

Audit Procedures and Field Protocol

The purpose of weatherizing multi-family units is to increase the energy efficiency of the individual units, reduce the occupants' expenditures, and improve their health and safety. All procedures and protocol has a goal of supporting this purpose while establishing a solid and accurate engineering model of energy saving assumptions.

For PY 2017/2018 when a project is selected for weatherization, the procedures start with a Quality Work Plan. Following the Multi-Family QCI class curricula, the Subrecipients will write their own plan for each multifamily project. The plans will include desk monitoring that happens prior to any visits to the site. Desk monitoring minimally consists of verifying eligibility of project, viewing of floor plans, site plans, internet maps, communication with stakeholders about project goals, and other necessary communication such as program requirements and limitations.

The information gathered during this process is used to help determine if the standard field procedures are appropriate for the particular project. Ultimately site visits will either confirm these assumptions or reveal the need to change plans for that particular site. A team of energy auditors use Data Collection Forms that are arranged in a particular order and designed to collect pertinent information efficiently. These forms include:

- General project information
- Structure design and layout
- Site climatic information
- Envelope information
- All necessary TREAT or NEAT input data
- Diagnostic testing including advanced tests and unit to unit zonal tests
- Other data collection or tests needed to solve unusual problems
- Health and safety considerations and tests
- SWS requirements
- Client Education

When the final procedure appropriate for the project has been determined, the data collection and testing is either resumed or re-scheduled. This is performed on a pre-selected random sample for each type; i.e. 3 bedroom upstairs, 3 bedroom downstairs, etc. Once this is complete, it is verified for accuracy and input into the TREAT or NEAT model along with the necessary utility data and library updates.

The energy auditor runs the model and looks for errors, warnings, areas that are not compatible with general logic, and user mistakes. When the model is free of errors, has determined the SIRs, and makes predictions that are in alignment with utility bills, it is submitted to the grantee for approval.

Below is an outline of the methods, field procedures, and protocol used for multi-family energy audits.

1. Pre-Visit Planning and Desk Monitoring

- a. Eligibility is confirmed or denied
- b. Stakeholder communication is initiated
 - i. Parties identified to work with throughout project (building operator, owners, etc.)
 - ii. Project Goals
 - iii. Verification of 10 CFR 440.22 compliant
 - iv. Client education starts
 - v. Grantee (MFA) is notified and included in the communication loop
- c. Site maps, plans, floor plans, and internet maps viewed
 - i. Sampling plan is formed for each population type
 1. Random units selected
 - ii. Building orientations are viewed
- d. Age of buildings documented
 - i. Required testing prepared and planned (Lead, asbestos)
 - ii. SHPO considerations for necessary photos and information
 - iii. Construction history is applied so reasonable assumptions can be made
- e. Information about the heating and cooling systems is obtained
 - i. This helps determine how much time to allow for diagnostic testing and if other engineers or HVAC professionals need to be included.
 - ii. Testing equipment needed for systems is secured
- f. Forecasted data collection and diagnostic testing methods are prepared
- g. One person site visit to verify estimates and assumptions
- h. Team of assessors are assembled and scheduled with pre-selected sample units

2. Site Assessment, Data Collection, and Diagnostic Testing

Arrival and Meet

- a. After coordination with the property managers, the team arrives, is introduced to the participating parties, plan is reviewed, and the assessments begin.

Outside Inspection

- b. The entire team views the exterior of the buildings to match with previously gathered records. (Quick walk around)
- c. The team then breaks up into smaller teams of two inspecting the exterior carefully.
- d. Photos and/or videos are taken
- e. Exterior building measurements are recorded along with windows and door information.
- f. Outside penetrations and identified

- g. Exterior type of buildings are confirmed
- h. Infra-red viewing if applicable is recorded
- i. Insulation levels and condition in crawl space and attic are measured and photographed
- j. Flue conditions are documented and photographed
- k. Health and safety conditions are documented and photographed
- l. Gas meter testing is completed
- m. Envelope and SWS checklist portions of Data Collection Forms are filled out
- n. Client education is constant if the building operator accompanies team or notes are taken for a later consultation
- o. Prior to audit being run, scope of work is estimated so material list can be generated. This reduces the need to go back a second time.
- p. The team looks for additional problems related to weatherization needing to be solved that are not previously covered.
- q. Grantee visits during this process to confirm quality

3. Interior Inspection

- a. Units selected for sampling are entered
- b. Data Collection Sheet for interior is filled out
- c. Tenants/Occupants are engaged in client education
- d. All appliances are identified and necessary information is obtained
- e. Refrigerator is metered and information is recorded
- f. Photos are taken of necessary items(with occupant permission)
- g. Lighting information is gathered
- h. Water flow rates are measured
- i. Interior condition of windows and doors are documented
- j. Infra-Red camera is used on each of the outside walls
- k. Wall insulation level is verified with drill and patch method (usually in unoccupied unit if possible)
- l. Any anomalies or inconsistencies are noted
 - i. Need for additional sampling is considered
- m. Health and Safety concerns are noted, and client education delivered if necessary
- n. SWS checklist is completed from Data Collection Sheet
- o. Existing ventilation fan information is documented, flow measured, area is assessed for replacement to comply with ASHRAE 62.2 2013
- p. Diagnostic testing procedure is confirmed from previous notes or changed if appliances vary from plans
- q. Teams set up for all diagnostic testing
- r. Estimated scope of work and material list (preliminary)
- s. The team looks for additional problems related to weatherization needing to be solved that are not previously covered.

4. Diagnostic Tests Appliances

The goals of the tests are to determine the efficiency, safety, and general operating condition of the systems. The team is trained to recognize when additional tests from the minimum are required tests are needed to support this goal and will perform the testing as necessary.

All appliances in all units are tested for combustion safety if the project is approved with the "test in, test out" fashion. For assessment/audit purposes, only the selected sample units are tested.

If there are centralized systems, the same goals apply. The testing methods selected are verified by the Grantee to be appropriate for each type of system. On occasion, further consultation is required prior to proceeding. The vast majority of what is used in NM is forced air furnaces and natural draft water heaters in their own closets.

- a. Testing procedures outlined in the NM Energy Smart Technical Standards are followed for the gas leaks, kitchen range, water heating, and heating systems.
- b. Data Collection Forms are completed
- c. The need for additional samples is determined
- d. Client education is continued with occupants and/or building operators
 - i. Centralized units client education will be with building operator or maintenance
 - ii. This includes general safety and maintenance
 - iii. Results of testing are delivered with explanations to the appropriate parties
- e. Appliance size/capacity in relation to usage is documented
- f. Appliance room/closet is assessed for combustion air, safety, how it can be separated from the unit if individual
- g. Possible tune-up needs are assessed
- h. Possible replacements are assessed
 - i. Coding issues are identified
 - ii. Space requirements are documented
 - iii. SWS requirements are included
- i. SWS compliance is assessed
- j. Preliminary material list and scope of work is formed
- k. Videos and photos are taken
- l. The team looks for additional problems related to weatherization needing to be solved that are not previously covered. They determine if additional testing is needed.
- m. Health and Safety Plan is followed

5. Diagnostic Testing Blower Door, Ducts, Zonal Tests, Connectivity

- a. At this point a very close assumption has been made as to whether or not the units are connected. The connectivity test is run first so this assumption is either confirmed or debunked at this point. Zonal testing procedures outlined in the NM Energy Smart Technical Standards are followed.
- b. Zonal Pressure Testing:
 - i. Neighbors are notified of the quick procedure by management ahead of time even though they may not be part of the sampling process
 - ii. Testing hose to each neighbor sharing any part of the envelope is routed through the blower door set up and to the neighbor being tested.
 - iii. Hose is attached to the appropriate location of the gauges depending on where the person testing is located in relation to the unit being tested
 - iv. The sample unit is depressurized to -50 and each neighbor's connectivity is recorded.
- c. The connectivity of the units will generally fall into one of the three below categories:
- d. No connectivity
If it is determined the units are not connected by more than 10 pascals, then the single family blower door/duct/zonal testing procedures outlined in the Technical Standards are followed with some variance if needed.
- e. Minor connectivity, no interior entrances
If it is found there is connectivity between the units more than 10 but not more than 25, the reasons for connectivity are considered. If it appears the units may be compartmentalized through usual measures such as sealing attic top plates that would normally be done, then a second or third blower door may be set up to the connected neighbors and run at the same time in order to collect a more accurate pre CFM 50 reading.
- f. Completely connected or interior entrances
Prescribed air sealing measure scope of work is generated that includes measures such as weather-stripping doors, separating CAZ, top and bottom plate sealing. Estimated seasonal air changes per hour is determined for entry into the TREAT audit.
- g. As the testing is being conducted, scope of work and material lists are constructed.
- h. Infra-Red is used
- i. Photos and videos are taken
- j. Client education is communicated
- k. The need for additional sampling is determined and the team makes sure there are not additional problems related to these tests that need to be solved. They determine if additional testing is needed.

6. Site Visit Final Walk Through

- a. Prior to leaving site, all field notes are viewed
- b. Data Collection Sheets are reviewed for completion
- c. Additional samples, tests, or photos may be needed to deliver a completed package and completed at this point
- d. Final property walk through is done to look for anything that was missed
- e. Summary of client education is delivered to appropriate parties
 - i. This includes the next steps and what to expect
 - ii. Health and safety concerns are delivered with action plan
- f. The team verifies there are not additional problems related to weatherization that were missed.

7. TREAT Modeling Entry-Required when buildings consist of 25 or more units or contain a shared heating system, optional for all other units

- a. When timing allows, data entry into the software happens as close to the collection time as possible. Entry at the site with a laptop is preferable but not always practical.
- b. Libraries are updated if needed
- c. General Information and Billing Data categories and already determined prior to site visits and assumptions are confirmed
- d. Utility data is used and unusual spikes or lows are noted
- e. Field notes are questioned where needed
- f. Once all the information is entered the model is calculated
- g. Errors with the Model Inspector screen are considered
- h. Utility data comparison is made to see how true model is and where possible errors may be
- i. Once model is satisfactory and no entry or data collection errors are present, improvements from preliminary scope of work are entered to determine SIRs
- j. Incidental repairs and health and safety measures are entered
- k. Two "Improvement packages" are formed. One for incidental repairs and ECMs and one for health and safety.
 - i. This is done with actual costs so owner buy down can be determined where measures do not meet an SIR of 1.
 - ii. The cost is adjusted after it is determined if there will be a buy down or if the measure will be removed.
- l. Communication with building owners is provided
- m. TPG file is sent to Grantee for viewing, comments and approval

8. NEAT Modeling Entry-For use when units have individual heating systems and buildings are less than 25 units

- a. When timing allows, data entry into the software happens as close to the collection time as possible. Entry at the site with a laptop is preferable but not always practical.
- b. Libraries are updated when needed
- c. General site conditions are pre-determined
- d. Utility data is viewed but not required for entry
- e. Field notes are questioned and compared with photos and diagrams
- f. Input report is compared to field notes
- g. SIRs and loads are examined
- h. Incidental repairs and health and safety measures are entered when needed
- i. Communication with building owners is provided
- j. Input reports, recommended measures, photos, field notes, and explanations are sent to Grantee for approval