged from wet-hood scrubbers shall not be collected for reuse within a graywater system.

**708.12.2 Traps.** Traps serving fixtures and devices discharging wastewater to graywater reuse systems shall have a liquid seal of not less than 2 inches (51 mm) and not more than 4 inches (102 mm). Where a trap seal is subject to loss by evaporation, a trap seal primer valve shall be installed in accordance with the International Plumbing Code.

**708.12.3 Collection pipe.** Graywater reuse systems shall utilize drainage piping approved for use within plumbing drainage systems to collect and convey untreated graywater. Vent piping approved for use within plumbing venting systems shall be utilized for vents within the graywater system. Drains to the sanitary sewer shall use approved waste piping.

**708.12.3.1 Joints.** Collection piping conveying untreated graywater shall utilize joints approved for use with the distribution piping and appropriate for the intended applications as specified in the International Plumbing Code.

**708.12.3.2 Size.** Collection piping conveying rainwater from collection surfaces shall be sized in accordance with storm drainage sizing requirements specified in the International Plumbing Code.

**708.12.3.3 Labeling and marking.** Additional marking of untreated graywater collection piping shall not be required beyond that required for sanitary drainage, waste, and vent piping by the International Plumbing Code.

**708.12.4 Filtration.** Collected graywater shall be filtered as required for the intended end use. Filters shall be accessible for inspection and maintenance. Filters shall utilize a pressure gage or other approved method to provide indication when a filter requires servicing or replacement. Filters shall be installed with shutoff valves installed immediately upstream and downstream to allow for isolation during maintenance.

**708.12.5 Disinfection.** Where the intended application for collected graywater requires disinfection or other treatment or both, collected graywater shall be disinfected as needed to ensure that the required water quality is delivered at the point of use. Untreated graywater shall be retained in collection reservoirs for a maximum of 24 hours in accordance with Section 708.12.6.1.

**708.12.6 Storage tank.** The design of the storage tank shall be in accordance with Sections 708.12.6.1 through 708.12.6.12.

**708.12.6.1 Sizing.** The holding capacity of the storage tank shall be sized in accordance with the anticipated demand. Where graywater is to be used in untreated form for groundwater recharge or subsurface irrigation, the storage tank shall be sized to limit the retention time of graywater to a maximum of 24 hours.

**708.12.6.2 Location.** Storage tanks shall be installed above or below grade. Above grade storage tanks shall be protected from direct sunlight and shall be constructed using opaque, UV resistant, materials such as, but not limited to, heavily tinted plastic, lined metal, concrete, wood, or painted to prevent algae growth, or shall have specially constructed sun barriers including but not limited to installation in garages, crawlspaces, or sheds. Storage tanks and their manholes shall not be located directly under any soil or waste piping or any source of contamination. Graywater storage tanks shall be located with a minimum horizontal distance between various elements as indicated in Table 708.12.6.2. Storage tanks containing untreated graywater shall be located a minimum horizontal distance of 5 feet from buildings, in addition to the requirements in Table 708.12.6.2.

**TABLE 708.12.6.2**

**LOCATION OF GRAYWATER STORAGE TANKS**

| <b>Element</b>                              | <b>Minimum Horizontal Distance from Storage Tank (feet)</b> |
|---|---|
| Critical root zone (CRZ) of protected trees | 2   |
| Lot line adjoining private lots             | 5   |
| Seepage pits                                | 5   |
| Septic tanks                                | 5   |
| Water wells                                 | 50  |
| Streams and lakes                           | 50  |
| Water service                               | 5   |
| Public water main                           | 10  |

**708.12.6.3 Materials.** Where collected onsite, water shall be collected in an approved tank constructed of durable, nonabsorbent and corrosion-resistant materials. The storage tank shall be constructed of materials compatible with any disinfection systems used to treat water upstream of the tank and with any systems used to maintain water quality within the tank.

**708.12.6.3.1 Wood tanks.** Wooden storage tanks that are not equipped with a makeup water source shall be provided with a flexible liner.

**708.12.6.4 Foundation and supports.** Storage tanks shall be supported on a firm base capable of withstanding the storage tank's weight when filled to capacity. Where earthquake loads are applicable in accordance with the International Building Code, above-ground collection reservoir supports shall be designed and installed for the seismic forces in accordance with the International Building Code.

**708.12.6.4.1 Ballast.** Where the soil can become saturated, an underground storage tank shall be ballasted, or otherwise secured, to prevent the tank from floating out of the ground when empty. The combined weight of the tank and hold down ballast shall meet or exceed the buoyancy force of the tank. Where the installation requires a

foundation, the foundation shall be flat and shall be designed to support the storage tank weight when full, consistent with the bearing capability of adjacent soil.

**708.12.6.4.2 Structural support.** Where installed below grade, storage tank installations shall be designed to withstand earth and surface structural loads without damage and with minimal deformation when filled with water or empty.

**708.12.6.5 Makeup water.** Where an uninterrupted supply is required for the intended application, potable or - municipally supplied reclaimed/recycled water shall be provided as a source of makeup water for the storage tank. The potable or reclaimed/recycled water supply shall be protected against backflow by means of an air gap not less than 4 inches (102 mm) above the overflow or an approved backflow device in accordance with the International Plumbing Code. There shall be a full-open valve located on the makeup water supply line to the storage tank. Inlets to storage tank shall be controlled by fill valves or other automatic supply valves installed so as to prevent the tank from overflowing and to prevent the water level from dropping below a predetermined point. Where makeup water is provided, the water level shall not be permitted to drop below the graywater inlet or the intake of any attached pump.

**708.12.6.6 Overflow.** The storage tank shall be equipped with an overflow pipe having the same or larger area as the sum of the areas of all reservoir inlet pipes. The overflow pipe shall be trapped and shall be indirectly connected to the sanitary drainage system. The overflow drain shall not be equipped with a shutoff valve. A minimum of one cleanout shall be provided on each overflow pipe in accordance with Section 708 of the International Plumbing Code.

**708.12.6.7 Access.** A minimum of one access opening shall be provided to allow inspection and cleaning of the tank interior. Access openings shall have an approved locking device or other approved method of securing access. Below grade storage tanks, located outside of the building, shall be provided with either a manhole not less than 24 inches (610 mm) square or a manhole with an inside diameter not less than 24 inches (610 mm) and extending not less than 4 inches above ground. Finished grade shall be sloped away from the manhole to divert surface water from the manhole. Each manhole cover shall have an effective locking device. Service ports in manhole covers shall be not less than 8 inches (203 mm) in diameter and shall be a minimum of 4 inches (102 mm) above the finished grade level. The service port shall have an effective locking cover or a brass cleanout plug.

**Exception:** Storage tanks under 800 gallons in volume installed below grade shall not be required to be equipped with a manhole, but shall have a service port not less than 8 inches (203 mm) in diameter.

**708.12.6.8 Venting.** The tank shall be provided with a vent sized in accordance with the International Plumbing Code and based on the diameter of the tank influent pipe. The reservoir vent shall not be connected to sanitary drainage system vents.

**708.12.6.9 Inlets.** Storage tank inlets shall be designed to introduce water into the tank with minimum turbulence, and shall be located and designed to avoid agitating the contents of the storage tank.

**708.12.6.10 Outlets.** Outlets shall be located at least 4 inches (102 mm) above the bottom of the storage tank, and shall not skim water from the surface.

**708.12.6.11 Drain.** A drain shall be located at the lowest point of the storage tank and shall be indirectly connected to the sanitary drainage system. The total area of all drains shall not be smaller than the total area of all overflow pipes. A minimum of one cleanout shall be provided on each drain pipe in accordance with Section 708 of the International Plumbing Code.

**708.12.6.12 Labeling and signage.** Each storage tank shall be labeled with its rated capacity and the location of the upstream bypass valve. The contents of storage tanks shall be identified with the words "CAUTION: NON-POTABLE WATER – DO NOT DRINK" where an opening is provided that could allow the entry of personnel, the opening shall be marked with the words, "DANGER – CONFINED SPACE." Markings shall be indelibly printed on a tag or sign constructed of corrosion-resistant waterproof material mounted on the tank or shall be indelibly printed on the tank. The letters of the words shall be not less than 0.5 inches in height and shall be of a color in contrast with the background on which they are applied.

**708.12.7 Valves.** Valves shall be supplied in accordance with Sections 708.12.7.1 and 708.12.7.2.

**708.12.7.1 Bypass valve.** One three-way diverter valve certified to NSF 50 or other approved device shall be installed on graywater collection piping upstream of each storage tank, or drainfield, as applicable, to divert untreated graywater sources to the sanitary sewer to allow servicing and inspection of the system. Bypass valves shall be installed downstream of fixture traps and vent connections. Bypass valves shall be labeled to indicate the direction of flow, connection and storage tank or drainfield connection. Bypass valves shall be installed in accessible locations. Two shutoff valves shall not be installed to serve as a bypass valve.

**708.12.7.2 Backwater valve.** Backwater valves shall be installed on each overflow and tank drain pipe. Backwater valves shall be installed so that access is provided to the working parts for service and repair.

**708.12.8 Vent piping.** Storage tanks shall be provided with a vent in accordance with the requirements of Section 708.12.6.8. Vents shall be sized in accordance with the International Plumbing Code, based on the aggregate diameter of storage tank influent pipes. Open vents shall be protected from contamination by means of a U-bend installed with the opening directed downward or an approved cap. Vent outlets shall extend a minimum of 4 inches above grade, or as necessary to prevent surface water from entering the storage tank. Vent openings shall be protected against the entrance of vermin and insects in accordance with the requirements of Section 708.8.

**708.12.9 Pumping and control system.** Mechanical equipment including pumps, valves and filters shall be accessible and removable in order to perform repair, maintenance and cleaning. Pressurized water shall be supplied at a pressure appropriate for the application and within the range specified by the International Plumbing Code. Where water could be supplied at an excessive pressure, a pressure-reducing valve shall be installed in accordance with the requirements of the International Plumbing Code.

**708.12.9.1 Standby power.** Where required for the intended application, automatically activated standby power, capable of powering all essential treatment and pumping systems under design conditions shall be provided.

**708.12.9.2 Inlet control valve alarm.** Make-up water systems shall be provided with a warning mechanism that alerts the user to a failure of the inlet control valve to close correctly. The alarm shall activate before the water within the collection reservoir storage tank begins to discharge into the overflow system.

**708.12.9.3 Water-pressure reducing valve or regulator.** Where the graywater pressure supplied by the pumping system exceeds 80 psi (552 kPa) static, a pressure-reducing valve shall be installed to reduce the pressure in the graywater distribution system piping to 80 psi (552 kPa) static or less. Pressure-reducing valves shall be specified and installed in accordance with Section 604.8 of the International Plumbing Code.

**708.12.10 Distribution pipe.** Distribution piping shall comply with Sections 708.12.10.1 through 708.12.10.4.

**708.12.10.1 Materials.** Distribution piping conveying graywater shall conform to standards and requirements specified by the International Plumbing Code for non-potable water.

**708.12.10.2 Joints.** Distribution piping conveying graywater shall utilize joints approved for use with the distribution piping and appropriate for the intended applications as specified in the International Plumbing Code.

**708.12.10.3 Size.** Distribution piping conveying graywater shall be sized in accordance with the International Plumbing Code for the intended application or applications.

**708.12.10.4 Labeling and marking.** All graywater distribution piping shall be either the color purple and embossed or integrally stamped or marked "CAUTION: NONPOTABLE WATER – DO NOT DRINK" or shall be installed with a purple identification tape or wrap. Identification tape shall be at least 3 inches wide and have white or black lettering on purple field stating "CAUTION: NON-POTABLE WATER – DO NOT DRINK". Identification tape shall be installed on top of graywater distribution pipes, fastened at least every 10 feet to each pipe length and run continuously the entire length of the pipe. Lettering shall be readily observable within the room or space where the piping is located.

**Exception:** Outside of the building, purple piping is not required downstream of the backflow preventer where graywater is used for outdoor applications.

**708.13 Tests and inspections.** Tests and inspections shall be performed in accordance with Sections 708.13.1 through 708.13.9.

**708.13.1 Drainage and vent test.** A pressure test shall be applied to the graywater collection piping, overflow piping, storage tank, storage tank drainage piping and tank vent piping in accordance with Section 312 of the International Plumbing Code.

**708.13.2 Drainage and vent final test.** A final test shall be applied to the graywater collection piping, overflow piping, storage tank, and tank vent piping in accordance with Section 312.4 of the International Plumbing Code.

**708.13.3 Water supply system test.** The testing of makeup water supply piping and rainwater distribution piping shall be conducted in accordance with Section 312.5 of the International Plumbing Code.

**708.13.4 Inspection and testing of backflow prevention assemblies.** The testing of backflow preventers and backwater valves shall be conducted in accordance with Section 312.10 of the International Plumbing Code.

**708.13.5 Inspection vermin and insect protection.** Inlets and vents to the system shall be inspected to verify that each is protected to prevent the entrance of insects and vermin into the storage tank and piping systems in accordance with Section 708.8.

**708.13.6 Storage tank tests.** Storage tanks shall be tested in accordance with all of the following:

1. Storage tanks shall be filled with water to the overflow line prior to and during inspection. All seams and joints shall be left exposed and the tank shall remain water tight without leakage for a period of 24 hours.
2. After 24 hours, supplemental water shall be introduced for a period of 15 minutes to verify proper drainage of the overflow system and verify that there are no leaks.
3. Following the successful test of the overflow, the water level in the tank shall be reduced to a point 2 inches below the makeup water trigger point using the tank drain. The tank drain shall be observed for proper operation. The makeup water system shall be observed to verify proper operation, and successful automatic shutoff of the system at the refill threshold. Water shall not be drained from the overflow at any time during the refill test.

**708.13.7 Supply pressure test.** The static water pressure at the point of use furthest from the supply shall be verified to be within the range required for the application, in accordance with Section 707.12.11.

**708.13.8 Water quality test.** The quality of the water for the intended application shall be verified at the point of use in accordance with the requirements of the jurisdiction.

**708.14 Operation and maintenance manuals.** Operations and maintenance materials shall be supplied with graywater systems in accordance with Sections 708.14.1 through 708.14.4.

**708.14.1 Manual.** A detailed operations and maintenance manual shall be supplied in hardcopy form with all graywater systems.

**708.14.2 Schematics.** The manual shall include a detailed system schematic, locations of all system components, and a list of all system components including manufacturer and model number.

**708.14.3 Maintenance procedures.** The manual shall provide a maintenance schedule and procedures for all system components requiring periodic maintenance. Consumable parts including filters shall be noted along with part numbers.

**708.14.4 Operations procedures.** The manual shall include system startup and shutdown procedures. The manual shall include detailed operating procedures for the system.

## **SECTION 709 RECLAIMED WATER SYSTEMS**

**709.1 Scope.** The provisions of this section shall govern the construction, installation, alteration, and repair of systems supplying non-potable reclaimed water.

**709.2 Permits.** Permits shall be required for the construction, installation, alteration, and repair of reclaimed water systems. Construction documents, engineering calculations, diagrams, and other such data pertaining to the reclaimed system shall be submitted with each application for permit.

**709.3 Potable water connections.** Connections between a reclaimed water system and a potable water system shall be protected against backflow in accordance with Section 608 of the International Plumbing Code.

**709.4 Installation.** Except as provided for in this section, systems shall be installed in compliance with the provisions of the International Plumbing Code and manufacturer's instructions, as applicable.

**709.5 Applications.** Reclaimed water shall be utilized in accordance with Section 706 and local codes.

**709.6 Approved components and materials.** Piping, plumbing components, and material used in the reclaimed water systems shall be manufactured of material approved for the intended application.

**709.7 Water-pressure reducing valve or regulator.** Where the reclaimed water pressure supplied to the building exceeds 80 psi (552 kPa) static, a pressure-reducing valve shall be installed to reduce the pressure in the reclaimed water distribution system piping to 80 psi (552 kPa) static or less. Pressure-reducing valves shall be specified and installed in accordance with Section 604.8 of the International Plumbing Code.

**709.8 Trenching requirements.** Water service piping, including piping containing reclaimed water, shall be separated from the building sewer by 5 feet (1524 mm) of undisturbed or compacted earth. Reclaimed water piping shall be separated from potable water piping underground by 5 feet (1524 mm) of undisturbed or compacted earth. Reclaimed water service pipes shall not be located in, under or above cesspools, septic tanks, septic tank drainage fields or seepage pits. Buried reclaimed water piping shall comply with the requirements of Section 306 of the International Plumbing Code for support, trenching, bedding, backfilling, and tunneling.

### **Exceptions:**

1. The required separation distance shall not apply where the bottom of the reclaimed water service pipe within 5 feet (1524 mm) of the sewer is a minimum of 12 inches (305 mm) above the top of the highest point of the sewer and the pipe materials comply with the requirements of the International Plumbing Code for the application.
2. The required separation distance shall not apply where the bottom of the potable water service pipe within 5 feet (1524 mm) of the reclaimed water pipe is a minimum of 12 inches (305 mm) above the top of the highest point of the reclaimed water pipe and the pipe materials comply with the requirements of the International Plumbing Code for the application.
3. Water service pipe is permitted to be located in the same trench with a building sewer, provided such sewer is constructed of materials that comply with the requirements of the International Plumbing Code for the application.
4. The required separation distance shall not apply where a potable or non-potable water service pipe crosses a sewer pipe provided the water service pipe is sleeved to at least 5 feet (1524 mm) horizontally from the sewer pipe centerline on both sides of such crossing with pipe materials that comply with the requirements of the International Plumbing Code for the application.
5. The required separation distance shall not apply where a potable water service pipe crosses a reclaimed water pipe provided the potable water service pipe is sleeved to at least 5 feet (1524 mm) horizontally from the reclaimed water pipe centerline on both sides of such crossing with pipe materials that comply with the requirements of the International Plumbing Code for the application.

**709.9 Reclaimed water systems.** The design of the reclaimed water systems shall conform to accepted engineering practice.

**709.9.1 Distribution pipe.** Distribution piping shall comply with Sections 709.9.1.1 through 709.9.1.4.

**709.9.1.1 Materials.** Distribution piping conveying reclaimed water shall conform to standards and requirements specified by the International Plumbing Code.

**709.9.1.2 Joints.** Distribution piping conveying reclaimed water shall utilize joints approved for use with the distribution piping and appropriate for the intended applications as specified in the International Plumbing Code.

**709.9.1.3 Size.** Distribution piping conveying reclaimed water shall be sized in accordance with the International Plumbing Code for the intended application.

**709.9.1.4 Labeling and marking.** Reclaimed water distribution piping shall be either the color purple and embossed or integrally stamped or marked "CAUTION: NONPOTABLE WATER – DO NOT DRINK" or be installed with a purple identification tape or wrap. Identification tape shall be at least 3 inches wide and have white or black lettering on purple field stating "CAUTION: NON-POTABLE WATER – DO NOT DRINK". Identification tape shall be installed on top of reclaimed water distribution pipes, fastened at least every 10 feet to each pipe length and run continuously the entire length of the pipe. Lettering shall be readily observable within the room or space where the piping is located.

**Exception:** Outside of the building, purple piping is not required downstream of the backflow preventer where reclaimed water is used for outdoor applications.

**709.10 Tests and inspections.** Tests and inspections shall be performed in accordance with Sections 709.10.1 and 709.10.2.

**709.10.1 Water supply system test.** The testing of makeup water supply piping and reclaimed water distribution piping shall be conducted in accordance with Section 312.5 of the International Plumbing Code.

**709.10.2 Inspection and testing of backflow prevention assemblies.** The testing of backflow preventers shall be conducted in accordance with Section 312.10 of the International Plumbing Code.

**X01.1.5. Indoor environmental quality and comfort.** Building indoor environmental quality and comfort shall be in accordance with the following:

1. **Construction features, operation and maintenance facilitation shall be in accordance with Section 802.**  
[Language extracted from IgCC PV-2.0]

**SECTION 802  
BUILDING CONSTRUCTION FEATURES, OPERATIONS AND MAINTENANCE FACILITATION**

**802.1 Scope.** To facilitate the operation and maintenance of the completed building, the building and its systems shall comply with the requirements of Sections 802.2 through 802.5.

**802.2 Air handling system access.** The arrangement and location of air handling system components including, but not limited to, ducts, air handler units, fans, coils and condensate pans shall allow access for cleaning and repair of the air handling surfaces of such components. Access ports shall be installed in the air handling system to permit such cleaning and repairs. Piping, conduits, and other building components shall not be located so as to obstruct the required access ports.

**802.3 Durability of air handling surfaces.** Surfaces exposed to airflow within air handling systems shall be constructed of materials that are resistant to deterioration and will not break away, crack, peel, flake off, or show evidence of delamination or continued erosion when tested in accordance with the erosion test in UL 181.

**802.4 Air handling system filters.** Filter racks shall be designed to prevent airflow from bypassing filters. Access doors and panels provided for filter replacement shall be fitted with flexible seals to provide an effective seal between the doors and panels and the mating filter rack surfaces. Special tools shall not be required for opening access doors and panels. Filter access panels and doors shall not be obstructed.

**802.5 Airstream surfaces.** Materials exposed to airflow within ducts, within air plenums, or on top of suspended ceilings, shall not break away, crack, peel, flake off, or show evidence of delamination or continued erosion when tested in accordance with the erosion test in UL 181.

2. **Building HVAC systems shall be in accordance with Section 803.1 and ASHRAE 62.2.**

[Language extracted from IgCC PV-2.0]

**803.1 Construction phase requirements.** The ventilation of buildings during the construction phase shall be in accordance with sections 803.1.1 through 803.1.3.

**803.1.1 Duct openings.** Duct and other related air distribution component openings shall be covered with tape, plastic, sheet metal or shall be closed by an approved method to reduce the amount of dust and debris that collects in the system from the time of rough-in installation and until startup of the heating and cooling equipment. Dust and debris shall be cleaned from duct openings prior to system flush out and building occupancy.

**803.1.2 Indoor air quality during construction.** Temporary ventilation during construction shall be provided in accordance with Sections 803.1.2.1 through 803.1.2.3.

**803.1.2.1 Ventilation.** Ventilation during construction shall be achieved through openings in the building envelope using natural ventilation in accordance with the provisions of the International Building Code or the International Mechanical Code, or fans that produce a minimum of three air changes per hour.

**803.1.2.2 Protection of HVAC system openings.** HVAC supply and return duct and equipment openings shall be protected during dust-producing operations.

**803.1.2.3 Return air filters.** Where a forced air HVAC system is used during construction, new return air filters shall be installed prior to system flush out and building occupancy.

**803.1.3 Construction phase ductless system or filter.** Where spaces are conditioned during the construction phase, space conditioning systems shall be of the ductless variety, or filters for ducted systems shall be rated at MERV 8 or higher and system equipment shall be designed to be compatible. Duct system design shall account for pressure drop across the filter.

3. Indoor air quality and pollutant control measures shall be in accordance with Section 804.  
[Language extracted from IgCC PV-2.0]

**SECTION 804**  
**SPECIFIC indoor air quality & Pollutant Control MEASURES**

**804.1 Fireplaces and appliances.** Where located within buildings, fireplaces, solid fuel-burning appliances, vented decorative gas appliances, vented gas fireplace heaters and decorative gas appliances for installation in fireplaces shall comply with Sections 804.1.1 through 804.1.7. Unvented room heaters and unvented decorative appliances, including alcohol burning, shall be prohibited.

**804.1.1 Installation.** Fireplaces and appliances shall be installed in accordance with the manufacturer's instructions.

**804.1.2 Venting.** Fireplaces and fuel-burning appliances shall be vented to the outdoors and shall be provided with combustion air in accordance with the International Mechanical Code and the International Fuel Gas Code.

**804.1.3 Gas fireplaces.** Vented decorative gas appliances and vented gas fireplace heaters shall be direct-vented and listed in accordance with ANSI Z21.50/CSA 2.22 and ANSI Z21.88/CSA 2.33, respectively.

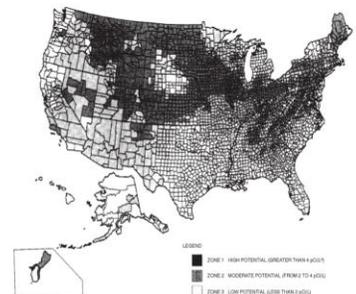
**804.1.4 Fireplaces.** Wood-burning fireplaces shall be provided with combustion air directly from the outdoors and shall be provided with a means to tightly close off the chimney flue and combustion air outlets when the fireplace is not in use.

**804.1.5 Wood-fired appliances.** Wood stoves and wood fireplace inserts shall be listed in accordance with UL 1482 and shall be certified in accordance with the requirements of the EPA Standards of Performance for New Residential Wood Heaters, 40 CFR Part 60 subpart AAA.

**804.1.6 Biomass appliances.** Biomass fireplaces, stoves and inserts shall be listed in accordance with ASTM E1509. Biomass boilers and furnaces shall be listed in accordance with CSA B366.1-2009 or UL391.

**804.2 Radon mitigation.** Buildings in High and Moderate Radon Potential (Zone 1 and 2) locations, as determined by Figure 804.2(1) and Table 804.2 shall comply with Sections 804.2.1 through 804.2.10.

**FIGURE 804.2**  
**EPA MAP OF RADON ZONES**



**TABLE 804.2 (Following Pages)**  
**HIGH RADON POTENTIAL (ZONE 1) COUNTIES<sup>a</sup>**

a. pCi/L standard for picocuries per liter of radon gas. EPA recommends that all homes that measure 4 pCi/L and greater be mitigated

The United States Environmental Protection Agency and the United States Geological Survey have evaluated the radon potential in the United States and have developed a map of radon zones designed to assist code officials in deciding whether radon-resistant features are applicable in new construction.

The map assigns each of the 3,141 counties in the United States to one of three zones based on radon potential. Each zone designation reflects the average short-term radon measurement that can be expected to be measured in a building without the implementation of radon control methods. The radon zone designation of highest priority is Zone 1. Table 804.2 lists the Zone 1 counties illustrated on the map. More detailed information can be obtained from state-specific booklets (EPA-402-R-93-021 through 070) available through State Radon Offices or from U.S. EPA Regional Offices.

**ALABAMA**

Calhoun  
Clay  
Cleburne  
Colbert  
Coosa  
Franklin  
Jackson  
Lauderdale  
Lawrence  
Limestone  
Madison  
Morgan  
Talladega

**CALIFORNIA**

Santa Barbara  
Ventura

**COLORADO**

Adams  
Arapahoe  
Baca  
Bent  
Boulder  
Chaffee  
Cheyenne  
Clear Creek  
Crowley  
Custer  
Delta  
Denver  
Dolores  
Douglas  
El Paso  
Elbert  
Fremont  
Garfield  
Gilpin  
Grand  
Gunnison  
Huerfano  
Jackson  
Jefferson  
Kiowa  
Kit Carson  
Lake  
Larimer  
Las Animas  
Lincoln  
Logan  
Mesa  
Moffat  
Montezuma  
Montrose  
Morgan  
Otero  
Ouray  
Park  
Phillips  
Pitkin  
Prowers  
Pueblo  
Rio Blanco  
San Miguel  
Summit  
Teller  
Washington  
Weld  
Yuma

**CONNECTICUT**

Fairfield  
Middlesex  
New Haven  
New London

**GEORGIA**

Cobb  
De Kalb  
Fulton  
Gwinnett

**IDAHO**

Benewah  
Blaine  
Boise  
Bonner  
Boundary  
Butte  
Camas  
Clark  
Clearwater  
Custer  
Elmore  
Fremont  
Gooding  
Idaho  
Kootenai  
Latah  
Lemhi  
Shoshone  
Valley

**ILLINOIS**

Adams  
Boone  
Brown  
Bureau  
Calhoun  
Carroll  
Cass  
Champaign  
Coles  
De Kalb  
De Witt  
Douglas  
Edgar  
Ford  
Fulton  
Greene  
Grundy  
Hancock  
Henderson  
Henry  
Iroquois  
Jersey  
Jo Daviess  
Kane  
Kendall  
Knox  
La Salle  
Lee  
Livingston  
Logan  
Macon  
Marshall  
Mason  
McDonough  
McLean  
Menard  
Mercer

Morgan  
Moultrie  
Ogle  
Peoria  
Piatt  
Pike  
Putnam  
Rock Island  
Sangamon  
Schuyler  
Scott  
Stark  
Stephenson  
Tazewell  
Vermilion  
Warren  
Whiteside  
Winnebago  
Woodford

**INDIANA**

Adams  
Allen  
Bartholomew  
Benton  
Blackford  
Boone  
Carroll  
Cass  
Clark  
Clinton  
De Kalb  
Decatur  
Delaware  
Elkhart  
Fayette  
Fountain  
Fulton  
Grant  
Hamilton  
Hancock  
Harrison  
Hendricks  
Henry  
Howard  
Huntington  
Jay  
Jennings  
Johnson  
Kosciusko  
Lagrange  
Lawrence  
Madison  
Marion  
Marshall  
Miami  
Monroe  
Montgomery  
Noble  
Orange  
Putnam  
Randolph  
Rush  
Scott  
Shelby  
Steuben  
St. Joseph  
Tippecanoe  
Tipton  
Union  
Vermillion

Wabash  
Warren  
Washington  
Wayne  
Wells  
White  
Whitley

**IOWA**

All Counties

**KANSAS**

Atchison  
Barton  
Brown  
Cheyenne  
Clay  
Cloud  
Decatur  
Dickinson  
Douglas  
Ellis  
Ellsworth  
Finney  
Ford  
Geary  
Gove  
Graham  
Grant  
Gray  
Greeley  
Hamilton  
Haskell  
Hodgeman  
Jackson  
Jewell  
Johnson  
Keary  
Kingman  
Kiowa  
Lane  
Leavenworth  
Lincoln  
Logan  
Marion  
Marshall  
McPherson  
Meade  
Mitchell  
Nemaha  
Ness  
Norton  
Osborne  
Ottawa  
Pawnee  
Phillips  
Pottawatomie  
Pratt  
Rawlins  
Republic  
Rice  
Riley  
Rooks  
Rush  
Russell  
Saline  
Scott  
Sheridan  
Sherman  
Smith  
Stanton

Thomas  
Trego  
Wallace  
Washington  
Wichita  
Wyandotte

**KENTUCKY**

Adair  
Allen  
Barren  
Bourbon  
Boyle  
Bullitt  
Casey  
Clark  
Cumberland  
Fayette  
Franklin  
Green  
Harrison  
Hart  
Jefferson  
Jessamine  
Lincoln  
Marion  
Mercer  
Metcalfe  
Monroe  
Nelson  
Pendleton  
Pulaski  
Robertson  
Russell  
Scott  
Taylor  
Warren  
Woodford

**MAINE**

Androscoggin  
Aroostook  
Cumberland  
Franklin  
Hancock  
Kennebec  
Lincoln  
Oxford  
Penobscot  
Piscataquis  
Somerset  
York

**MASS.**

Essex  
Middlesex  
Worcester

**MICHIGAN**

Branch  
Calhoun

Cass  
Hillsdale  
Jackson  
Kalamazoo  
Lenawee  
St. Joseph  
Washtenaw

**MINNESOTA**

Becker  
Big Stone  
Blue Earth  
Brown  
Carver  
Chippewa  
Clay  
Cottonwood  
Dakota  
Dodge  
Douglas  
Faribault  
Fillmore  
Freeborn  
Goodhue  
Grant  
Hennepin  
Houston  
Hubbard  
Jackson  
Kanabec  
Kandiyohi  
Kittson  
Lac Qui Parle  
Le Sueur  
Lincoln  
Lyon  
Mahnomen  
Marshall  
Martin  
McLeod  
Meeker  
Mower  
Murray  
Nicollet  
Nobles  
Norman  
Olmsted  
Otter Tail  
Pennington  
Pipestone  
Polk  
Pope  
Ramsey  
Red Lake  
Redwood  
Renville  
Rice  
Rock  
Roseau  
Scott  
Sherburne  
Sibley  
Stearns  
Steele  
Stevens  
Swift  
Todd  
Traverse  
Wabasha  
Wadena  
Waseca

Washington  
Watonwan  
Wilkin  
Winona  
Wright  
Yellow Medicine

**MISSOURI**

Andrew  
Atchison  
Buchanan  
Cass  
Clay  
Clinton  
Holt  
Iron  
Jackson  
Nodaway  
Platte

**MONTANA**

Beaverhead  
Big Horn  
Blaine  
Broadwater  
Carbon  
Carter  
Cascade  
Chouteau  
Custer  
Daniels  
Dawson  
Deer Lodge  
Fallon  
Fergus  
Flathead  
Gallatin  
Garfield  
Glacier  
Granite  
Hill  
Jefferson  
Judith Basin  
Lake  
Lewis and Clark  
Liberty  
Lincoln  
Madison  
McCone  
Meagher  
Mineral  
Missoula  
Park  
Phillips  
Pondera  
Powder River  
Powell  
Prairie  
Ravalli  
Richland  
Roosevelt  
Rosebud  
Sanders  
Sheridan  
Silver Bow  
Stillwater  
Teton  
Toole  
Valley  
Wibaux

Yellowstone  
National Park

**NEBRASKA**

Adams  
Boone  
Boyd  
Burt  
Butler  
Cass  
Cedar  
Clay  
Colfax  
Cuming  
Dakota  
Dixon  
Dodge  
Douglas  
Fillmore  
Franklin  
Frontier  
Furnas  
Gage  
Gosper  
Greeley  
Hamilton  
Harlan  
Hayes  
Hitchcock  
Hurston  
Jefferson  
Johnson  
Kearney  
Knox  
Lancaster  
Madison  
Nance  
Nemaha  
Nuckolls  
Otoe  
Pawnee  
Phelps  
Pierce  
Platte  
Polk  
Red Willow  
Richardson  
Saline  
Sarpy  
Saunders  
Seward  
Stanton  
Thayer  
Washington  
Wayne  
Webster  
York

**NEVADA**

Carson City  
Douglas  
Eureka  
Lander  
Lincoln  
Lyon  
Mineral  
Pershing  
White Pine

**NEW HAMPSHIRE**  
Carroll

**NEW JERSEY**

Hunterdon  
Mercer  
Monmouth  
Morris  
Somerset  
Sussex  
Warren

**NEW MEXICO**

Bernalillo  
Colfax  
Mora  
Rio Arriba  
San Miguel  
Santa Fe  
Taos

**NEW YORK**

Albany  
Allegany  
Broome  
Cattaraugus  
Cayuga  
Chautauqua  
Chemung  
Chenango  
Columbia  
Cortland  
Delaware  
Dutchess  
Erie  
Genesee  
Greene  
Livingston  
Madison  
Onondaga  
Ontario  
Orange  
Otsego  
Putnam  
Rensselaer  
Schoharie  
Schuyler  
Seneca  
Steuben  
Sullivan  
Tioga  
Tompkins  
Ulster  
Washington  
Wyoming  
Yates

**N. CAROLINA**

Alleghany  
Buncombe  
Cherokee  
Henderson  
Mitchell  
Rockingham  
Transylvania  
Watauga

**N. DAKOTA**

All Counties

**OHIO**

Adams  
Allen  
Ashland

Auglaize  
Belmont  
Butler  
Carroll  
Champaign  
Clark  
Clinton  
Columbiana  
Coshocton  
Crawford  
Darke  
Delaware  
Fairfield  
Fayette  
Franklin  
Greene  
Guernsey  
Hamilton  
Hancock  
Hardin  
Harrison  
Holmes  
Huron  
Jefferson  
Knox  
Licking  
Logan  
Madison  
Marion  
Mercer  
Miami  
Montgomery  
Morrow  
Muskingum  
Perry  
Pickaway  
Pike  
Preble  
Richland  
Ross  
Seneca  
Shelby  
Stark  
Summit  
Tuscarawas  
Union  
Van Wert  
Warren  
Wayne  
Wyandot

**PENNSYLVANIA**

Adams  
Allegheny  
Armstrong  
Beaver  
Bedford  
Berks  
Blair  
Bradford  
Bucks  
Butler  
Cameron  
Carbon  
Centre  
Chester  
Clarion  
Clearfield  
Clinton  
Columbia  
Cumberland  
Dauphin

Delaware  
Franklin  
Fulton  
Huntingdon  
Indiana  
Juniata  
Lackawanna  
Lancaster  
Lebanon  
Lehigh  
Luzerne  
Lycoming  
Mifflin  
Monroe  
Montgomery  
Montour  
Northampton  
Northumberland  
Perry  
Schuylkill  
Snyder  
Sullivan  
Susquehanna  
Tioga  
Union  
Venango  
Westmoreland  
Wyoming  
York

**RHODE ISLAND**

Kent  
Washington

**S. CAROLINA**

Greenville

**S. DAKOTA**

Aurora  
Beadle  
Bon Homme  
Brookings  
Brown  
Brule  
Buffalo  
Campbell  
Charles Mix  
Clark  
Clay  
Codington  
Corson  
Davison  
Day  
Deuel  
Douglas  
Edmunds  
Faulk  
Grant  
Hamlin  
Hand  
Hanson  
Hughes  
Hutchinson  
Hyde  
Jerauld  
Kingsbury  
Lake  
Lincoln  
Lyman  
Marshall  
McCook  
McPherson

Miner  
Minnehaha  
Moody  
Perkins  
Potter  
Roberts  
Sanborn  
Spink  
Stanley  
Sully  
Turner  
Union  
Walworth  
Yankton

**TENNESEE**

Anderson  
Bedford  
Blount  
Bradley  
Claiborne  
Davidson  
Giles  
Grainger  
Greene  
Hamblen  
Hancock  
Hawkins  
Hickman  
Humphreys  
Jackson  
Jefferson  
Knox  
Lawrence  
Lewis  
Lincoln  
Loudon  
Marshall  
Maury  
McMinn  
Meigs  
Monroe  
Moore  
Perry  
Roane  
Rutherford  
Smith  
Sullivan  
Trousdale  
Union  
Washington  
Wayne  
Williamson  
Wilson

**UTAH**

Carbon  
Duchesne  
Grand  
Piute  
Sanpete  
Sevier  
Uintah

**VIRGINIA**

Alleghany  
Amelia  
Appomattox  
Augusta  
Bath  
Bland  
Botetourt

Bristol  
Brunswick  
Buckingham  
Buena Vista  
Campbell  
Chesterfield  
Clarke  
Clifton Forge  
Covington  
Craig  
Cumberland  
Danville  
Dinwiddie  
Fairfax  
Falls Church  
Fluvanna  
Frederick  
Fredericksburg  
Giles  
Goochland  
Harrisonburg  
Henry  
Highland  
Lee  
Lexington  
Louisa  
Martinsville  
Montgomery  
Nottoway  
Orange  
Page  
Patrick  
Pittsylvania  
Powhatan  
Pulaski  
Radford  
Roanoke  
Rockbridge  
Rockingham  
Russell  
Salem  
Scott  
Shenandoah  
Smyth  
Spotsylvania  
Stafford  
Staunton  
Tazewell  
Warren  
Washington  
Waynesboro  
Winchester  
Wythe

**WASHINGTON**

Clark  
Ferry  
Okanogan  
Pend Oreille  
Skamania  
Spokane  
Stevens

**W. VIRGINIA**

Berkeley  
Brooke  
Grant  
Greenbrier  
Hampshire  
Hancock  
Hardy  
Jefferson

Marshall  
Mercer  
Mineral  
Monongalia  
Monroe  
Morgan  
Ohio  
Pendleton  
Pocahontas  
Preston  
Summers  
Wetzel

**WISCONSIN**

Buffalo  
Crawford  
Dane  
Dodge  
Door  
Fond du Lac  
Grant  
Green  
Green Lake  
Iowa  
Jefferson  
Lafayette  
Langlade  
Marathon  
Menominee  
Pepin  
Pierce  
Portage  
Richland  
Rock  
Shawano  
St. Croix  
Vernon  
Walworth  
Washington  
Waukesha  
Waupaca  
Wood

**WYOMING**

Albany  
Big Horn  
Campbell  
Carbon  
Converse  
Crook  
Fremont  
Goshen  
Hot Springs  
Johnson  
Laramie  
Lincoln  
Natrona  
Niobrara  
Park  
Sheridan  
Sublette  
Sweetwater  
Teton  
Uinta  
Washakie

**804.2.1 Subfloor preparation.** A layer of gas-permeable material shall be placed under all concrete slabs and other floor systems that directly contact the ground and are within the walls of the occupied spaces of the building, to facilitate future installation of a sub-slab depressurization system, if needed. The gas-permeable layer shall consist of one of the following:

1. A uniform layer of clean aggregate, a minimum of 4 inches (102 mm) thick. The aggregate shall consist of material that will pass through a 2-inch (51 mm) sieve and be retained by a 1/4-inch (6.4 mm) sieve.
2. A uniform layer of sand (native or fill), a minimum of 4 inches (102 mm) thick, overlain by a layer or strips of geotextile drainage matting designed to allow the lateral flow of soil gases.
3. Other materials, systems or floor designs with demonstrated capability to permit depressurization across the entire sub-floor area.

**804.2.2 Soil-gas-retarder.** A minimum 6-mil (0.15 mm) [or 3-mil (0.075 mm) cross-laminated] polyethylene or equivalent flexible sheeting material that conforms to ASTM E1643 shall be placed on top of the gas-permeable layer prior to casting the slab or placing the floor assembly to serve as a soil-gas-retarder by bridging any cracks that develop in the slab or floor assembly and to prevent concrete from entering the void spaces in the aggregate base material. The sheeting shall cover the entire floor area with separate sections of sheeting lapped at least 12 inches (305 mm). The sheeting shall fit closely around any pipe, wire or other penetrations of the material. All punctures or tears in the material shall be sealed or covered with additional sheeting.

**804.2.3 Entry routes.** Potential radon entry routes shall be closed in accordance with Sections 804.2.3.1 through 804.2.3.10.

**804.2.3.1 Floor openings.** Openings around bathtubs, showers, water closets, pipes, wires or other objects that penetrate concrete slabs or other floor assemblies shall be filled with a polyurethane caulk or equivalent sealant applied in accordance with the manufacturer's recommendations.

**804.2.3.2 Concrete joints.** All control joints, isolation joints, construction joints and any other joints in concrete slabs or between slabs and foundation walls shall be sealed with a caulk or sealant. Gaps and joints shall be cleared of loose material and filled with polyurethane caulk or other elastomeric sealant applied in accordance with the manufacturer's recommendations.

**804.2.3.3 Condensate drains.** Condensate drains shall be trapped or routed through nonperforated pipe to daylight.

**804.2.3.4 Sumps.** Sump pits open to soil or serving as the termination point for sub-slab or exterior drain tile loops shall be covered with a gasketed or otherwise sealed lid. Sumps used as the suction point in a sub-slab depressurization system shall have a lid designed to accommodate the vent pipe. Sumps used as a floor drain shall have a lid equipped with a trapped inlet.

**804.2.3.5 Foundation walls.** Hollow block masonry foundation walls shall be constructed with either a continuous course of solid masonry, one course of masonry grouted solid, or a solid concrete beam at or above finished ground surface to prevent passage of air from the interior of the wall into the living space. Where a brick veneer or other masonry ledge is installed, the course immediately below that ledge shall be sealed. Joints, cracks or other openings around all penetrations of both exterior and interior surfaces of masonry block or wood foundation walls below the ground surface shall be filled with polyurethane caulk or equivalent sealant. Penetrations of concrete walls shall be filled.

**804.2.3.6 Dampproofing.** The exterior surfaces of portions of concrete and masonry block walls below the ground surface shall be dampproofed.

**804.2.3.7 Air-handling units.** Air-handling units in crawl spaces shall be sealed to prevent air from being drawn into the unit.

**Exception:** Units with gasketed seams or units that are otherwise sealed by the manufacturer to prevent leakage.

**804.2.3.8 Ducts.** Ductwork passing through or beneath a slab shall be of seamless material or sealed water-tight. Joints in such ductwork shall be sealed water-tight.

**804.2.3.9 Crawl space floors.** Openings around all penetrations through floors above crawl spaces shall be caulked or otherwise filled to prevent air leakage.

**804.2.3.10 Crawl space access.** Access doors and other openings or penetrations between basements and adjoining crawl spaces shall be closed, gasketed or otherwise filled to prevent air leakage.

**804.2.4 Passive submembrane depressurization system.** In buildings with crawl space foundations, the following components of a passive sub-membrane depressurization system shall be installed during construction.

**Exception:** Buildings in which an approved mechanical crawl space ventilation system or other equivalent system is installed.

**804.2.4.1 Ventilation.** Crawl spaces shall be provided with vents to the exterior of the building.

**804.2.4.2 Soil-gas-retarder.** The soil in crawl spaces shall be covered with a continuous layer of minimum 6-mil (0.15 mm) polyethylene soil-gas-retarder that conforms to ASTM E1643. The ground cover shall be lapped a minimum of 12 inches (305 mm) at joints and shall extend to all foundation walls enclosing the crawl space area.

**804.2.4.3 Vent pipe.** A plumbing tee or other approved connection shall be inserted horizontally beneath the sheeting and connected to a 3- or 4-inch-diameter (76 mm or 102 mm) fitting with a vertical vent pipe installed through the sheeting. The vent pipe shall be extended up through the building floors, terminate at least 12 inches (305 mm) above the roof in a location at least 10 feet (3048 mm) away from any window or other opening into the conditioned spaces of the building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.

**804.2.5 Passive subslab depressurization system.** In basement or slab-on-grade buildings, the following components of a passive sub-slab depressurization system shall be installed during construction.

**804.2.5.1 Vent pipe.** A minimum 3-inch-diameter (76 mm) ABS, PVC or equivalent gas-tight pipe shall be embedded vertically into the sub-slab aggregate or other permeable material before the slab is cast. A "T" fitting or equivalent method shall be used to ensure that the pipe opening remains within the sub-slab permeable material. Alternatively, the 3-inch (76 mm) pipe shall be inserted directly into an interior perimeter drain tile loop or through a sealed sump cover where the sump is exposed to the sub-slab aggregate or connected to it through a drainage system.

The pipe shall be extended up through the building floors, terminate at least 12 inches (305 mm) above the surface of the roof in a location at least 10 feet (3048 mm) away from any window or other opening into the conditioned spaces of the building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.

**804.2.5.2 Multiple vent pipes.** In buildings where interior footings or other barriers separate the sub-slab aggregate or other gas-permeable material, each area shall be fitted with an individual vent pipe. Vent pipes shall connect to a single vent that terminates above the roof or each individual vent pipe shall terminate separately above the roof.

**804.2.6 Vent pipe drainage.** All components of the radon vent pipe system shall be installed to provide positive drainage to the ground beneath the slab or soil-gas-retarder.

**804.2.7 Vent pipe accessibility.** Radon vent pipes shall be accessible for future fan installation through an attic or other area outside the habitable space.

**Exception:** The radon vent pipe need not be accessible in an attic space where an approved roof-top electrical supply is provided for future use.

**804.2.8 Vent pipe identification.** All exposed and visible interior radon vent pipes shall be identified with at least one label on each floor and in accessible attics. The label shall read: "Radon Reduction System."

**804.2.9 Combination foundations.** Combination basement/crawl space or slab-on-grade/crawl space foundations shall have separate radon vent pipes installed in each type of foundation area. Each radon vent pipe shall terminate above the roof or shall be connected to a single vent that terminates above the roof.

**804.2.10 Power source.** To provide for future installation of an active sub-membrane or sub-slab depressurization system, an electrical circuit terminated in an approved box shall be installed during construction in the attic or other anticipated location of vent pipe fans. An electrical supply shall also be accessible in anticipated locations of system failure alarms.

**804.3 Building flush out.** After all interior finishes are installed, the building shall be flushed-out by supplying continuous ventilation with all air handling units at their maximum outdoor air rate for at least 14 days while maintaining an internal temperature of at least 60°F, and relative humidity not higher than 60 percent. Occupancy shall be permitted to start 7 days after start of the flush-out, provided that flush-out continues for the full 14 days. The building shall not be "baked out" by increasing the temperature of the space. Where continuous ventilation is not possible, the aggregate of flush-out periods shall be equivalent to 14 days of continuous ventilation.

**Exceptions:**

1. Group S, F, H and U occupancies shall not be required to comply with this section.
2. A building shall not be required to be flushed-out where it is tested for indoor air quality and the testing results indicate that the levels of VOC's are acceptable.

**804.4 Building Entrances.** All building entrances shall employ an entry mat system that shall have a scraper surface, an absorption surface, and a finishing surface in accordance with Sections 804.4.1 through 804.4.3. Each surface shall be not less than the width of the entry opening, and the minimum length is measured in the primary direction of travel.

**Exceptions:**

1. Entrances to individual dwelling units.
2. The length of entry mat surfaces is allowed to be reduced because of a barrier, such as a counter, partition or wall, or where local regulations prohibit the use of scraper surfaces outside of the entry. In such cases, the entry mat surfaces shall have a minimum length of 3 ft (914mm) of indoor surface, with a minimum combined length of 6 ft (1829 mm).

**804.4.1 Scraper Surface.** The scraper surface shall comply with all of the following:

1. It shall be the first surface stepped on when entering the building.
2. It shall be either immediately outside of or inside of the entry.
3. It shall be not less than 3 feet (914mm) in length.
4. It shall consist of permanently mounted grates or removable mats with knobby or squeegee like projections.

**804.4.2 Absorption Surface.** The absorption surface shall comply with all of the following:

1. It shall be the second surface stepped on when entering the building.
2. It shall be not less than 3 feet (914mm) in length and made from materials that can perform both a scraping action and a moisture wicking action.

**804.4.3 Finishing Surface.** The finishing surface shall comply with all of the following:

1. It shall be the third surface stepped on when entering the building.
2. It shall be not less than 4 feet (1219mm) in length and made from materials that will both capture and hold any remaining particles or moisture.

4. Material emissions and pollution control shall be in accordance with Section 806.

[Language extracted from IgCC PV-2.0]

**SECTION 806  
material EMISSIONS & Pollutant Control**

**806.1 Emissions from glued wood products.** Glued wood products used interior to the approved weather covering of the building shall comply with the emission limits or be manufactured in accordance with the standards cited in Table 806.1. Compliance with emission limits shall be demonstrated following the requirements of Section 93120 of title 17, California Code of Regulations, Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products.

**Exceptions:**

1. Glued wood products that are made using adhesives that do not contain urea-formaldehyde (UF) resins.
2. Glued wood products that are sealed on all sides and edges.
3. Glued wood products that are used to make elements considered to be furniture, fixtures and equipment (FF&E) that are not permanently installed.

**TABLE 806.1  
GLUED PRODUCTS EMISSIONS**

| <b>PRODUCT</b>   | <b>FORMALDEHYDE LIMIT<br/>(ppm)</b> | <b>STANDARD</b>       |
|--|-------------------------------------|-----------------------|
| Hardwood plywood   | 0.05                                | -                     |
| Particle board   | 0.09                                | -                     |
| Medium density fiberboard  | 0.11                                | -                     |
| Thin medium density fiberboard <sup>a</sup>  | 0.13                                | -                     |
| Wood Structural Panels (plywood and OSB)<br>manufactured with moisture resistant adhesives<br>rated with the EXTERIOR or EXPOSURE 1 Bond<br>Classification | -                                   | DOC PS1 or<br>DOC PS2 |
| Prefabricated I-joint  | -                                   | ASTM D5055            |
| Structural Composite Lumber  | -                                   | ASTM D5456            |

a. Maximum thickness of 5/16 inch (8mm).

**806.2 Adhesives and sealants.** A minimum of 85 percent by weight or volume, of site applied adhesives and sealants shall comply with the VOC content limits in Table 806.2(1) or alternative VOC emissions limits in Table 806.2(2). The VOC content shall be determined in accordance with the appropriate standard being either U.S. EPA Method 24, SCAQMD Method 304, 316A or 316B. The exempt compound content shall be determined by either SCAQMD Methods 302 and 303 or ASTM D 3960. Table 806.2(1) adhesives and sealants regulatory category and VOC content compliance determination shall conform to the SCQMD Rule 1168 Adhesive and sealant Applications as amended on 1/7/05. The provisions of this section shall not apply to adhesives and sealants subject to state or federal consumer product VOC regulations. HVAC duct sealants shall be classified as "Other" category within the SCAQMD Rule 1168 sealants table.

**Exception:** HVAC air duct sealants are not required to meet the emissions or the VOC content requirements when the air temperature in which they are applied is less than 40°F (4.5°C).

Table 806.2(2) adhesive alternative emissions standards compliance shall be determined utilizing test methodology incorporated by reference in the CDPH/EHLB/Standard Method V1.1 "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.1" dated February 2010. The alternative emissions testing shall be performed by a laboratory that has the CDPH/EHLB/Standard Method V1.1 test methodology in the scope of its ISO 17025 Accreditation.

**TABLE 806.2(1)  
SITE APPLIED ADHESIVE AND SEALANTS VOC LIMITS**

| <b>ADHESIVE</b>                     | <b>VOC LIMIT</b> |
|-------------------------------------|------------------|
| Indoor carpet adhesives             | 50               |
| Carpet pad adhesives                | 50               |
| Outdoor carpet adhesives            | 150              |
| Wood flooring adhesive              | 100              |
| Rubber floor adhesives              | 60               |
| Subfloor adhesives                  | 50               |
| Ceramic tile adhesives              | 65               |
| VCT and asphalt tile adhesives      | 50               |
| Dry wall and panel adhesives        | 50               |
| Cove base adhesives                 | 50               |
| Multipurpose construction adhesives | 70               |
| Structural glazing adhesives        | 100              |
| Single ply roof membrane adhesives  | 250              |
| Architectural Sealants              | 250              |
| Architectural Sealant Primer        |                  |
| Non Porous                          | 250              |
| Porous                              | 775              |
| Modified Bituminous Sealant Primer  | 500              |
| Other Sealant Primers               | 750              |
| CPVC solvent cement                 | 490              |
| PVC solvent cement                  | 510              |
| ABS solvent cement                  | 325              |
| Plastic Cement Welding              | 250              |
| Adhesive Primer for Plastic         | 550              |
| Contact Adhesive                    | 80               |
| Special Purpose Contact Adhesive    | 250              |
| Structural Wood Member Adhesive     | 140              |

- i. VOC limit less water and less exempt compounds in grams/liter
- ii. For low-solid adhesives and sealants, the VOC limit is expressed in grams/liter of material as specified in Rule 1168. For all other adhesives and sealants, the VOC limits are expressed as grams of VOC per liter of adhesive or sealant less water and less exempt compounds as specified in Rule 1168.

**TABLE 806.2(2)  
VOC EMISSION LIMITS**

| <b>VOC</b>      | <b>LIMIT</b>  |
|-----------------|---|
| Individual VOCs | ≤ ½ CA chronic REL <sup>a</sup>                     |
| Formaldehyde    | ≤ 16.5 µg/m <sup>3</sup> or ≤ 13.5 ppb <sup>b</sup> |

- b. CDPH/EHLB/Standard Method V1.1 Chronic Reference Exposure Level (CREL)
- c. Effective January 1, 2012 limit becomes less than or equal to the CDPH/EHLB/Standard Method V1.1 CREL (≤ 9 µg/m<sup>3</sup> or ≤ 7 ppb)

**806.2.1 Single-ply roof membrane adhesives.** Single-ply roof membrane adhesives shall be exempt from the requirements of Table 806.2(1) in climate zones 6, 7 and 8 as identified in the 2009 IECC.

**806.3 Architectural paints and coatings.** A minimum of 85 percent by weight or volume, of site-applied interior architectural coatings shall comply with VOC content limits in Table 806.3(1) or the alternate emissions limits in Table 806.3(2). The exempt compound content shall be determined by ASTM D3960.

Table 806.3(2) architectural coating alternate emissions standards compliance shall be determined utilizing test methodology incorporated by reference in the CDPH/EHLB/STANDARD METHOD V.1.1 "Standard Method For The Testing And Evaluation Of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers Version 1.1" dated February 2010. The alternative emissions testing shall be performed by a laboratory that has the CDPH/EHLB/STANDARD METHOD V 1.1 test methodology in the scope of its ISO 17025 Accreditation.

**806.4 Flooring** A minimum of 85 percent of the total area of flooring installed within the interior of the building shall comply with the requirements of Table 806.4 (2). Where flooring with more than one distinct product layer is installed, the emissions from each layer shall comply with these requirements. The test methodology used to determine compliance shall be from CDPH/EHLB/STANDARD METHOD V.1.1 "Standard Method For The Testing And Evaluation Of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers Version 1.1" dated February 2010. The emissions testing shall be performed by a laboratory that has the CDPH/EHLB/STANDARD METHOD V 1.1 test methodology in the scope of its ISO 17025 Accreditation.

Where post manufacture coatings or surface applications have not been applied, the flooring listed in Table 806.4(1) shall be deemed to comply with the requirements of Table 806.4(2).

**806.5 Acoustical ceiling tiles and wall systems.** A minimum of 85 percent of acoustical ceiling tiles and wall systems, by square feet, shall comply with the requirements of Table 806.5(2). Where ceiling and wall systems with more than one distinct product layer are installed, the emissions from each layer shall comply with these requirements. The test methodology used to determine compliance shall be from CDPH/EHLB/STANDARD METHOD V.1.1 "Standard Method For The Testing And Evaluation Of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers Version 1.1" dated February 2010. The emissions testing shall be performed by a laboratory that has the CDPH/EHLB/STANDARD METHOD V 1.1 test methodology in the scope of its ISO 17025 Accreditation.

Where post manufacture coatings or surface applications have not been applied, the ceiling or wall systems listed in Table 806.5(1) shall be deemed to comply with the requirements of Table 806.5(2).

**806.6 Insulation.** A minimum of 85 percent of insulation shall comply with the requirements of Table 806.6. The test methodology used to determine compliance shall be from CDPH/EHLB/STANDARD METHOD V.1.1 "Standard Method For The Testing And Evaluation Of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers Version 1.1" dated February 2010. The emissions testing shall be performed by a laboratory that has the CDPH/EHLB/STANDARD METHOD V 1.1 test methodology in the scope of its ISO 17025 Accreditation.

**TABLE 806.3(1)  
VOC CONTENT LIMITS FOR ARCHITECTURAL COATINGS<sup>c,d,e</sup>**

|                                | Effective: JANUARY 1, 2010       | Effective: JANUARY 1, 2012       |
|--------------------------------|----------------------------------|----------------------------------|
| <b>Coating Category</b>        | <b>LIMIT<sup>a</sup><br/>g/l</b> | <b>LIMIT<sup>a</sup><br/>g/l</b> |
| Flat Coatings                  | 50                               |                                  |
| Non-flat Coatings              | 100                              |                                  |
| Non-flat - High Gloss Coatings | 150                              |                                  |
| Specialty Coatings:            |                                  |                                  |
| Aluminum Roof Coatings         | 400                              |                                  |
| Basement Specialty Coatings    | 400                              |                                  |
| Bituminous Roof Coatings       | 50                               |                                  |
| Bituminous Roof Primers        | 350                              |                                  |
| Bond Breakers                  | 350                              |                                  |
| Concrete Curing Compounds      | 350                              |                                  |
| Concrete/Masonry Sealers       | 100                              |                                  |
| Driveway Sealers               | 50                               |                                  |
| Dry Fog Coatings               | 150                              |                                  |
| Faux Finishing Coatings        | 350                              |                                  |
| Fire Resistive Coatings        | 350                              |                                  |

|  | Effective: JANUARY 1, 2010 | Effective: JANUARY 1, 2012 |
|--|----------------------------|----------------------------|
| Floor Coatings                               | 100                        |                            |
| Form-Release Compounds                       | 250                        |                            |
| Graphic Arts Coatings (Sign Paints)          | 500                        |                            |
| High Temperature Coatings                    | 420                        |                            |
| Industrial Maintenance Coatings              | 250                        |                            |
| Low Solids Coatings                          | 120 <sup>b</sup>           |                            |
| Magnesite Cement Coatings                    | 450                        |                            |
| Mastic Texture Coatings                      | 100                        |                            |
| Metallic Pigmented Coatings                  | 500                        |                            |
| Multi-Color Coatings                         | 250                        |                            |
| Pre-Treatment Wash Primers                   | 420                        |                            |
| Primers, Sealers, and Undercoaters           | 100                        |                            |
| Reactive Penetrating Sealers                 | 350                        |                            |
| Recycled Coatings                            | 250                        |                            |
| Roof Coatings                                | 50                         |                            |
| Rust Preventative Coatings                   | 400                        | 250                        |
| Shellacs, Clear                              | 730                        |                            |
| Shellacs, □ Opaque                           | 550                        |                            |
| Specialty Primers, Sealers, and Undercoaters | 350                        | 100                        |
| Stains                                       | 250                        |                            |
| Stone Consolidants                           | 450                        |                            |
| Swimming Pool Coatings                       | 340                        |                            |
| Traffic Marking Coatings                     | 100                        |                            |
| Tub and Tile Refinish Coatings               | 420                        |                            |
| Waterproofing Membranes                      | 250                        |                            |
| Wood Coatings                                | 275                        |                            |
| Wood Preservatives                           | 350                        |                            |
| Zinc-Rich Primers                            | 340                        |                            |

- Limits are expressed as VOC Regulatory (except as noted), thinned to the manufacturer's maximum thinning recommendation, excluding any colorant added to tint bases.
- Limit is expressed as VOC actual.
- The specified limits remain in effect unless revised limits are listed in subsequent columns in the table.
- Values in this table are derived from those specified by the California Air Resources Board, Architectural Coatings Suggested Control Measure, February 1, 2008.
- Table 806.3(1) architectural coating regulatory category and VOC content compliance determination shall conform to the California Air Resources Board Suggested Control Measure for Architectural Coatings dated February 1, 2008.

**TABLE 806.3(2)  
ARCHITECTURAL COATINGS VOC EMISSION LIMITS**

| VOC          | LIMIT                                  |
|--------------|--|
| Individual   | ≤ ½ CA chronic REL <sup>a</sup>        |
| Formaldehyde | ≤ 16.5 ug/m <sup>3</sup> or ≤ 13.5 ppb |

- CA Chronic Reference Exposure Level (CREL)

**TABLE 806.4 (1)  
FLOORING DEEMED TO COMPLY WITH VOC EMISSION LIMITS**

|                           |
|---------------------------|
| Ceramic and concrete tile |
|---------------------------|

|                                    |
|------------------------------------|
| <i>Organic-free, mineral-based</i> |
| <i>Clay pavers</i>                 |
| <i>Concrete pavers</i>             |
| <i>Concrete</i>                    |
| <i>Metal</i>                       |

**TABLE 806.4(2)  
FLOORING VOC EMISSION LIMITS**

| <b>VOC</b>             | <b>LIMIT</b>  |
|------------------------|---|
| <i>Individual VOCs</i> | $\leq \frac{1}{2}$ CA chronic REL <sup>a</sup>        |
| <i>Formaldehyde</i>    | $\leq 16.5 \text{ ug/m}^3$ or $\leq 13.5 \text{ ppb}$ |

a. CA Chronic Reference Exposure Level (CREL)

**TABLE 806.5 (1)  
CEILING AND WALL SYSTEMS DEEMED TO COMPLY WITH VOC EMISSION LIMITS**

|                                    |
|------------------------------------|
| <i>Ceramic tile</i>                |
| <i>Organic-free, mineral-based</i> |
| <i>Clay masonry</i>                |
| <i>Concrete masonry</i>            |
| <i>Concrete</i>                    |
| <i>Metal</i>                       |

**TABLE 806.5(2)  
ACOUSTICAL CEILING TILES AND WALL SYSTEMS VOC EMISSION LIMITS**

| <b>VOC</b>          | <b>LIMIT</b>  |
|---------------------|---|
| <i>Individual</i>   | $\leq \frac{1}{2}$ CA chronic REL <sup>a</sup>        |
| <i>Formaldehyde</i> | $\leq 16.5 \text{ ug/m}^3$ or $\leq 13.5 \text{ ppb}$ |

a. CA Chronic Reference Exposure Level (CREL)

b. Defined to be the total response of measured VOCs falling within the C6-C16 range, with responses calibrated to a toluene surrogate.

**TABLE 806.6  
INSULATION VOC EMISSION LIMITS**

| <b>VOC</b>             | <b>LIMIT</b>  |
|------------------------|---|
| <i>Individual VOCs</i> | $\leq \frac{1}{2}$ CA chronic REL <sup>a</sup>        |
| <i>Formaldehyde</i>    | $\leq 16.5 \text{ ug/m}^3$ or $\leq 13.5 \text{ ppb}$ |

a. CA Chronic Reference Exposure Level (CREL)

**X01.1.6 Commissioning, operation and maintenance.** Building commissioning, operation and maintenance shall be in accordance with the following:

1. Energy commissioning shall be in accordance with the residential provisions of the 2012 IECC.

Find the code at [www.ICCSafe.org](http://www.ICCSafe.org): [2012 International Energy Conservation Code® \(IECC®\)](http://www.ICCSafe.org)

2. Building site waste management shall be in accordance with Section 406.2.

[Language extracted from IgCC PV-2.0]

**406.2 Non-potable water systems for irrigation systems.** Non-potable water systems used for irrigation shall comply with the graywater, municipal reclaimed water and collected rainwater provisions of this section.

**406.2.1 Graywater systems.** Graywater systems used for landscape irrigation purposes shall be limited to subsurface and surface irrigation applications. The retention time for surface irrigation shall be 24 hours or less. Graywater to be used in graywater irrigation shall comply with the provisions of Section 708 other than Sections 708.6 and 708.12.6.5. Subsurface graywater systems shall be in accordance with Section 406.3. Graywater shall be filtered by a 100 micron or finer filter. The control panel for the graywater irrigation system shall be provided with signage in accordance with Section 706.2.

**406.2.2 Municipal reclaimed water.** Municipal reclaimed water used for landscape irrigation purposes shall be limited to subsurface applications. Reclaimed water used in irrigation systems shall comply with the provisions of Section 709 except for Section 709.5. Reclaimed water shall be filtered by a 100 micron or finer filter. The control panel for the reclaimed water irrigation system shall be provided with signage in accordance with Section 706.2

**Exception:** Subject to the approval of the code official based on the extent of purification occurring in reclamation process, municipal reclaimed water shall be permitted in sprinkler irrigation applications.

**406.2.3 Collected rainwater.** Rainwater collected on the surface of the building site, or from the roof surfaces of the building, and used for landscape irrigation purposes shall not be limited regarding the method of application. Rainwater collected from elevated building locations that is to be used in building site irrigation, shall be in compliance with the provisions of Section 707 other than Sections 707.6, 707.12.1, 707.12.1.1 and 707.12.7.4.

3. Site hardscape shall be in accordance with Section 408.2.

**[Language extracted from IgCC PV-2.0]**

**408.2 Site Hardscape.** In climate zones 1 through 6, as established in the International Energy Conservation Code, not less than 50 percent of the site hardscape shall be provided with one or any combination of options described in Sections 408.2.1 through 408.2.4. For the purposes of this section, site hardscape shall not include areas of the site covered by solar photovoltaic arrays or solar thermal collectors.

4. Vegetative roofs and terraces shall be in accordance with Section 408.3.2.

**[Language extracted from IgCC PV-2.0]**

**408.3.2 Vegetative roofs.** Extensive and intensive vegetative roofs, where provided in accordance with Section 408.3 shall comply with the following:

1. All plantings shall be selected according their United States Department of Agriculture hardiness zone classifications and shall be capable of withstanding the climate conditions of the jurisdiction and the micro climate conditions of the building site including, but not limited to, wind, precipitation and temperature. Planting density shall provide foliage coverage, in the warm months, of not less than 80 percent within two years of the date of installation unless a different time period is established in the approved design. Plants shall be distributed to meet the coverage requirements. Invasive plant species shall not be planted. Selected plants shall not add to the potential for fire hazard in the event of severe drought.
2. The engineered soil medium shall be designed for the physical conditions and local climate to support the plants and shall consist of non-synthetic materials. The planting design shall include measures to protect the engineered soil medium until the plants are established. Protection measures include, but are not limited to, installation of pre-grown vegetated mats or modules, tackifying agents, fiber blankets and reinforcing mesh. The maximum wet weight and water holding capacity of an engineered soil medium shall be determined in accordance with ASTM E2399.
3. Where access to the building facades is provided from locations on the perimeter of the roof, non-vegetated buffers adequate to support associated equipment and to protect the roof shall be provided.
4. Plantings shall be managed to maintain the function of the vegetative roof.

5. Construction material and waste management shall be in accordance with Section 502.1.

**[See X01.1.2.1]**

6. Moisture control preventative measures shall be in accordance with Section 506.3.

**[See X01.1.2.3]**

7. Non-potable water systems shall be in accordance with Sections 706, 707, 708 and 709.

**[See X01.1.4.2]**

8. Ventilation shall comply with ASHRAE 62.2.

Find the Standard at [www.ASHRAE.org](http://www.ASHRAE.org): [ANSI/ASHRAE Standard 62.2 - Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings](#)

9. Building operations, maintenance and owner education shall comply with Sections 904.2, 904.3 and 904.4.

**904.2 Record documents.** *The cover sheet of the record documents for the project shall clearly indicate that at least one copy of the materials shall be in the possession of the owner and at least one additional copy shall remain with the building throughout the life of the structure. Record documents shall include all of the following:*

1. *Copies of the approved construction documents, including plans and specifications.*
2. *As-built plans and specifications indicating the actual locations of piping, ductwork, valves, controls, equipment, access panels, lighting and other similar components where they are concealed or are installed in locations other than those indicated on the approved construction documents.*
3. *A copy of the Certificate of Occupancy.*

**904.3 Building operations and maintenance documents.** *The building operations and maintenance documents shall consist of manufacturer's specifications and recommendations, programming procedures and data points, narratives, and other means of illustrating to the owner how the building, site and systems are intended to be maintained and operated. The following information shall be included in the materials, as applicable to the specific project:*

1. *Directions to the owner or occupant on the manual cover sheet indicating that at least one copy of the materials shall be in the possession of the owner or occupant and at least one additional copy shall remain with the building.*
2. *Operations and maintenance manuals for equipment, products and systems installed under or related to the provisions of Chapter 4 including, but not limited to, the following, as applicable:*
  - 2.1 *Vegetative shading, vegetative roofs and natural resource protections and setbacks.*
  - 2.2 *Water conserving landscape and irrigation systems.*
  - 2.3 *Stormwater management systems*
  - 2.4 *Permanent erosion control measures.*
  - 2.5 *Landscape or tree management plans.*
3. *Operations and maintenance documents for materials, products, assemblies and systems installed under or related to the provisions of this code for material resource conservation in accordance with Chapter 5 including, but not limited to, the following, as applicable:*
  - 3.1 *Care and maintenance and instructions and recommended replacement schedule for flooring, including, but not limited to, carpeting, walk-off mats and tile.*
  - 3.2 *Care and maintenance instructions for natural materials including, but not limited to, wood, bio-based materials and stone.*
  - 3.3 *Available manufacturer's instructions on maintenance for:*
    - 3.3.1. *Exterior wall finishes*
    - 3.3.2. *Roof coverings*
    - 3.3.3. *Exterior doors, windows and skylights*
  - 3.4 *Information and recommended schedule for required routine maintenance measures, including but not limited to, painting and refinishing.*
  - 3.5 *A copy of the service life plan required by Chapter 5.*
4. *Operations and maintenance documents for equipment, products and systems installed under or related to the provisions of this code for energy conservation in accordance with Chapter 6 including, but not limited to, the following:*
  - 4.1 *Heating, Ventilating and Air Conditioning systems including:*
    - 4.1.1. *Recommended equipment maintenance schedule.*
    - 4.1.2. *Air filters and fluid filters, including recommended replacement schedule and materials.*
    - 4.1.3. *Time clocks, including settings determined during commissioning.*
    - 4.1.4. *Programmable controls and thermostats, including settings determined during commissioning.*
  - 4.2 *Domestic hot water systems including performance criteria and controls.*
  - 4.3 *Building thermal envelope systems including:*

- 4.3.1. *Glazing systems inspection schedule.*
- 4.3.2. *Performance criteria for replacements and repairs.*
- 4.3.3. *Information and recommended schedule on required routine maintenance measures, including but not limited to, sealants, mortar joints and screens.*

4.4 *Electrical and lighting systems including:*

- 4.4.1. *Technical specifications and operating instructions for installed lighting equipment*
- 4.4.2. *Luminaire maintenance and cleaning plan*
- 4.4.3. *Lamp schedule, recommended relamping plan, and lamp disposal information.*
- 4.4.4. *Programmable and automatic controls documentation, including settings determined during commissioning.*
- 4.4.5. *Occupant sensor and daylight sensors documentation, including settings determined during commissioning.*

4.5 *Automatic demand reduction systems*

- 5. *Operations and maintenance documents for equipment, products and systems installed under or related to the provisions of this code for water conservation in accordance with Chapter 7, including, but not limited to the following:*

- 5.1 *Domestic fixtures.*
- 5.2 *Water regulating devices including faucets and valves.*
- 5.3 *Irrigation and rainwater and graywater catchment.*

- 6. *Operations and maintenance documents for equipment products and systems under or related to the provisions of this code for indoor environmental quality in accordance with Chapter 8, including, but not limited to the following:*

- 6.1 *Humidification/dehumidification.*
- 6.2 *Green cleaning products, procedures and techniques.*
- 6.3 *Recommended window cleaning schedule.*
- 6.4 *Ventilation controls.*
- 6.5 *Floor finishes.*
- 6.6 *Fireplaces and combustion appliances.*
- 6.7 *Radon mitigation system.*
- 6.8 *Indoor plants.*

**904.4 Building owner education manual.** *The owner shall cause to be assembled an informational document on the building, site or structure and systems and sustainable features that are covered by this code and included in the building. Such information shall be educational in nature and sufficient for future tenants, owners and operators of the building, building site, structure and systems to understand the basic purpose and basis for these systems and features and how they are to be maintained for continued performance. The education documents shall consist of a statement of performance goals or requirements and a narrative illustrating the reasoning behind the building's site, features, and systems design. One copy of the owner education manual shall be in the possession of the owner and one additional copy shall remain with the building throughout the life of the structure. Where a whole building life cycle assessment is performed in accordance with Section 304, the data and final report shall be included in the owner education manual.*

**Add new standard to Chapter 12 as follows:**

**ASHRAE**

**62.2-2007 Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Building**

Find the Standard at [www.ASHRAE.org](http://www.ASHRAE.org): [ANSI/ASHRAE Standard 62.2 - Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings](#)