

ORNL Updates: Audits and Radon Study

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**2017 NASCSP Annual Training
Conference**

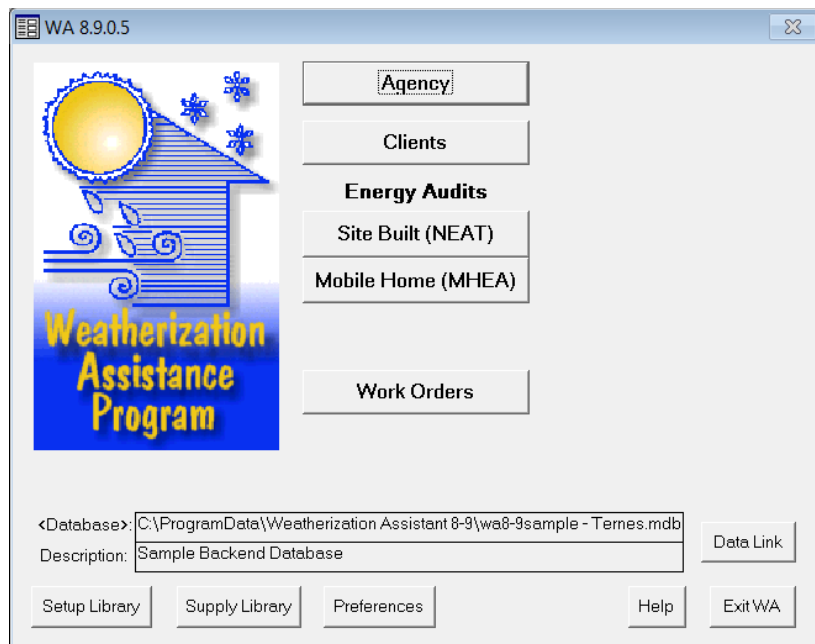
September 21, 2017



Weatherization Assistant – Suite of Audit Tools

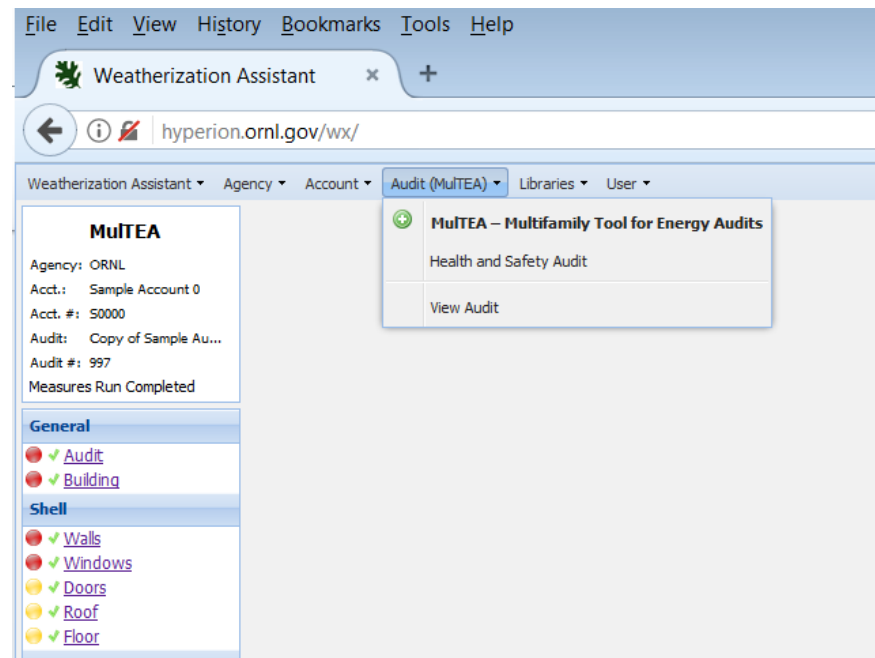
Computer-Based Application

- National Energy Audit Tool (NEAT)
- Manufactured Home Energy Audit (MHEA)
- Work Orders feature

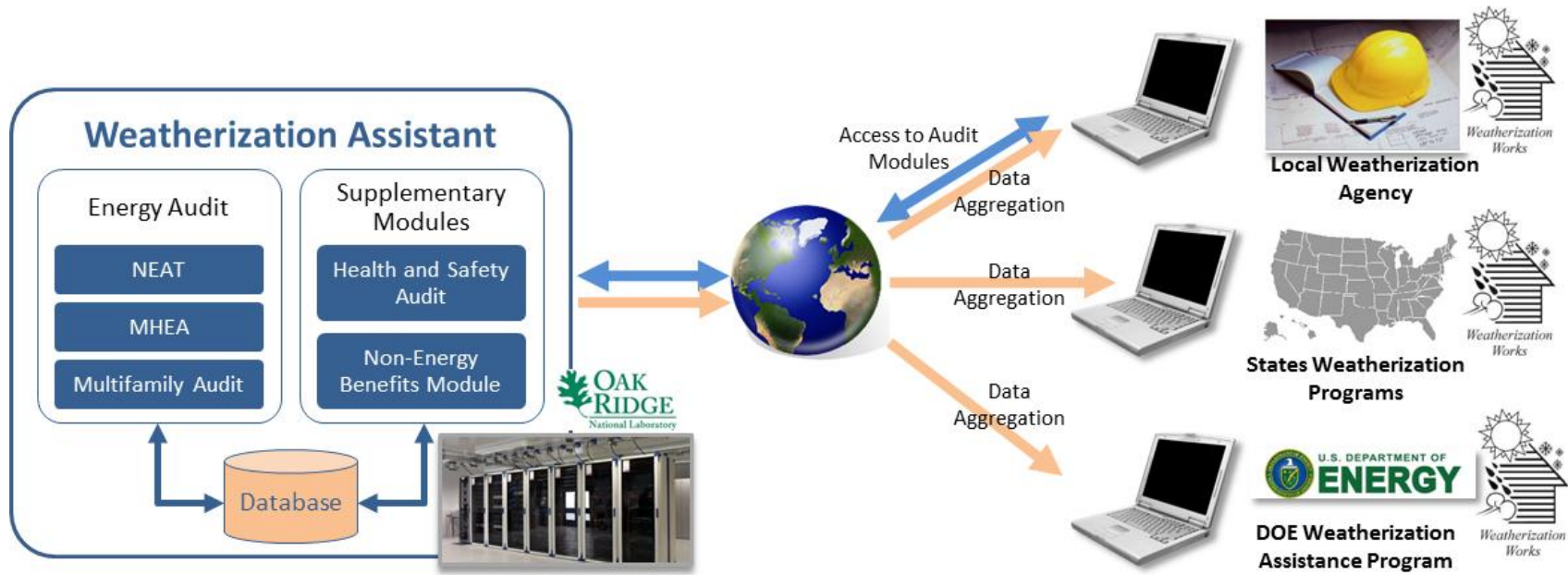


Web-Based Application

- Multifamily Tool for Energy Audits (MulTEA)
- Health and Safety Audit



Weatherization Assistant – Planned



- NEAT, MHEA, MulTEA, and H&S audit
- All run as internet web service on secure servers
- Central data base

MuTEA: ORNL and LBNL Collaboration

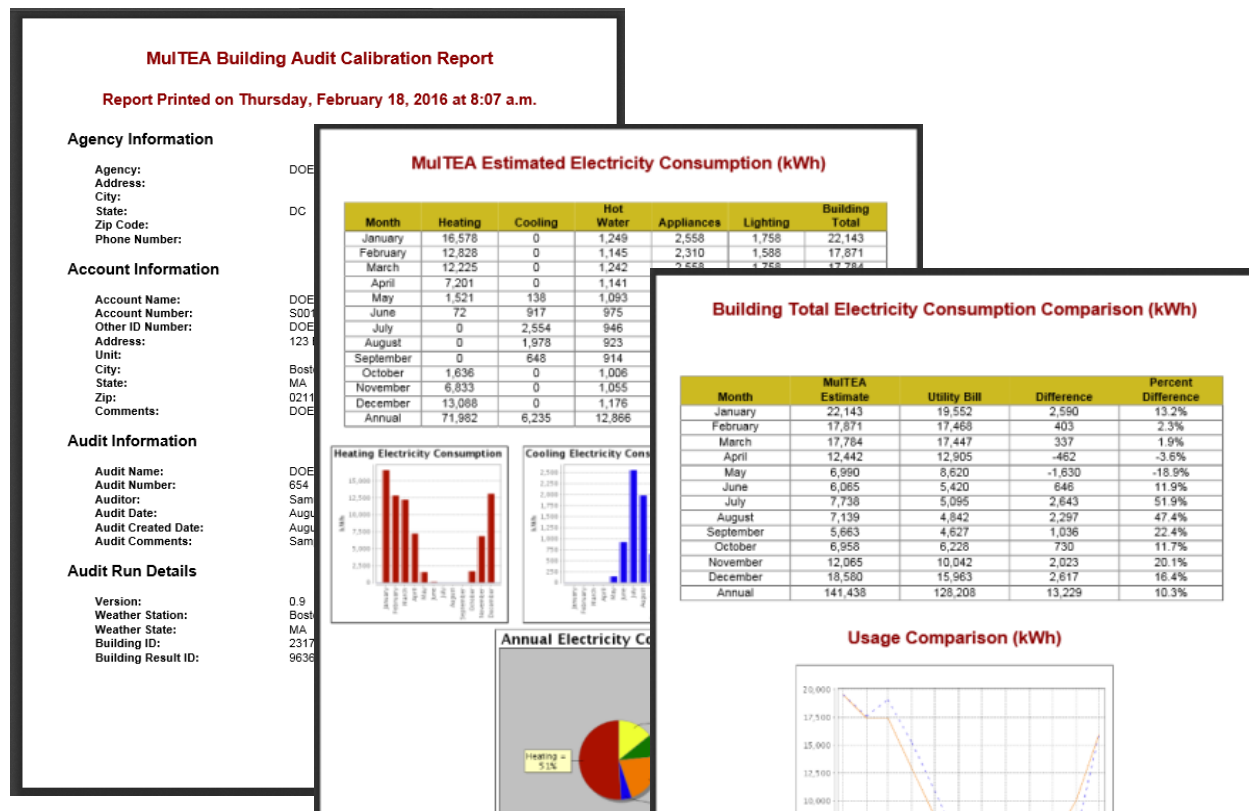


Develop Multifamily Audit Tool and Programmatic Elements for the Weatherization Assistance Program



Add Multifamily to Home Energy Saver Suite of Tools for Consumers and Policy Analyses and Provide API to Run the Energy Analysis Engines

- Web-based
- Investment grade audit
- Hourly simulation
- DOE-2.1e



Retrofit Package Leveraging (Includes Interaction Among Measures)									
#	Retrofit Measure	Component	Code	Estimated Installation Costs (\$)	Savings-to-Investment Ratio (SIR)	Leveraging			
						Buydown for SIR = 1.0 (\$)	Actual Buydown (\$)	Estimated Program Installation Cost (\$)	Program SIR
1	Replace Lamps	Lighting	Lamp Replacement	\$288	6.47	\$0	\$0	\$288	6.47
2	Air Sealing	Infiltration/Ventilation	Infiltration	\$2,000	3.27	\$0	\$0	\$2,000	3.27
3	Install Motion Sensors	Lighting	Hallway Motion Sensor	\$900	2.52	\$0	\$0	\$900	2.52
4	Add Ceiling Insulation	Roofs	Attic roof	\$3,870	1.96	\$0	\$0	\$3,870	1.96
5	Replace the Refrigerator	Refrigerator	Refrigerator Replacement	\$2,350	1.19	\$0	\$0	\$2,350	1.19
6	Replace Window	Windows	W1 60x48 windows	\$3,888	0.77	\$879	\$1,000	\$2,888	1.04
7	Replace Window	Windows	W2 36x48 windows	\$12,096	0.60	\$4,783	\$5,000	\$7,096	1.03
8	Replace Door	Doors	Building entrance door	\$500	0.03	\$483	\$0	\$500	0.03
9	Fix Roof Leak - Attic Insulation			\$500	0.00	\$0	\$0	\$500	0.00
10	Repair roof (for Add Ceiling Insulation)			\$500	0.00	\$0	\$0	\$500	0.00
Package				\$26,892	1.17		\$6,000	\$20,892	1.50

MuTEA Status

- Available for use within the Program per WPN 16-8:
 - DOE-sponsored audit tool that meets WAP requirements
 - Multifamily residences with individually heated and cooled units
- Initially rolled out to the weatherization community in June 2017
 - Series of three 2-hour webinar trainings provided to ~30 staff from ~10 states

Weatherization Assistant Agency Account Audit (MuTEA) Libraries User

MuTEA

Agency: ORNL
 Acct.: Sample Account 0
 Acct. #: S0000
 Audit: Copy of Sample Au...
 Audit #: 997
 Measures Run Completed

General

- ☒ Audit
- ☒ Building

Shell

- ☒ Walls
- ☒ Windows
- ☒ Doors
- ☒ Roof
- ☒ Floor

Systems

- ☒ HVAC
- ☒ Infiltration/Vent.
- ☒ Water Heating

Lighting & Appliances

- ☒ Lighting
- ☒ Appliances/Eqpt.
- ☒ Refrigerator

Other

- ☒ Itemized Costs
- ☒ Utility Bills

Calibration

☒ ☒ ☒

Measures

☒ ☒ ☒

Package

☒ ☒ ☒

Reports

☒

Icon Key

- Form is Required
- Form is Recommended
- Form is Optional
- Form is Completed

Building

Building Size and Occupancy

Number of Dwelling Units:
 Gross Floor Area of Building (sq ft):
 Number of Floors Above Grade:
 Number of Floors Below Grade:
 Average Floor Height (ft):
 Number of Occupants:
 During Daytime:
 During Nighttime:

Elevation of First Floor Above Grade (ft):
 Depth of Building Below Grade (ft):
 Site Grade Changes: ☐
 Depth of Building Below Grade:
 On the Back (ft):
 On the Right (ft):
 On the Front (ft):
 On the Left (ft):

Site Definition

Site Shielding and Terrain:
 Ground Surface:

Building Layout

Building Shape: Total Number of Dwelling Units:
 Hallway Configuration: Top Floor:
 Hallways Are Conditioned: ☐ Intermediate Floor(s):
 Orientation of Building (deg): First Floor Above Grade:
 First Floor Below Grade:

Configuration

Floor Area of Enclosed Spaces

Floor	Area (sq ft)				Floor Sum
	Units	Hallways	Other Conditioned Spaces	Other Unconditioned Spaces	
A3	2400	180	0	0	2580
A2	2400	180	0	0	2580
A1	2400	180	0	0	2580
B1	0	0	0	0	0
B2	NA	0	0	0	0
Bldg Totals:	7200	540	0	0	7740

Bldg totals include no floor multipliers.

Comments

FY18 Work Related to MuITEA

Continued Rollout

- Update information and materials on the WAPTAC and ORNL web sites soon
- Recording of the June 2017 training sessions (also available upon request)
- Web-Based Weatherization Assistant Getting Started Guideline
- Multifamily Tool for Energy Audits (MuITEA) Engineering Manual (currently in draft form)
- Provide another training webinar?
- Call us to discuss the audit, get a preview, and learn how to proceed with full implementation

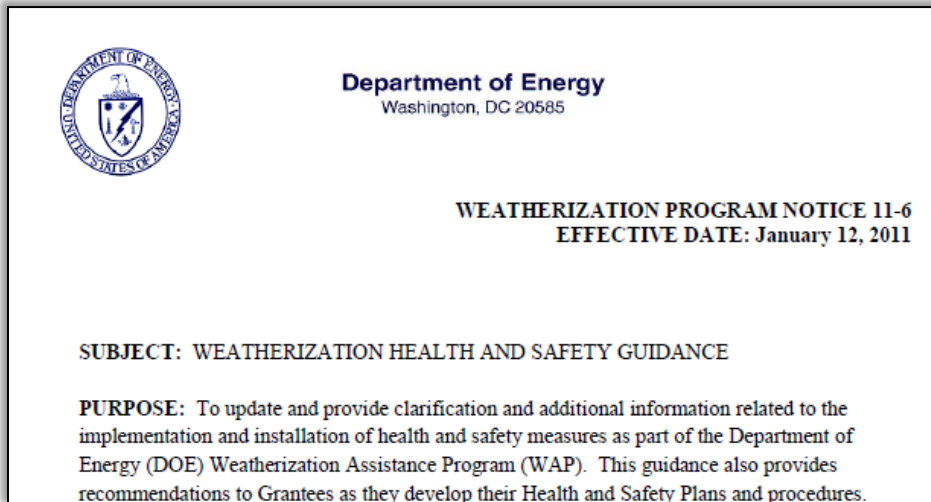
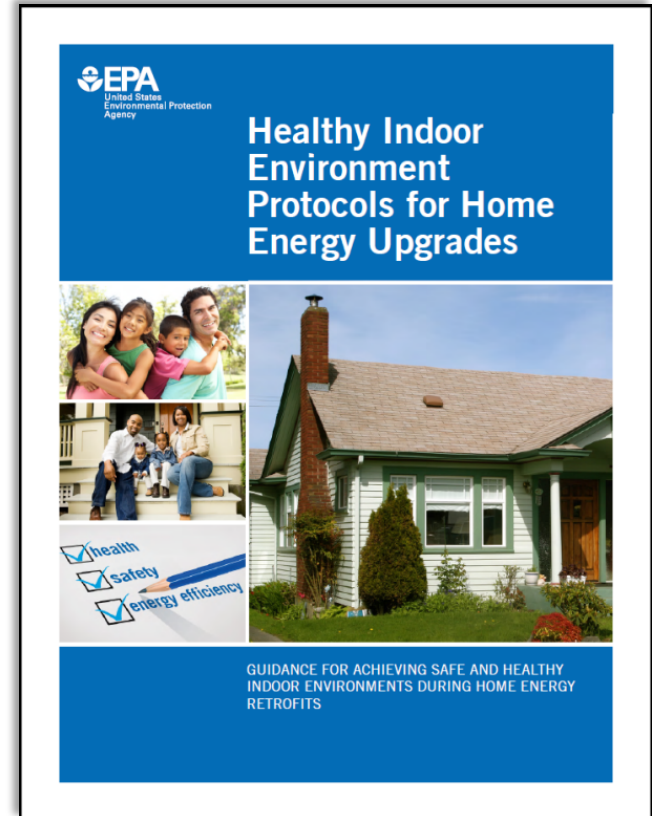
Development Tasks

- Implement calibration using actual weather data
- Expand application to central HVAC systems
- Publish technical guidelines

Health and Safety Audit

Integration of two documents:

- EPA's "Healthy Indoor Environment Protocols for Home Energy Upgrades," dated October 2011
- Weatherization Program Notice (WPN) 11-6: "Weatherization Health and Safety Guidance," dated January 12, 2011



Jointly funded by HUD Office of Healthy Homes and Lead Hazard Control and the DOE Weatherization Assistance Program

Purpose of the Health and Safety Audit

Mold and Moisture

Lead

Radon

Asbestos

Formaldehyde and VOCs

Combustion By-Products

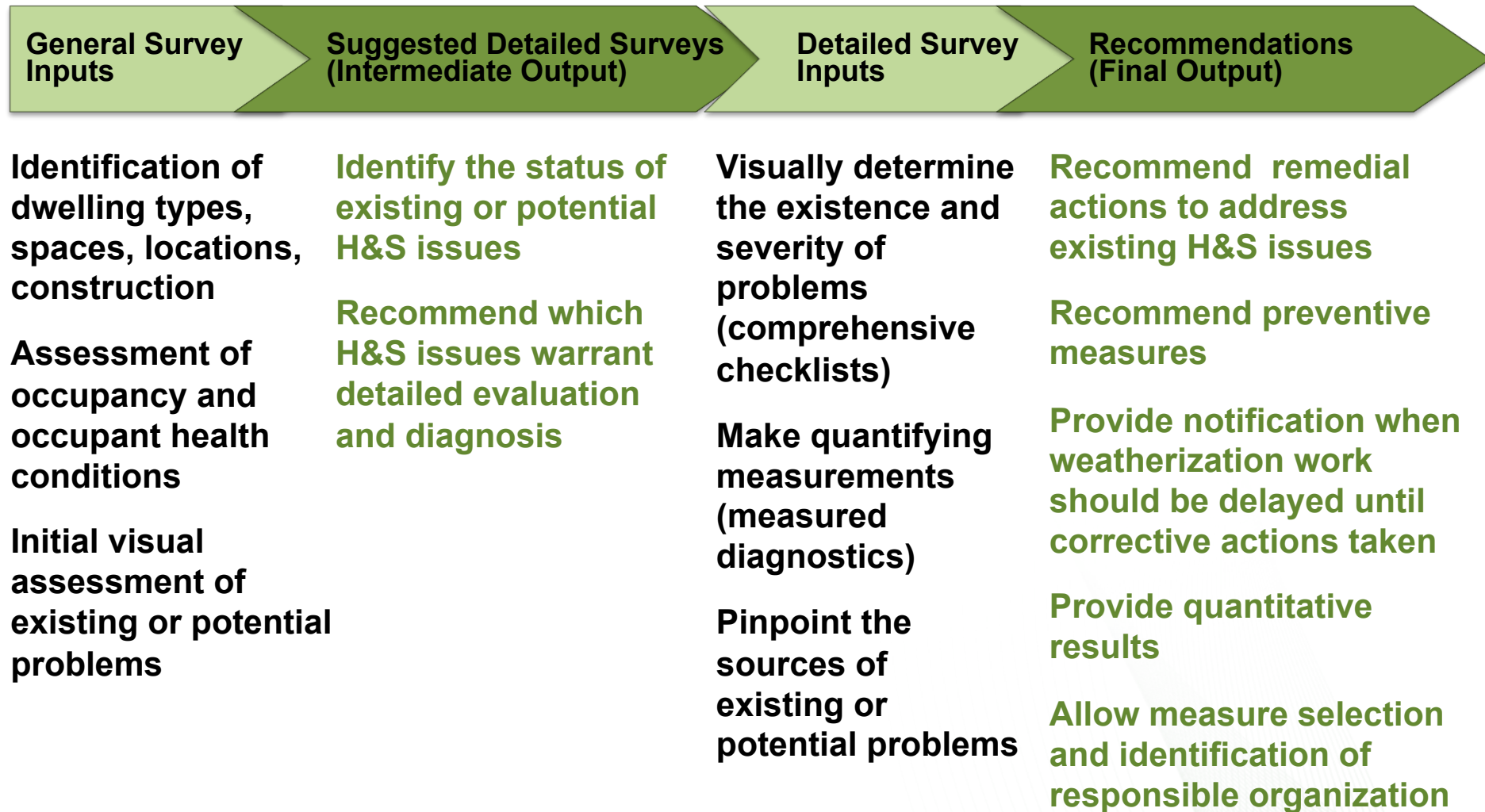
Pest Infestation

Safety

Ventilation

- Assess impact of
 - Existing conditions on planned weatherization work
 - Planned weatherization work on the health and safety of the occupants and crew members
- Recommend actions
 - For remediating existing health and safety problems that can be addressed in conjunction with weatherization
 - Required to perform weatherization in a healthy and safe manner
 - For preventing potential problems

Health and Safety Audit Design



Health and Safety Audit: Recommendations Form

Health and Safety Audit Recommendations

Mold and Moisture (2)
Lead (0)
Radon (0)
Asbestos (0)
Formaldehyde and VOCs (0)
Combustion (0)
Pest Infestation (0)
Safety (4)
Ventilation (0)

Recommended Measures

Recommendation	Must be Performed Before Weatherization	Intended Action			
		Implement	Refer	Recommend to Client	Defer
Remediate the visible mold in the attic following the guidance in the Mold Cleanup table.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reduce heat gains from house into the attic (e.g., add attic insulation, seal air leaks) to prevent snow melting and formation of ice dams.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Factors to Consider in Determining if Recommendation Required Before or as Part of Weatherization

1. Necessary to install weatherization measure or perform weatherization work.
2. Ensure the long term stability and durability of weatherization measures to be installed.
3. Ensure weatherization work does not cause a health and safety problem.
4. Provide a healthy and safe working environment for weatherization crews.

General Notes Regarding Interaction with Weatherization Measures

1. Do not install weatherization measures that will reduce the home's infiltration rate if any mold and moisture recommendation required for weatherization must be deferred.
2. Repair roof leaks before air sealing or insulating the attic.
3. Address drainage issues before insulating basement or crawlspace walls.
4. Manage rainwater in wall and window assemblies receiving retrofits (e.g., drainage plans, flashings).

Mold Cleanup Guidance

Notes Applicable to the Weatherization Assistance Program

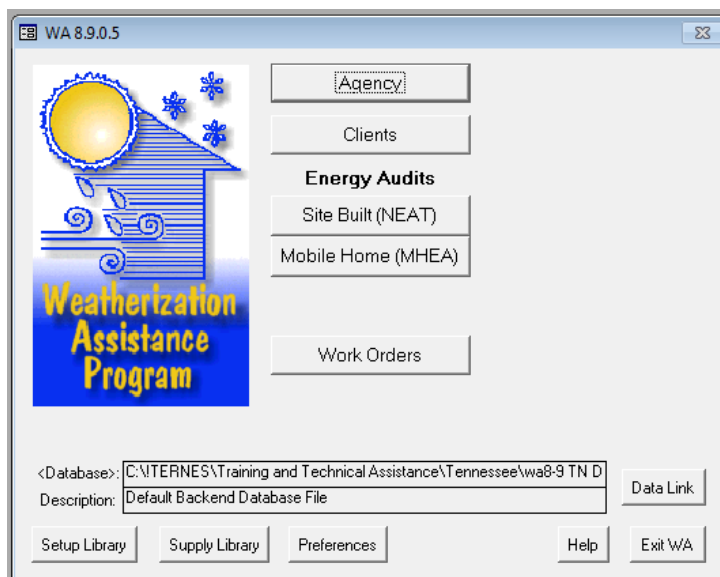
1. Mold remediation and testing are not allowed. Provide client notification and disclaimer on mold and moisture awareness, educate the client about the health risks, and give directions to client on cleaning small areas (optional).
2. Repairs of moisture damage are allowed when it is necessary to perform weatherization, but the repairs are limited to areas that can be corrected by weatherization workers.
3. Correction of mold and moisture creating conditions (i.e., sources) is allowed using health and safety funds when necessary in order to weatherize the home or to ensure the long term stability and durability of the measures, provided that severe mold is not already present (i.e., mold conditions are not so extreme that weatherization cannot proceed).
4. Drainage repairs to address a moisture creating condition are allowed (a) with health and safety funds only to correct code compliance issues triggered by the installation of weatherization measures or the performance of weatherization activities, and (b) as incidental repairs when they are components of efficiency measures. Correction of major drainage issues is beyond the scope of the Program. Inform client of importance of cleaning and maintaining drainage systems and proper landscape design.
5. Deferral of all weatherization activity is required if severe mold or moisture issues cannot be addressed.

FY18 Work Related to the Health and Safety Audit

- Roll out to the weatherization community
 - Will announce and provide a webinar-based training session in the near future
 - Update information and materials on the WAPTAC and ORNL web sites soon
 - Web-Based Weatherization Assistant Getting Started Guideline
 - Health and Safety Audit Design Manual
 - Call us to discuss the audit, get a preview, and learn how to proceed with full implementation
- Development tasks
 - Revise the audit based on recently released Program guidance (WPN 17-7: Health and Safety Guidance, August 9, 2017)

Computer-Based Weatherization Assistant

- NEAT
 - Developed by ORNL
 - Initially released in 1993
- MHEA
 - Developed by NREL
 - Incorporated with NEAT under the Weatherization Assistant umbrella in 2003
- Computer-based applications
- Variable-based degree day analysis approach
- Latest version (Version 8.9) released in 2012



Agency: <input type="text"/>	State: <input type="text"/>	Form: <input type="text"/>	Rev: <input type="text"/>	RevID: <input type="text"/>
Client ID: <input type="text"/>	Client Name: <input type="text"/>	Client Address: <input type="text"/>	Client City: <input type="text"/>	Client State: <input type="text"/>
Audit Date: <input type="text"/>	Audit By: <input type="text"/>	Audit Title: <input type="text"/>	Audit Notes: <input type="text"/>	Audit Status: <input type="text"/>
Weather File: <input type="text"/>	Setup Library Name: <input type="text"/>	Setup Library Path: <input type="text"/>	Setup Library Description: <input type="text"/>	Setup Library Status: <input type="text"/>
Connect: <input type="text"/>				

Index	Recommended Measure	Components	Heating (MMBtu)	Cooling (kBtu)	Build-out (kBtu)	Total (kBtu)
1	Weather Seal		15.1	14.8	0.0	30.0
2	Door Replacement		1.3	4.8	0.0	6.1
3	Door Insulation		1.4	2.4	0.0	3.8
4	Door Weatherstripping		0.0	0.0	0.0	0.0
5	Door Weatherstripping		0.0	0.0	0.0	0.0
6	Door Weatherstripping		0.0	0.0	0.0	0.0
7	Weatherstripping		0.0	0.0	0.0	0.0
8	Weatherstripping		0.0	0.0	0.0	0.0
9	Weatherstripping		0.0	0.0	0.0	0.0
10	Weatherstripping		0.0	0.0	0.0	0.0

Index	Recommended Measure	Components	Measure Savings (\$/yr)	Measure Cost (\$)	Measure Payback (yr)	Measure Cumulative Savings (\$/yr)
1	Weather Seal		0	250	0.0	250
2	Door Replacement		15.1	14.8	0.0	30.0
3	Door Insulation		1.3	2.4	0.0	3.8
4	Door Weatherstripping		0.0	0.0	0.0	0.0
5	Door Weatherstripping		0.0	0.0	0.0	0.0
6	Door Weatherstripping		0.0	0.0	0.0	0.0
7	Weatherstripping		0.0	0.0	0.0	0.0
8	Weatherstripping		0.0	0.0	0.0	0.0
9	Weatherstripping		0.0	0.0	0.0	0.0
10	Weatherstripping		0.0	0.0	0.0	0.0

Index	Material	Type	Quantity	Unit
1	Weather Seal	Weather Seal	100	ft
2	Door Replacement	Door Replacement	100	ft
3	Door Insulation	Door Insulation	100	ft
4	Door Weatherstripping	Door Weatherstripping	1	Each
5	Door Weatherstripping	Door Weatherstripping	1	Each
6	Door Weatherstripping	Door Weatherstripping	1	Each
7	Weatherstripping	Weatherstripping	1	Each
8	Weatherstripping	Weatherstripping	1	Each
9	Weatherstripping	Weatherstripping	1	Each
10	Weatherstripping	Weatherstripping	1	Each

	Heating	Cooling	Heating	Cooling
Annual Fuel (MMBtu)	94.1	11.3	94.1	11.3
Annual Energy (kBtu)	94.1	11.3	94.1	11.3
Annual Energy (kBtu)	94.1	11.3	94.1	11.3
Output required (kBtu/yr)	17.3	2.4	17.3	2.4

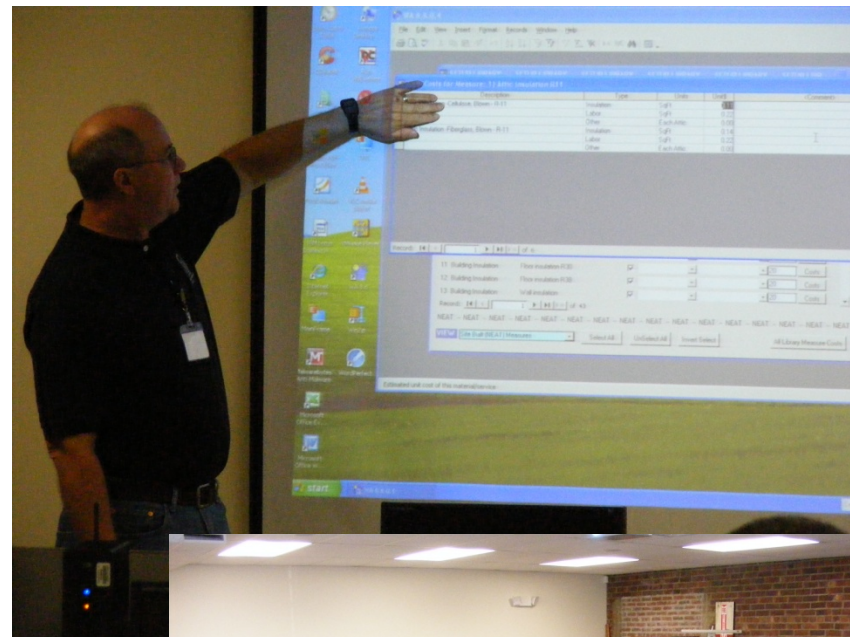
Component Type	Component Name	Area or Volume (ft ²)	Pre-Retrofit Load (kBtu/hr)	Post-Retrofit Load (kBtu/hr)
Wall	Wall	100	100	100
Wall	Wall	100	100	100
Wall	Wall	100	100	100
Wall	Wall	100	100	100
Wall	Wall	100	100	100
Wall	Wall	100	100	100
Wall	Wall	100	100	100
Wall	Wall	100	100	100
Wall	Wall	100	100	100
Wall	Wall	100	100	100

Move NEAT and MHEA to an Online Format in FY18

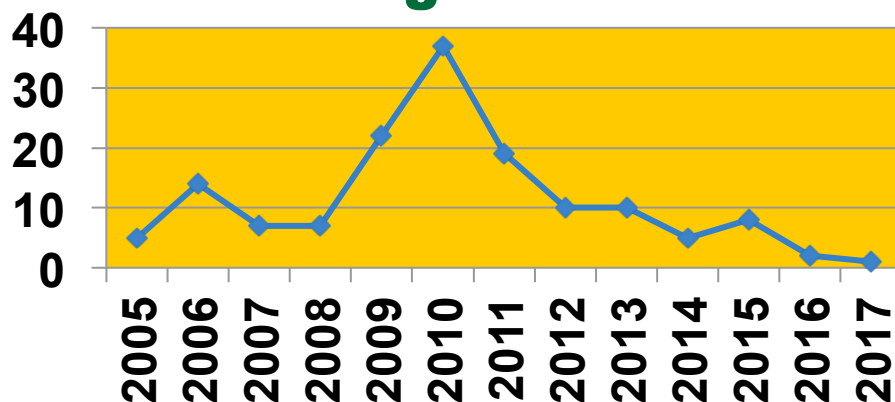
- DOE HQ announced this at the March 2017 NASCSP 2017 Spring Training Conference and the 2017 HPC National Home Performance Conference
- Migration will be performed in discrete steps
 - NEAT and MHEA in their current versions (to facilitate verification of calculations)
 - Address bugs
 - Add new features
 - LED lighting
 - ASHRAE 62.2
 - Work orders and other features
 - Will add ability to export data in HPXML format
- Then consider migration to an hourly simulation engine

NEAT and MHEA Training and Technical Assistance

- State-level trainings
 - Three-day training on basic use
 - One-day training for in-depth discussion of issues or features
- Technical assistance provided directly to individual users
- Web-based training tool for individual auditors (<https://weatherizationassistantraining.org/>)



Number of Annual Training Events



New Audit Training Approach

- DOE has asked ORNL to curtail training on NEAT and MHEA using HQ-provided T&TA funds to allow ORNL to focus its funding on audit development
- HQ's intent:
 - Have Grantees use their T&TA dollars to procure all direct trainings associated with the audit tools
 - Encourage Grantees to incorporate more comprehensive, in-depth audit training into their programs to ensure auditors are properly trained and using the tools correctly
- What might be more comprehensive audit training?
 - Multiple in-person trainings with individual agencies
 - Review and assistance in fuel and measure costs
 - Clearer tie-in of diagnostics and guidance with audit inputs

The Problem – and the Solution

- Difficult for ORNL to accept state funds for training
 - Rigorous approval process for non-DOE funds
 - “Routine” training raises concerns with the DOE Oak Ridge Site Office
 - Cannot subcontract out significant percentages of funding from non-DOE sources
 - Not economical for small funding levels
- Solution – Migrate the Weatherization Assistant training to the Program’s training centers to more fully integrate them into the audit training process

Current Training Center Capacity

- CHP Energy Solutions and Southface Energy Institute are two training centers that have provided training on the Weatherization Assistant to states in the past
- The Wisconsin Energy Conservation Corporation provides ongoing training and support on the Weatherization Assistant to the State of Wisconsin
- Apple Energy Group provides weatherization training support to the State of Texas, including training on the Weatherization Assistant, and possibly to other states too
- D&R International has provided training on the Weatherization Assistant to various states

FY18 Work Related to Audit Training

- Work with the weatherization community to develop a training approach for the Weatherization Assistant
 - This includes NEAT, MHEA, MulTEA, and the Health and Safety Audit
- Initiate discussions with the training centers
- ORNL's possible role once the process is developed
 - Support the training centers and other training organizations to make sure they are fully versed on the tools and to keep them abreast of audit issues and solutions
 - Assist in developing training courses and approaches
 - Remain directly available to states, agencies, and individual auditors to address software issues and answer technical questions

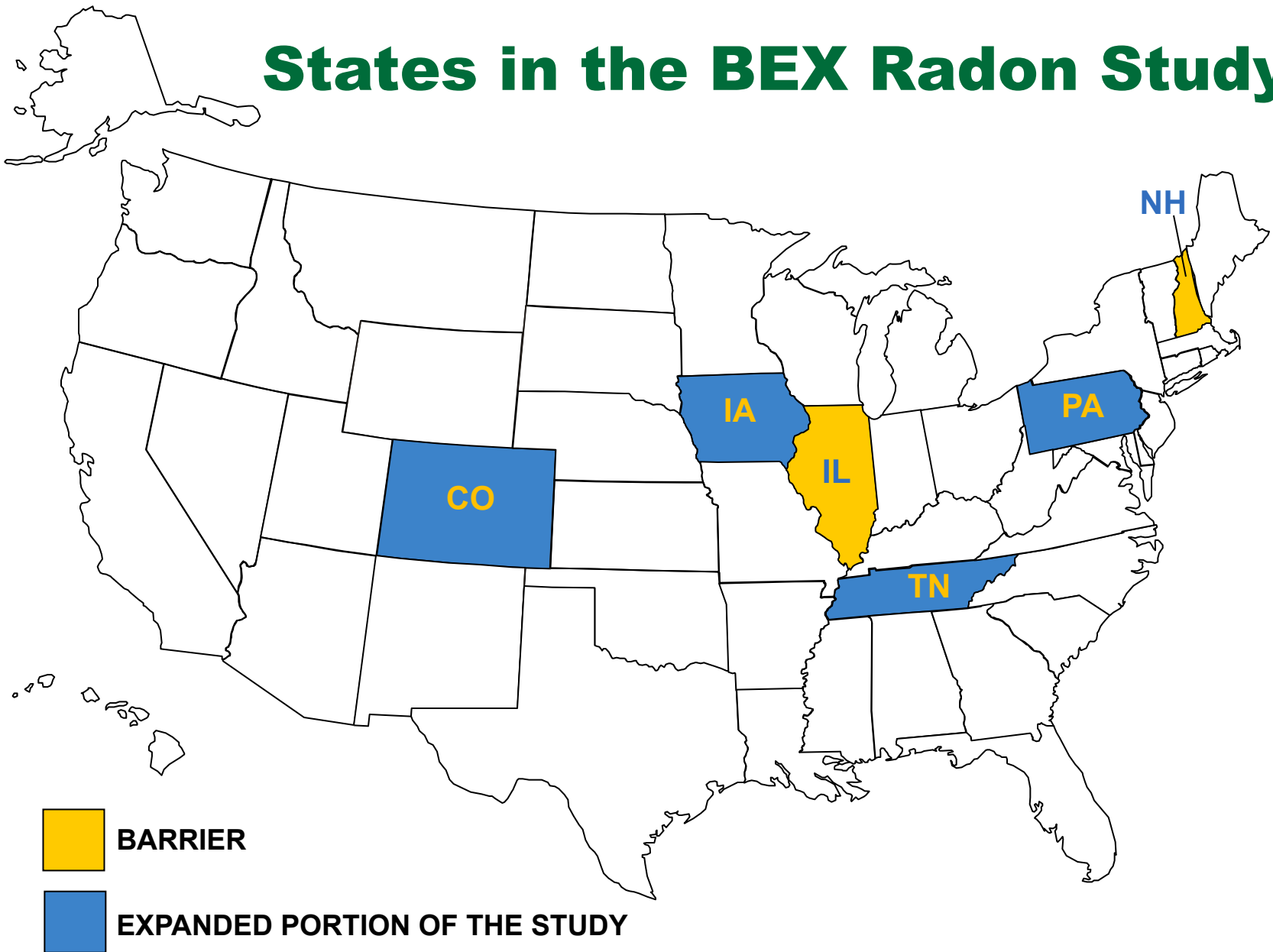
Radon Study

- Detailed update provided at the NASCSP 2017 Spring Training Conference
- BARRIER Plus Expanded (BEX) Study
 - Study underway to understand the impact of current weatherization practices on indoor radon levels
- Results will be used by DOE HQ to inform radon policy going forward

BEX Radon Study Design

- Principle Investigators
 - University of Illinois at Urbana-Champaign (Paul Francisco)
 - National Center for Healthy Housing (Jonathan Wilson)
 - Tohn Environmental Strategies (Ellen Tohn)
- Building Assessment of Radon/Moisture Reduction with Energy Retrofits (BARRIER) – Funded by HUD
 - 120 treatment houses and concurrent control homes in two states
 - Two treatment options: “business as usual” and “enhanced”
- Expanded Portion of the Study – Funded by DOE WAP and EPA
 - Adds 200 treatment and 40 control homes in four states

States in the BEX Radon Study



BEX Radon Study Status

- BARRIER

- Data collection completed
- Draft final report will be completed and submitted to HUD in October 2017

- EXPANDED PORTION OF THE STUDY

- Pre- and post-weatherization data collection completed in three northern states for 2016-17 winter and on-going in the southern state for 2017 summer
- Winter 2017-18 and Summer 2018 data collection: pre-weatherization, post-weatherization, and one-year post-weatherization
- Winter 2018-19 and Summer 2019: additional one-year post-weatherization
- Draft final report December 2019

Discussion

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Visit our website:
<http://weatherization.ornl.gov>

