

**VERMONT HOUSING FINANCE AGENCY  
GREEN BUILDING AND DESIGN STANDARDS  
Eff: 2/13/2012**

Notes:

VHFA expects these standards to be followed in their entirety for all projects receiving Housing Credits, Construction and/or Permanent loans unless a specific waiver is requested and granted by VHFA Development staff. The only exception to this rule is if a project already in VHFA's portfolio is simply refinancing in which case that project will not need to meet these standards.

VHFA strongly recommends Developers engage in an Integrated Design Process that incorporates green building strategies from the very beginning of the design process with a development team.

VHFA acknowledges that some of these standards may be required by existing municipal building and energy codes. Should existing codes exist, VHFA requires that the more stringent standard is employed by the developer.

VHFA requires the Architect(s) to provide 1) a certificate of substantial completion; and, 2) a certificate of final completion. VHFA requires the Housing Credit Sponsor provide documentation using a checklist and evidence as needed for certification of compliance with these standards.

VHFA requires that all documentation of the products used be contained in the Operations and Maintenance Manual. This will provide building managers with the information necessary to maintain or replace the green components and reduce the effort and/or expense to the developer for creating an additional manual. Should additional documentation be required, it is up to the General Contractor to provide this information to the developer.

For Substantial Rehabilitation or lesser Rehabilitation projects, certain Standards may be impractical or cost prohibitive. Project Sponsors may request specific waivers for these projects.

VHFA incorporates the Efficiency Vermont Energy Standards and Universal Design Standards as part of the Green Building and Design Standards. VHFA also incorporates the Efficiency Vermont Mechanical Design Protocol as well as the Multifamily Air Sealing Protocol as part of the Green Building and Design Standards. All of these documents are in the Appendices.

## Table of Contents

### Section 1: Site

R1	Landscape Plantings.....	4
R2	Preservation of Existing Plantings .....	5
R3	Light Pollution .....	6
R4	Thorough Evaluation of Site Conditions .....	7

### Section 2: Building Design

R1	Indoor Air Quality & Mold.....	8
----	--------------------------------	---

### Section 3: Inspection/Certification

R1	Multifamily Mechanical Design Protocol.....	11
R2	Multifamily Air Sealing Protocol .....	12
R3	Duct Sealing.....	13

### Section 4: Multifamily Energy Design Standards

R1	Purpose Statement.....	14
R2	Vermont Multifamily Energy Design Standards .....	15

### Section 5: Indoor Environmental Quality

R1	Natural Ventilation and Light .....	16
R2	Pigment & Paint .....	17
R3	Adhesives & Sealants .....	18
R4	Carpets .....	20
R5	Flooring Requirements.....	21

### Section 6: Materials

R1	Low Impact Materials .....	22
----	----------------------------	----

### Section 7: Resource Efficiency

R1	Site Waste Management .....	24
R2	Non-mercury Thermostats .....	25
R3	Deconstruction and Construction Waste Management.....	26

### Section 8: Post Occupancy

R1	Post Occupancy Requirements .....	27
----	-----------------------------------	----

### Appendices:

I	Efficiency Vermont Energy Standards .....	28
II	Universal Design Standards .....	29
III	Multifamily Mechanical Design Protocol	
IV	Multifamily Air Sealing Protocol	

## **SECTION 1-R1: SITE**

### **Standard**

Landscape with at least 75% northern hardy native species that do not require irrigation and are not considered invasive species. This is measured by number of plantings.

### **Intent**

Create natural areas that provide wildlife habitat, promote biodiversity appropriate to the ecosystem and lower water consumption needed for non-native plantings.

### **Requirement**

1. Plant with trees, shrubs, perennials, annuals and groundcovers that have one or more of the following attributes:
  - a. Northern, hardy and native to this area
  - b. Edible and/or wildlife enhancing
2. In addition to one of the above - drought tolerant
3. Permanent irrigation system to be permitted by VHFA on a case by case basis

### **Verification**

1. Provide VHFA with a site plan demonstrating areas of paving, landscaping (with species) and building footprint.
2. Provide a list of all species to be planted
3. Construction Inspector to verify on site (VHFA given copies of inspection reports if not financing construction.)

### **Resources**

**University of Vermont Extension-Invasive Plant Information**

[www.uvm.edu/mastergardener/invasives/invasivesindex.html](http://www.uvm.edu/mastergardener/invasives/invasivesindex.html)

**Vermont Invasive Exotic Plant Committee** [www.vtinvasiveplants.org](http://www.vtinvasiveplants.org)

### **Rehab/Renovation**

The requirements of this standard must be followed where landscaping is included within the scope of the renovation project

### **Cost Implication**

No additional cost

## **SECTION 1-R2: SITE**

### **Standard**

Preserve existing trees and vegetation, not including within 30' of buildings, driveways, solar access, areas cleared for food production and as required for grading for drainage requirements. Within those 30' preserve existing trees and vegetation to the extent possible and practical.

### **Intent**

Preserve mature trees and vegetation which are not within 30' of buildings, et al and to the extent possible preserve mature trees and vegetation within that 30' buffer zone.

### **Requirement**

1. Use best practices to preserve existing trees and vegetation to the extent possible
2. Inventory existing healthy trees and vegetation on the site
3. Identify trees and vegetation to be saved
4. Identify strategies to be used:
  - a. Protective barriers (Must extend to the drip line)
  - b. Relocation

### **Verification**

Provide predevelopment and post development site plans highlighting trees and vegetation that were preserved and/or relocated on site

### **Rehab/Renovation**

The requirements of this standard must be followed in all rehab projects

### **Cost Implication**

No to low additional cost

## **SECTION 1-R3: SITE**

### **Standard**

Minimize light pollution to the night sky.

### **Intent**

Eliminate light trespass from the building site to reduce the impact on nocturnal environments and the night sky in municipalities which either do not have local foot candle level requirements or the local foot candle level requirement is less stringent than the IESNA foot candle requirement.

### **Requirement**

*\*If compliance with any of these requirements cannot be done while maintaining compliance with other regulatory or funding agency requirements (such as the National Parks Service's Secretary of the Interior's Standards for Historic Preservation) then the other standards supersede these standards.*

1. Design outdoor lighting to provide security without creating light pollution.
2. Do not exceed Illuminating Engineering Society of North America (IESNA) foot candle level requirements as stated in the Recommended Practice Manual: Lighting for Exterior Environments (IESNA RP-33-99) **OR** local foot candle level requirements as required by local towns or municipalities, whichever is more stringent.
3. Design interior and exterior lighting so that zero direct beam illumination leaves the project site.
4. Do not use unshielded fixtures (floodlights)

### **Verification**

1. Specifications
2. Site lighting plan
3. Foot candle verification (completed post-construction)

### **Resources**

The IESNA standard is RP-33-99, IESNA Recommended Practice Manual: Lighting for Exterior Environments

**IESNA**

[www.iesna.org](http://www.iesna.org)

### **Rehab/Renovation**

The requirements of this standard must be followed where exterior lighting is included within the scope of the renovation project.

### **Cost Implication**

No to low additional cost

## SECTION 1-R4: THOROUGH EVALUATION OF SITE CONDITIONS

### Standard

Thorough evaluation of site conditions to:

1. Limit costs associated with unexpected environmental hazard mitigation
2. Limit costs associated with unexpected site improvements

For All New Construction Projects the following are required:

- Floodplain determination (if site is located in a floodplain)
- Wetlands delineation (if site is located near a wetland as per State of Vermont standard)
- Opinion from a Professional Engineer (PE) on the adequacy of water/wastewater connections (to be provided after conceptual approval from the municipality); or, all relevant permits

If Full or Partial Foundation:

- Soil classification
- Borings for ledge

If on a site with Wastewater and/or Storm Water disposal:

- State Water/Wastewater and Storm Water Discharge Permit; or a Professional Engineer's opinion on the site's capacity

### Requirement

A thorough site evaluation must be completed by civil engineers and other professionals to detail any site challenges.

Timing of the above evaluation is determined by the developer; however, if the evaluation of the site is not completed prior to the purchase of the land and development budget, VHFA will require a higher contingency for site conditions.

### Verification

Final plans and specifications with a civil engineer stamp and signature as well as necessary permit documentation.

## SECTION 2-R1: BUILDING DESIGN

### Standard

Implement an overall water management plan for the building envelope for prevention of indoor air quality (IAQ) problems from mold.

### Intent

Create durable and healthy buildings

### Requirements:

#### Exterior

##### *Footings & Slab*

1. Capillary break over footing with damp proofing, low perm or elastomeric paint (for basements, crawlspaces, and slabs, but not for monolithic slab assemblies) {New Construction only}
2. Foundation drain at outside perimeter edge of footing (only for a basement)
3. Sub-grade (footing) drainage system where conditions require
4. Gravel bed beneath slab minimum 4" depth, 1/2" gravel, no fines
5. Minimum six mil polyethylene vapor diffusion retarder between slab and gravel with joints lapped at least one foot
6. One inch foam under slab on grade where you have living space on the slab

##### *Surface Drainage*

1. Slope final grade away from foundation wall (recommend slope of 5/8" per foot for 10 feet and patios & driveways at 1/4" per foot) but not to conflict with Americans with Disabilities Act (ADA) requirements
2. Downspouts, when connected to a gutter system, should deposit roof water at least 5' from the foundation
3. Provide a 3' wide graded perimeter of impermeable backfill around the foundation, or other equally efficient method of controlling surface water

##### *Basement*

1. Damp proofing or moisture barrier assembly system applied to grade
2. Use porous backfill material against foundation walls
3. Provide exterior wall insulation and/or capillary break finish system that drains water to footing drain
4. Capillary break between the foundation and framing {New Construction only}

### *Crawlspaces*

1. Crawlspaces must be approved by VHFA staff
2. Approved crawlspaces must be sealed and conditioned

### *Windows & Doors*

1. Sill jams and head wrapped with membrane for moisture protection
2. Casement windows should not be used for family housing unless prior approval is given by VHFA

### *Roof*

1. Overhangs - Minimum of 1 foot at eaves

## **Interior**

### *Appliances*

1. Drainage pans or floor drains are required under water heaters and clothes washers when installed on or over finished floors - not required when located within unfinished basements

## **Envelope**

1. No wet blown insulation (damp spray cellulose)

## **Verification**

1. Construction plans highlighting envelope details for water management
1. 2. Construction Inspector to verify on site (VHFA given copies of inspection reports if not financing construction.)

## **Resources**

**Building America:** [http://www.eere.energy.gov/buildings/building\\_america/](http://www.eere.energy.gov/buildings/building_america/)  
**Building Science Corporation:** <http://www.buildingscience.com/>  
**Housing and Urban Development (HUD) 'Durability by Design'** available at [http://www.huduser.org/intercept.asp?loc=/Publications/PDF/durability\\_by\\_design\\_part1.pdf](http://www.huduser.org/intercept.asp?loc=/Publications/PDF/durability_by_design_part1.pdf)

## **Rehab/Renovation**

The requirements of this standard must be followed to the maximum extent possible where rehab of the building envelope and site work that would permit

water management improvements are included within the scope of the renovation project.

### **Cost Implications**

Cost implications are dependent on which and how many of these measures differ from standard practice.

## **SECTION 3-R1: INSPECTION/CERTIFICATION**

### **Standard**

Each project must conform to the Efficiency Vermont Multifamily Mechanical Design Protocol (see Appendix 4).

### **Intent**

To verify that systems are operating as designed and specified.

### **Resources**

Vermont Residential Building Energy Code

### **Rehab/Renovation**

The requirements of this standard must be followed where central mechanical system, replacements in projects of five or more units are included within the scope of the renovation project.

### **Cost Implications**

Additional costs contingent upon size and complexity of central mechanical systems.

## **SECTION 3-R2: INSPECTION/CERTIFICATION**

### **Standard**

Each project must follow the Multifamily Air Sealing Protocol (see Appendix 3).

### **Intent**

Verify that the building meets VHFA requirements for effective air sealing to prevent heat loss and creation of cold surfaces that can cause condensation and mold growth.

### **Requirement**

Each project must conform to the Efficiency Vermont Air Sealing Protocol (see Appendix 3).

### **Verification**

Detailed in the Efficiency Vermont Air Sealing Protocol.

### **Notes**

### **Rehab/Renovation**

The requirements of this standard must be followed where envelope air sealing is included within the scope of the renovation project.

### **Cost Implications**

Blower Door tests cost \$150-\$200 / unit tested

## **SECTION 3-R3: INSPECTION/CERTIFICATION**

### **Standard**

A representative sampling of ducted air distribution systems must be tested to verify effectiveness of duct sealing.

### **Intent**

Verify that the ductwork meets VHFA requirements for effective air sealing to optimize performance and prevent heat loss

### **Requirement**

Duct test conducted with calibrated equipment conducted by a trained and qualified technician

### **Verification**

Duct tightness test report(s) completed by a trained and qualified technician  
Verify that the leakage areas identified by the test are sealed after the test

### **Resources**

**The Energy Conservatory:** <http://www.energyconservatory.com/>

**Home Energy Magazine:**

<http://homeenergy.org/archive/hem.dis.anl.gov/eehem/99/991114.html>

**Testing Methodology:** <http://epb.lbl.gov/publications/lbnl-47308.pdf>

### **Rehab/Renovation**

The requirements of this standard must be followed where ducted distribution systems are included in the project.

### **Cost Implications**

Low additional cost

## **SECTION 4-R1: PURPOSE STATEMENT**

After a sharp increase in fuel oil prices in 2008, VHFA and VHCB commissioned a study using MacArthur Foundation funding. The study was done by Andy Shapiro of Energy Balance, Inc. and by Benjamin Fowler, Matthew Napolitan, and Jennifer Chiodo of CX Associates, LLC. A combination of measures was proposed based on building type, with a goal of keeping energy usage, and therefore utility costs, low at multifamily rental properties. The two documents produced from this study are known as the Roadmap for Housing Energy Affordability (the “Roadmap”) and the Mechanical System Optimization Guide. The Roadmap identified two different tiers of measures: those that could keep properties relatively stable on energy consumption for the short term of up to 15 years (“Tier I”) and those that would go beyond 15 years (“Tier II”), based on a variety of assumptions. Subsequently a steering that had been formed to oversee the development of these guides continued its work and formed a set of policy recommendations, which took three forms: The Vermont Multifamily Energy Design Standards, the Vermont Multifamily Mechanical Design Protocol, and the Vermont Multifamily Air Sealing Protocol. These two protocols are found in Appendix III and Appendix IV.

The purpose of these standards and protocols is to ensure that when new construction or substantial rehab occurs a building will be brought to a relatively high level of air sealing and insulation and incorporate advanced mechanical design features in order to keep energy usage relatively low. This is intended to provide some stability to the operating budgets at these developments. Because of the many different types of buildings (e.g. historic rehabilitation, new construction) and because projects of many different sizes are undertaken, these standards are intended to span these different types of construction and to encourage the construction of energy efficient structures.

## SECTION 4-R2: VERMONT MULTIFAMILY ENERGY DESIGN STANDARDS

Vermont Multifamily Energy Design Standards-Draft - January 2012, v4.1

	Units	Ceiling / Attic R <sup>1</sup>	Wall R <sup>2</sup>	Window <sup>3</sup> R-value / U-Value	Foundation R-Value, Continuous	Slab Edge R	Air Sealing: VMASP <sup>5</sup>	Mechanical <sup>6</sup>	Advanced Mechanical <sup>8</sup>		
									Solar <sup>7</sup>	Biomass <sup>9</sup>	ASHP
Rehabilitation	All	60	25	R 3.3 / U.30	15	15	<3ACH 50	VMMDP	Required 50% Load	<i>Not Required</i>	<i>Not Required</i>
New Construction	>5	60	25	R 3.3 / U.30	15	15	<2ACH 50	VMMDP	Required 50% Load	<i>Not Required</i>	<i>Not Required</i>
New Construction	<4	60	25	R5/U.20 <sup>4</sup>	15	15	<2 ACH50	VMMDP	Required 50% Load	<i>Not Required</i>	<i>Not Required</i>
Tier II Level	All	60	30	R 5 / U.20	15	15	<1ACH 50	HRV required	75%+ of load	75%+ of load	COP >3

### Alternative Model Based Design Standard:

Exceptions to the minimum requirements may be granted if the project can demonstrate equivalent or lower energy consumption through funder approved modeling.

### ***Projects not meeting the base standard or Alternative Model Based Design will be considered Moderate Rehabilitation Projects***

#### Moderate Rehabilitation Discouraged:

Where required for portfolio reasons moderate rehabilitation projects will be underwritten from an energy perspective on a case by case basis. During pre-application feasibility a blower door guided energy audit is required to determine all possible energy upgrades that can be accomplished within the parameters of project scope and budget. In addition all moderate rehabilitation upgrades shall include an operating budget based on \$6.25/gal. fuel oil equivalent input price.

### Notes

<sup>1</sup> Exceptions to attic R-Value will be provided on a case by case basis for particular rigid foam applications as well as applications in rehab. projects where altering attic/ceiling cavity or sloped areas areas would be cost prohibitive, unduly impact upon interior space configurations or unduly impact the historic fabric of the building.

<sup>2</sup> R-20 Exemption may be made for historic buildings where siding can not be replaced or cavity depth can not be increased. Developers are encouraged to bid R-30+ wall systems and implement those more robust R-Values when budgeting and other design / development considerations allow.

<sup>3</sup> Developers are encouraged to incorporate non-double hung windows in support of more advanced air sealing goals.

<sup>4</sup> Developers will provide for R-5 windows in base bid of all new construction projects of 4 units or less. Exceptions due to sourcing issues may be provided on a case by case basis.

<sup>5</sup> VMASP: Developers will follow the Vermont Multifamily Air Sealing Protocol. Projects that fall short of air sealing targets but have documented that project build out has incorporated the VMASP procedures will have met the intent of this requirement. This document is meant to be used as a guideline.

<sup>6</sup> VMMDP: Developers will follow the Vermont Multifamily Mechanical Design Protocol. This document is meant to be used as a guideline.

<sup>7</sup> Exceptions to standard will be made on a case by case basis for adequate site line and placement issues or if the systems would be cost prohibitive or unduly impact the historic fabric of the building. If an exception is granted, it is expected that the project will be built as 'solar ready' (chase, conduit to roof and dedicated mechanical room space).

<sup>8</sup> Tier II Level projects must comply with at least 1 (solar, biomass, or ASHP) Advanced Mechanical system option.

<sup>9</sup> Although Biomass systems are not required, developers are encouraged to analyze the potential long term benefits of these systems and incorporate them into projects whenever such benefits are evident. Projects must comply with Vermont RBES 2011. R-values and other general definitions identified here are as defined in RBES or IECC 2009.

Projects must enroll in Efficiency Vermont Multifamily New Construction/Major Rehabilitation program.

Tier II Level projects are designed to represent a deeper level of energy efficiency than that of baseline standards.

## **SECTION 5-R1: INDOOR ENVIRONMENTAL QUALITY**

### **Standard**

Position and size operable windows and glazing systems to take advantage of natural ventilation, cooling and daylighting

### **Intent**

Optimize daylighting and passive ventilation opportunities

### **Requirement**

1. Operable windows to the east and west to take advantage of summer ventilation
2. Shading to reduce overheating in summer

\*Note casement window requirement in Appendix II

### **Verification**

Review of 50% building plans

### **Resources**

None.

### **Rehab/Renovation**

The requirements of this standard must be followed to the extent possible where window & glazing system replacements are included within the scope of the renovation project.

### **Cost Implications**

No to low additional cost

## **SECTION 5-R2: INDOOR ENVIRONMENTAL QUALITY**

### **Standard**

Use low VOC pigment & paint

### **Intent**

Protect installers and occupants from irritating and/or harmful indoor air contaminants

### **Requirement**

Volatile Organic Compound (VOC) emissions from paints & coatings must not exceed the VOC limits of Green Seal's standard GS-11 requirements:

1. Non-flat: 150 g/L
2. Flat: 50 g/L

### **Verification**

Specifications

### **Resources**

**Sustainable ABC:** [http://www.sustainableabc.com/m\\_p\\_f\\_a.html](http://www.sustainableabc.com/m_p_f_a.html)

**Zero VOC Paint Guide:** <http://www.aqmd.gov/prdas/brochures/paintguide.html>

**Green Seal:** [www.greenseal.org](http://www.greenseal.org) (Charge for publication)

**Sourcebook for Green & Sustainable Building:**  
<http://www.greenbuilder.com/sourcebook/FinishesAdhesives.html>

### **Rehab/Renovation**

The requirements of this standard must be followed where interior painting is included within the scope of the renovation project.

### **Cost Implications**

No additional cost

## SECTION 5-R3: INDOOR ENVIRONMENTAL QUALITY

### Standard

Use low VOC adhesives & sealants

### Intent

Protect installers and occupants from irritating and/or harmful indoor air contaminants

### Requirement

Volatile Organic Compound (VOC) emissions from adhesives and sealants must not exceed VOC limits of South Coast Air Quality Management District Rule #1168 AND sealants used as fillers must meet the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51  
(Attach tables)

### Verification

Specifications

### Resources

1. South Coast Air Quality Management District:  
[www.aqmd.gov/rules/html/r1168.html](http://www.aqmd.gov/rules/html/r1168.html)
2. Bay Area Air Quality Management District:  
[www.baaqmd.gov](http://www.baaqmd.gov)
3. South Coast Rule #1168 by the South Coast Air Quality Management District:  
[www.aqmd.gov/rules/html/r1168.html](http://www.aqmd.gov/rules/html/r1168.html)

Limits on VOCs in grams per liter for adhesives and sealants used on interior of building are as follows:

	VOC Limit (g/L)
<b>Welding and Installation</b>	
Indoor Carpet Adhesives	50
Carpet Pad Adhesives	50
Outdoor Carpet Adhesive	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
PVC Welding	510
CPVC Welding	490

ABS Welding	400
Plastic Cement Welding	350
Adhesive Primer for Plastic	650
Contact Adhesive	250
Special Purpose Contact Adhesive	250

**Substrates**

Metal to metal	30
Plastic foams	50
Porous material except wood	50
Wood	30
Fiberglass	80

Limits on VOCs in grams per liter for sealants and sealant primers per South Coast Rule #1168 by the South Coast Air Quality Management District:

**VOC Limit (g/L)**

**Sealants**

Architectural	250
Other	420

**Sealant Primers**

Architectural – porous	250
Architectural – nonporous	775
Other	750

Limits on VOCs in grams per liter for Sealants used as Fillers per Bay Area Air Quality Management District, Reg. 8 Rule 51

**VOC Limit (g/L)**

**Sealants**

Architectural	250
Other	420

**Sealant Primers**

Architectural- Nonpourous	250
Architectural- Pourous	775
Other	750

**Rehab/Renovation**

The requirements of this standard must be followed where adhesives and sealants are included within the scope of the renovation project.

**Cost Implications**

No additional cost

## SECTION 5-R4: INDOOR ENVIRONMENTAL QUALITY

### Standard

If carpet is installed it must meet CRI low emission label standard.

### Intent

Protect installers and occupants from irritating and/or harmful indoor air contaminants

### Requirement

Carpet systems must meet or exceed Carpet & Rug Institute (CRI) Green Label Indoor Air Quality Test Program

### Verification

Manufacturers cut sheets & submittals verifying that carpet systems meet CRI Air Quality test requirements

### Resources

Carpet & Rug Institute: [www.carpet-rug.com](http://www.carpet-rug.com)

Vermont Department of Health: [http://healthvermont.gov/enviro/indoor air/Carpet.aspx](http://healthvermont.gov/enviro/indoor_air/Carpet.aspx)

Limits on VOCs in grams per liter for carpets, cushion, and adhesives per the Carpet and Rug Institute Green Label Testing Program:

	<b>Emission factor limit (mg/m<sup>2</sup>/hr)</b>
<b>Carpets</b>	
Total VOCs	0.5
4 – Phenylcyclohexane	0.05
Formaldehyde	0.05
Styrene	0.4
<b>Cushion</b>	
Total VOCs	1
4 – Phenylcyclohexane	0.3
Formaldehyde	0.05
Styrene	0.05
<b>Adhesives</b>	
Total VOCs	10
Formaldehyde	0.05
2 - Ethyl - 1 – Hexanol	3

### Rehab/Renovation

The requirements of this standard must be followed where carpet installation is included within the scope of the renovation project.

### Cost Implications

No additional cost

## **SECTION 5-R5: INDOOR ENVIRONMENTAL QUALITY**

### **Standard**

*No installed carpet in kitchens, bathrooms or within 3' of primary entry doors to the outside*

### **Intent**

Prevent the growth of mold and mildew in carpet systems

### **Requirement**

Do not install carpet in kitchens, bathrooms or within 3 feet of primary-entry doors

### **Verification**

1. Construction drawings highlighting carpet system installation requirements  
2. Construction Inspector to verify on site (VHFA given copies of inspection reports if not financing construction.)

### **Resources**

Vermont Natural Coatings:

[www.vermontnaturalcoatings.com/index.html](http://www.vermontnaturalcoatings.com/index.html)

Building Green Guide:

[www3.uwm.edu/Dept/shwec/publications/cabinet/reductionreuse/615.SG.0502%20Update%2011.pdf](http://www3.uwm.edu/Dept/shwec/publications/cabinet/reductionreuse/615.SG.0502%20Update%2011.pdf)

### **Rehab/Renovation**

The requirements of this standard must be followed in all rehab projects

### **Cost Implications**

No additional cost

## SECTION 6-R1: LOW IMPACT MATERIALS

### Standard

Use framing and finish lumber harvested from sustainable managed forests OR local / regional materials OR durable materials

### Intent

Preserve resources by using 1) certified; 2) regional; or, 3) durable products

### Requirement

Choose **one** of the following:

1. Use framing and finish lumber milled from logs harvested from sustainable managed forests - credit requires that 25% of wood products (as measured by dollar value) used in the project come from "certified forests".
2. Local / regional materials that are manufactured / harvested / extracted within a 300 mile radius of the project - credit requires 20% of building materials (measured by dollar value)
3. For durable materials - use at least two of the following products:
  - Long lasting, low maintenance siding made out of a renewable, sustainable **or** recyclable resource
  - Composite decking with high recycled content
  - Natural linoleum flooring
  - Ceramic tile bathroom or kitchen flooring
  - Roofing with a reasonable expected life of at least 40 years
  - Insulated glass with a reasonable expected life of at least 20 years
  - Siding with a reasonable expected life of at least 40 years
  - Wood, cork or bamboo flooring (Bedrooms can be low VOC carpeting if desired.)

### Verification

- For certified wood - verify with: The contractor must verify sustainable forest management through a letter from the sawmill to the lumber yard that declares the percentage of saw logs harvested from certified forestland that were used in manufacturing lumber sold to the contractor. Certification of the forestland may be by the Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI), American Tree Farm System (ATFS), Certified Master Logger Program (MLP), or some other established standard, as approved by the State of Vermont; as such standards evolve over time.
- For local/regional materials: Declaration from product vendor or manufacturer stating where product is manufactured
- For durable materials: Manufacturer's product information and warranties

### Resources

**Vermont Department of Conservation:**  
<http://www.vtfpr.org/htm/forestry.cfm>

## **Rehab/Renovation**

The requirements of this standard must be followed to the extent possible where framing or finish material replacement is included within the scope of the renovation project

## **Cost Implications**

Additional costs, if any, for verification should be very low. FSC certified wood and most durable products will have higher first costs

## **SECTION 7-R1: RESOURCE EFFICIENCY**

### **Standard**

Provide space for recycling containers at convenient location(s) for storage of recyclables.

### **Intent**

Encourage building occupants to recycle and reduce owner waste disposal costs.

### **Requirement**

Provide recycling area for each unit and building. Provide recycling containers for each unit and building unless recycling services are not available in the municipality. Ensure that recycling containers are labeled properly to enable accurate disposal.

### **Verification**

Verify recycling location on plans

### **Resources**

Chittenden Solid Waste District: <http://www.cswd.net/>

### **Rehab/Renovation**

The requirements of this standard must be met by all rehab projects

### **Cost Implications**

Cost for additional Square Footage required for recycling area

## **SECTION 7-R2: RESOURCE EFFICIENCY**

### **Standard**

Non-mercury thermostats

### **Intent**

Prevent the release of mercury into the environment

### **Requirement**

All thermostats must be non-mercury thermostats

### **Verification**

1. Contractor submittals (cut sheets in O&M Manual)
2. Architect to issue certificate of compliance

### **Resources**

Vermont Mercury Education & Reduction Campaign: <http://www.mercvt.org/>

### **Rehab/Renovation**

The requirements of this standard must be followed where thermostat replacements are included within the scope of the renovation project.

### **Cost Implications**

Some additional cost

## **SECTION 7-R3: RESOURCE EFFICIENCY**

### **Standard**

Utilize deconstruction and construction waste recycling services

### **Intent**

To reduce the amount of construction debris entering landfills

### **Requirement**

Provide an opportunity for a deconstruction company to bid on demolition work  
All construction waste must be recycled when feasible

### **Verification**

- Contract for deconstruction; and/or
- Construction waste management plan submitted to VHFA or Construction Inspector; and
- Construction inspector to verify on site (VHFA provided copies of inspection reports if not financing construction.)

### **Resources**

Agency of Natural Resources:

[www.anr.state.vt.us/dec/wastediv/recycling/c&d.htm](http://www.anr.state.vt.us/dec/wastediv/recycling/c&d.htm)

Reuse and Recycling Markets Directory:

[http://www.anr.state.vt.us/dec/cf/wm/CandD\\_SearchList.cfm](http://www.anr.state.vt.us/dec/cf/wm/CandD_SearchList.cfm)

Vermont Business Materials Exchange:

<http://www.vbmex.net>

### **Rehab/Renovation**

Same

### **Cost Implications**

Nominal additional cost

## **SECTION 8-R1: POST OCCUPANCY**

### **Standard**

Provide tenants and facility managers with educational materials about green design, building operations, recycling and building maintenance

### **Intent**

To maintain the 'green' goals of the project after occupancy by educating and involving occupants in the site and building operations and maintenance procedures

### **Requirement**

1. Introductory presentation to facility managers describing design, operations, recycling, site and building maintenance goals
2. Owners/managers provide educational materials as applicable to tenants either in brochure form or tenant handbook regarding green practices or systems within project

### **Verification**

1. Provide VHFA with sign-off from owner and manger on introductory presentation
2. Provide VHFA with copies of educational materials for tenants

### **Rehab/Renovation**

The requirements of this standard are to educate tenants, building managers and maintenance staff about all relevant green design and construction measures included within the scope of the renovation project.

### **Cost Implications**

Additional cost to purchase or produce, print and distribute educational materials

## APPENDIX I

- All Projects must comply with Vermont RBES 2011 as well as enroll in Efficiency Vermont Multifamily New Construction/Major Rehabilitation programs. All Projects must submit the current Efficiency Vermont Energy Checklist with their Housing Credit/Construction/Permanent Loan Application.

## APPENDIX II

Project Design will be reviewed to assess both site and livability issues including but not limited to: universal design and accessibility, pedestrian access, access to transportation, recreation and community space amenities, appropriate unit size and configuration, and consistency and appropriateness with the surrounding neighborhood. To the extent that other funding sources have conflicting design standards, the more stringent requirements will take precedence. In addition, design that enhances the safety and security of residents and helps to prevent crime is encouraged. Quality design shall be a prerequisite for an allocation of credits.

<b>Project Amenities:</b>	<b>Under 20 Units</b>	<b>20 – 50 Units</b>	<b>Over 50 Units</b>
<ul style="list-style-type: none"> <li>Furnished accessible community room with a bathroom and kitchen area</li> </ul>	N/a	Recommended	required
<ul style="list-style-type: none"> <li>Elevator (Required for all garden-style buildings {i.e. single-level apartments, or “flats”} three-stories or greater, and for all buildings for senior occupancy of two or more stories. Grade changes can negate this requirement, which is intended to eliminate the need to walk up more than one flight of stairs.)</li> </ul>	N/a	N/a	N/a
<ul style="list-style-type: none"> <li>Designated exterior playground area adequate for the size of the project (not applicable for units designated for senior occupancy). The requirement for a playground may be modified or waived based on site considerations and proximity to an available public playground or other public recreational facilities.</li> </ul>	Recommended	Required	Required
<ul style="list-style-type: none"> <li>Covered parking</li> </ul>	Recommended	Recommended	Recommended
<ul style="list-style-type: none"> <li>Adequate storage area for each unit</li> </ul>	Recommended	Recommended	Recommended
<ul style="list-style-type: none"> <li>Management Office</li> </ul>	N/a	Recommended	Required
<ul style="list-style-type: none"> <li>Planned designated smoking outdoor smoking area</li> </ul>	Required	Required	Required
<b>Unit amenities:</b>			
<ul style="list-style-type: none"> <li>All units three-bedroom or larger must have at a minimum 1 &amp; 1/2 bathrooms (required for new construction and “adaptive reuse” rehab, recommended for rehab of existing housing units)</li> </ul>	Required	Required	Required
<ul style="list-style-type: none"> <li>All units must have an easily reachable area designated for a microwave (such as a microwave shelf or a combination microwave/fan hood) in addition to adequate counter space.</li> </ul>	Required	Required	Required
<ul style="list-style-type: none"> <li>All units must be constructed with wall soundproofing having a Sound Transmission Classification (STC) Rating of a minimum of 50 which can be achieved with either method: 1) UL Section #U311; or 2) 2x4 studs 16” OC, 5/8” X GWB on one side, RC-1</li> </ul>	Required	Required	Required

## APPENDIX II

Channel 12" OC with 5/8" X GWB on opposite side, the cavity filled with sound batts.			
<ul style="list-style-type: none"> <li>All units must have at least two phone outlets wired with CAT 5e to a central location (where available) installed by qualified installers. All units must also have two RG 6 coax cable outlets.</li> </ul>	Required	Required	Required
<ul style="list-style-type: none"> <li>Casement Windows – No casement windows are permitted except with prior review and approval by the Agency.</li> </ul>	N/A	N/A	N/A
<b>Site Selection</b>			
<ul style="list-style-type: none"> <li>Site Amenities – Proposed site(s) should be in proximity to schools, churches, shopping (grocery stores), recreational facilities and public transportation.</li> </ul>	Recommended	Recommended	Recommended
<ul style="list-style-type: none"> <li>Site Evaluation – The Purchase and Sales Contract should contain a contingency which provides for adequate site evaluation, testing and feasibility analysis.</li> </ul>	Recommended	Recommended	Recommended

## APPENDIX III

### Means and Methods

- **Air Barrier Description:** Provide a schematic drawing illustrating (or written narrative describing) the design and location of the air barrier. Drawing (or narrative) will illustrate how all penetrations, joints, and openings will be sealed, including but not limited to:
  - Mechanical penetrations
  - Plumbing penetrations
  - Electrical, cable, phone, data penetrations
  - Clothes dryer exhausts
  - Windows and doors
  - Attic access
  - Party wall connections
  - Wall / floor / ceiling joints
- **Closure:** The air barrier design must close such that it can be traced in sectional view from “start to start”.
- **Integration:** Describe how each component of the air barrier system connects to adjoining systems.
- **Full Alignment:** Air Barriers must be fully aligned with the insulation, including behind shower and tub enclosures, staircase walls, band and rim joists, behind dropped ceilings or soffits, etc.

### Materials

- **Selection:** Provide the material selected for each component of the air barrier system and the transitions between those systems.
- **Cold Application:** If planning winter construction, please address material compatibility with low temperatures, and any special considerations required for low temperature installation.

### Verification

Please provide a plan for air tightness verification, the plan must include a least two stages:

1. Air Barrier progress testing or inspection:
  - a. For new construction projects, integration with ENERGY STAR Thermal Enclosure System Rater Checklist requirements
  - b. Occurs before air barrier components are covered by subsequent work
  - c. If faults are found, they can be easily remedied.
2. A final close out test, after all air barrier components have been installed and before building occupation. Results will be recorded as the air tightness of record.

### Procurement Suggestions (either)

- Include in RFP for design team a requirement to provide three examples of past projects that have achieved a leakage rate tighter than three (3) air changes per hour at 50 Pascal.
- Please provide the name of the firm or individual whom you plan to contract with whom can provide a list of three projects that has achieved an air tightness of three (3) air changes per hour at 50 Pascal.

## APPENDIX III

Efficiency Vermont  
Multi-Family Air Sealing Protocol  
Example Submittal:

January 2012

Project Name: \_\_\_\_\_ Project Location: \_\_\_\_\_

Project Sqft: \_\_\_\_\_ Project Volume: \_\_\_\_\_

Air leakage goal: \_\_\_\_\_ ACH @50Pa *which is:* \_\_\_\_\_ CFM @50Pa

### Means and Methods:

Please describe air barrier design

The slab on grade project will utilize an exterior sheathing air barrier, starting at the top of concrete wall and ending at the top of wall plate. At which point we will transition the air barrier to the gypsum attic floor through the top plate, the transition will occur at the top plate, with both the exterior sheathing and drywall ceiling being completely caulked to the top plate. The air barrier will continue along the ceiling, down the other exterior wall and return through the concrete slab.

All penetrations or opening will be sealed using low expansion foam or caulk

### Materials:

Please describe materials for each air barrier system

System:	Material
Walls	Liquid applied air barrier at sheathing seams, Tremco Exoair 220 or equal
Transitions	Acoustic sealant Auralex StopGap or equal
Ceiling	5/8" gypsum wall board with taped joints, penetrations sealed
Wall openings	Low expansion foam "Touch and Seal" or equal

### Verification Plan:

A progress test and inspection will be conducted upon completion of the drywall ceiling, window installation and air barrier application. If deficiencies found, they will be corrected.

## APPENDIX IV

<b>Efficiency Vermont Multifamily Mechanical Design Protocol</b>			
<b>Task</b>		<b>Responsibility</b>	<b>Completed</b>
1.	<b>Owner Project Requirements (OPR)</b>	Provided by the Owner/Developer to the design team with RFP. If this is not feasible, provided prior to design work on the project.	
2.	<b>Basis of Design (BoD)</b>	<ul style="list-style-type: none"> <li>• Draft BoD submitted as part of Design Development.</li> <li>• Updated version shall be submitted with 80% Design Drawing review.</li> </ul> <p><i>(Review by owner, all members of design team and energy consultants. If project includes commissioning, the Commissioning Agent should be included in review.)</i></p>	
3.	<b>Training</b>	Staff training will be included at both project turn-over and end of warranty period. Design team will include this requirement in 80% Design Drawing review.	
		During construction: training plan review with installation contractors, including schedules	

## APPENDIX IV

### 1. Owner Project Requirements (OPR):

Provided by the Owner/Developer to the design team with RFP. If this is not feasible, provided prior to design work on the project.

<b>Owner Project Requirements</b>	
<i>Sample OPR language is provided in the Mechanical Systems Optimization Guide (MSOG), Appendix C. This is not a comprehensive example, but rather a starting place for the development of a project specific OPR. The OPR should include:</i>	
<b>General</b>	<ul style="list-style-type: none"> <li>• Contains all information necessary to develop the Basis of Design (BoD) documentation (Section 2).</li> <li>• Training expectations (Section 3) for both project turnover and end of warranty.</li> <li>• Expected occupancy information, number of units, accessibility needs, estimated occupancy schedule</li> </ul>
<b>Energy Performance Requirements</b>	<ul style="list-style-type: none"> <li>• Per Unit Per Month (PUM) energy cost goals               <ul style="list-style-type: none"> <li>○ Central systems (owner paid)</li> <li>○ Individual systems (occupant paid)</li> </ul> </li> <li>• Minimum energy efficiency requirements including               <ul style="list-style-type: none"> <li>○ Efficiency Vermont Multifamily New Construction program, including Mechanical and Air Sealing protocols</li> <li>○ ENERGY STAR, LEED, or other building certification</li> <li>○ Use of ENERGY STAR appliances, lighting, and mechanical systems</li> <li>○ Renewable energy systems</li> <li>○ Other energy performance requirements</li> </ul> </li> <li>• Expected lifetime of equipment and components.</li> </ul>
<b>Indoor Environmental Conditions</b>	<ul style="list-style-type: none"> <li>• Conditioning expectations: in-units, hallways, common spaces, etc.</li> <li>• Time delay for domestic hot water</li> <li>• Expectations for unit to unit air movement (compartmentalization)</li> <li>• Light levels for common areas during occupied and unoccupied</li> <li>• Non energy items which may be included include:               <ul style="list-style-type: none"> <li>○ Elevator turnaround time times</li> <li>○ VOC limitations during construction and maintenance, etc.</li> </ul> </li> </ul>
<b>Building Occupant and O&amp;M Personnel Requirements</b>	<ul style="list-style-type: none"> <li>• Will ongoing maintenance be provided by owner personnel or contracted?</li> <li>• Acceptable frequency of maintenance               <ul style="list-style-type: none"> <li>○ Central systems</li> <li>○ In – Unit systems</li> </ul> </li> <li>• For in-unit maintenance, address access expectations</li> </ul>

## APPENDIX IV

### 2. Basis of Design (BoD) Documentation

The design team shall provide Basis of Design documentation outlining the design assumptions, and describing how the system design will meet or exceed the OPR

#### a. Deliverable Schedule:

Event	Deliverable
<b>RFP &amp; Contract</b>	<u>Recommended</u> : Owner includes BoD requirements in RFP and Contract
<b>Design Development</b>	<u>Required</u> : BoD submitted for review.  (Review by owner, all members of design team, and energy consultants. If the project includes commissioning, the Commissioning Agent should be included.)
<b>80% Design Drawings</b>	<u>Required</u> : Updated and final BoD.

#### b. Content Requirements:

Basis of Design document will include three sections (*Sample BoD language is provided in the Mechanical Systems Optimization Guide (MSOG), Appendix G*):

BoD Content Requirements	
1	<b>General Project Information</b> , including primary design, applicable standards and codes
2	<b>Narratives</b> of mechanical systems
3	<b>Modeling</b> and sizing inputs and outputs

#### a. General Project Information

- Standards and Codes – Reference specific applicable codes (version), regulation, guidelines and other references that will be used for the project. The BoD should include as a minimum:
  - Specific applicable code, including referenced version for design (including Energy, Building, Fire and Life Safety, Plumbing, etc.)
  - Standards (including Ventilation)
  - Guidelines

#### b. Narrative descriptions of performance criteria that specifically indicate how these systems and the design approaches satisfy the Owner Project Requirements.

Including:

- Lighting: design foot-candles, lighting power density, types of lighting (interior/exterior), lighting controls
- HVAC: design loads, diversity factors, zoning, controls, venting requirements
- Boilers: redundancy, operating efficiency, quantity, etc.
- Pumping: arrangement (primary / secondary), variable flow, diversity factors, full load and part efficiency, fluid design temperature difference

## APPENDIX IV

- Ventilation: loads, coils, delivery temperatures, economizers, exhaust systems, energy recovery systems, fan power, fan efficiency (including performance metrics)
- Domestic Hot Water: system type (direct/indirect), full load capacity, full and part load efficiency, design entering/storage/delivery temperatures, DHW recirculation sizing, insulation standards

Narrative should include control and operational concepts for each system; operations and maintenance requirements

- c. **Modeling and Sizing**: design and operating assumptions demonstrating the interactive assumptions responsible for the building performance (Modeling / Sizing Inputs and Outputs). *Sample Modeling / Sizing Table is from the Mechanical Systems Optimization Guide (MSOG), Appendix B:*

<b>PART A: Modeling / Sizing Inputs</b>	
<b>Parameter</b>	<b>Modeled Value or Range</b>
<b>General Parameters</b>	
	[Example information provided]
Building Location	Burlington, VT
Building Type Classification	Multifamily, Mixed Use Commercial, etc.
Weather Data Source / Type	NOAA TMY3, BTV
Winter and Summer Design Temperatures	-5°F, 90°F
<b>Building Dimensions</b>	
Building square feet	XX,XXX
Perimeter	200 ft
Surface Area	4000 sq-ft
<b>Envelope</b>	
Infiltration rate	0.1 ACH
Exterior Wall Assembly R-Value, Insulation Type	R-2 (x" continuous polyiso + x" Batt)
Attic Floor Assembly R-Value, Insulation Type	R-55 (x" continuous polyiso + x" Batt)
First Conditioned Floor is Above (Slab, Garage, Other)	Garage, open to ambient conditions.
Slab Insulation (Below, above, slab edge, etc)	X" continuous R-14 below + 3" polyiso slab edge
Below Grade Wall Insulation	R-15, (continuous polyurethane, x")
Window & Door Tabulation	Types, assembly U-values, SHGC, quantities, etc.
Other Envelope Features	(inc. fixed exterior shading, trees, etc.)
<b>Building Occupants</b>	
Occupancy Schedule	Weekdays 5pm to 7am 100%, Weekdays 7am - 3 PM 55%, Weekdays 3PM - 5PM 75%, Weekends & holidays 85%
Occupied Temperature Set Point (winter, summer)	70/75F
Unoccupied Temperature Set Point (winter, summer)	70/75F (no setback)
Total # of Units in Building	12
Average # of Occupants per Unit	3
Total Bedrooms in Building	20
Occupant types for DHW calculations	Senior, Family, etc.
<b>Central Heating Plant Equipment</b>	
Equipment Type	Condensing Boiler
Fuel Source	Oil
Equipment Efficiency	91% Efficient
<b>Cooling Equipment</b>	
Equipment Type	
Chilled Delivery Mode	
Equipment Efficiency (EER/COP)	
Number of Units	

## APPENDIX IV

DHW HP heating system	
ERV heating/cooling system	
<b>Terminal Equipment</b>	
Terminal Equipment Type	<i>Baseboard</i>
Capacity Rating	<i>800 BTU/hr/ft</i>
<b>Ventilation</b>	
Ventilation rate dwelling	
Ventilation rate common areas	
<b>Building Loads &amp; Schedules</b>	
Lighting Power Density - exterior parking areas	
Common area lighting schedule	
Dwelling unit lighting schedule	
Laundry loads & frequency	
Cooking assumptions	
Miscellaneous plug loads	

<b>PART B: Modeling / Sizing Outputs</b>		
<b>Energy Use</b>	<b>Value</b>	<b>Units</b>
Total Annual Space Heating Input Energy		MMBTU
Total Annual Space Cooling Input Energy [3]		Ton-Hrs
Total Annual Building Electrical Energy		kWh/yr
Total Annual DHW Input Energy		MMBtu
DHW Thermal Storage		Gallons
Peak Space Heating Load		MBTU/hr
Peak Heating Load from Ventilation		MBTU/hr
Space Heating Thermal Storage		
Boiler size and quantity		
Boiler and Thermal Storage peak hour capacity		MBTU/hr
Peak Space Cooling Load [3]		MBTU/hr
Energy Intensity		MBTU/sq-ft/yr
PUM Electrical Cost (current \$ value) [1]		\$/unit/month
PUM Fuel Costs (current \$ Value) [1]		\$/unit/month
PUM Electrical Costs (Yr. 15 @ 5% Esc) [2]		\$/unit/month
PUM Fuel Costs (Yr. 15 @ 5% Esc)		\$/unit/month
[1] Per housing unit monthly expenses. Includes common areas.		
[2] To calculate year 15 rough costs for 5% multiply current dollar fuel costs by 2.08, this is a rough approximation and does not include inflation.		
[3] For buildings with cooling, model and report loads for ERV and for HRV to allow for comparison.		

## APPENDIX IV

### 3. Training Requirements Documentation

Training typically occurs at the end of project construction. Operators often do not assume full responsibility for the system until the system warranty period expires one year later. End-of warranty training shall also be included as part of the project to ensure Operation and Maintenance staff has the opportunity to apply what they've learned directly after training is completed.

Training Documentation Schedule	
Event	Deliverable
<b>OPR, RFP &amp; Contract</b>	<u>Recommended</u> : Include training requirements at both project completion and end of warranty period, specify in house or third party O&M.
<b>Design Review</b>	<u>Required</u> : 80% Design Development include training requirements at both project turn over and end of warranty period for all controls and mechanical equipment
<b>Construction</b>	<u>Required</u> : Training plan review with installation contractors, including schedules

- a. Example Training Schedule (*Sample Training Requirements table is from the Mechanical Systems Optimization Guide (MSOG), Appendix I*)

Appendix I: Training Requirements								
Spec Section	Equipment / System	Total Hours	Type of Training	Timing [1]	Verified in Spec	Trainer	Trainer Organization	Verified Training Provided
<b>Miscellaneous Equipment</b>								
142424	Hydraulic Elevators	4	System shut down, elevator recall, emergency procedures, demonstrate elevator operation upon loss of power and any required reset upon restoration of power	TO				
213250	Fire Suppression	2	Overview of system, maintenance requirements and testing, location of tamper and flow switches and system valves	TO				
<b>Plumbing</b>								
224100	Plumbing Piping	1	Review routing, access, placement of cleanouts, venting, roof drain locations - Building walk through with plans, review insulation levels	TO, 10 month post oc				
224400	Plumbing Fixtures	1	Review parts inventory, review equipment list	TO, 10				
	Well water system	1	location of well, pumps, valves, shut down procedure	TO, 10				
	Septic system	1	tank location(s), maintenance requirements, mowing requirements	TO, 10 month post oc				
	Domestic Hot Water Heater	1	Equipment startup, trouble shooting and shut down procedures, review preventive maintenance requirements as documented on the PM matrix, review spare parts	TO, 10 month post oc				
	Domestic Hot Water Pumps	1	Equipment startup, trouble shooting and shut down procedures, controls, expected operation, potential problems with operation, review preventive maintenance requirements as documented on the PM matrix, review spare parts	TO, 10 month post oc				