WEATHERIZATION POLICIES AND PROCEDURES
FOR ENERGY AUDITS

2022 Edition

The guidance in this manual is effective for all energy audits using DOE WAP or LIHEAP funds. These policies will continue to be evaluated for improvement in future program years.

Created by the New Jersey Department of Community Affairs and CHP Energy Solutions

TERMS AND DEFINITIONS

Additional Cost

The cost to pay for extra work that is <u>absolutely</u> needed to complete the measure, and that will ONLY be done if the measure is done. For example, a dam around an attic hatch must be installed before new attic insulation can be added but would not be built if no new attic insulation is added.

AFUE

Annual Fuel Utilization Efficiency is an efficiency measure for combustion furnaces, boilers, and water heaters. Given that this is a lab-tested result, it is the only efficiency measure available for a new unit prior to its installation.

Ancillary Repair

Items necessary for the proper installation of weatherization materials… "to achieve a finished product in a typical installation where no unusual or extensive repairs are needed. Ancillary items typically refer to small items such as hardware, fasteners, adhesive, sealant, etc.…[1]" Ancillary Repairs are noted in NEAT/MHEA, as Additional Costs.

Attic Hatch

Also known as a scuttle hole; this is the access point to an unfinished attic.

Collar Beam

The flat ceiling area at the top of a finished attic space.

Combustion Appliance Zone (CAZ)

Room and enclosed air volume that contains a combustion appliance. This may include, but is not limited to, a mechanical room, mechanical closet, or main body of the home.

Conditioned Stories

The number of conditioned stories in a home. Include finished basements that are (1) mostly above grade or (2) mostly below grade but with a direct exit to the outdoors.

EER

Energy Efficiency Ratio is a measure of how efficiently a cooling system will operate when the outdoor temperature is at 95'F. It is the typical efficiency unit for window air conditioners and must be converted to SEER in NEAT.

Energy Audit

The energy audit is an evaluation of the home and will address energy usage and limited aspects of building durability and occupant health and safety. It will provide a comprehensive report with a list of prioritized recommendations to improve the home energy efficiency and will include a cost-benefit analysis according to federal and state regulations. Energy audits shall be based on building science principles and include the use of appropriate equipment in diagnosing opportunities for improving energy efficiency and minimizing health and safety hazards. An energy audit consists of both the physical assessment and the data entry into an DCA approved energy audit modeling software.

Energy Auditor

An Energy Auditor (EA) is a building scientist who evaluates the energy efficiency and health and safety of a building and identifies areas for savings by

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[1] WPN 19-5

gathering empirical data, conducting tests and using energy modeling software, in order to reduce the energy consumption, improve the safety, and increase the lifespan of a building; while improving the quality of life and comfort for building occupants.[2]

Energy Conservation Measure

An ECM is "an installation procedure performed for its anticipated energy savings. ECM costs must include all material, labor, and ancillary items and must meet a Savings to Investment Ratio (SIR) of 1.0 or greater to be installed with WAP funds."[3]

Energy Factor

Measure of the overall energy efficiency of certain appliances. Most often used for water heaters, dishwashers, and clothes washers & dryers.

Foundation Wall

The masonry or concrete walls that serve as the main support for a structure. They are at least partly below grade, typically going down as far as the frost line, and can also form the walls of a basement area.

Glazing

Refers to the glass of a window, i.e., double pane, single pane, etc.

Health & Safety

"The actions taken to eliminate a health and safety hazard, the elimination of which is necessary to effectively perform weatherization work, OR the actions are necessary as a result of weatherization work.[4]" Use the flow chart in Appendix A to help you determine if a measure is a legitimate health and safety measure. See allowable H&S expenditures for HESWAP Shell Grants, as well as Heating Improvement Program (HIP) grants

HSPF

Heating Seasonal Performance Factor is the term used to measure the heating efficiency of a heat pump. Usually between 6 and 9.

IID

An intermittent Ignition Device. These have replaced pilot lights to ignite a combustion fuel source when the appliance is in use. Also called a Glow Plug.

Incidental Repair

A repair necessary for the effective performance or preservation of newly installed weatherization materials, but not part of standard installation[5]. These MUST be related to a weatherization measure the agency is installing. For example, a roof leak can be an IRM if new attic insulation is being installed. However, it cannot be an IRM if no new insulation is being installed as the repair does not protect a measure paid for by DOE. IRMs will not affect the SIR of any individual ECM. However, they will reduce the Package (Cumulative) SIR for this job, which cannot fall below 1.0.

Input Capacity

The amount of energy (fuel) that an appliance will consume for every hour of use. This can normally be found on data plates or stickers.

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[2] NREL Single-Family Energy Auditor JTA (2018)
[3] WPN 19-5
[4] WPN 22-7
[5] WPN 19-5

Knee Wall	A wall that is often about knee height (hence the name) that, most typically, is found separating conditioned and unconditioned attic spaces.
Major Measures	These are high priority measures, which if skipped, would result in only a "partial" weatherization of a unit. Major measures are as follows: air sealing, duct sealing of ducts outside the thermal boundary, attic insulation, wall insulation and floor or belly insulation. See Appendix E for more information
Measure Skipping	Measure skipping is not installing, in order of decreasing Savings to Investment Ratio (SIR), the cost-justified Energy Conservation Measures (ECMs) and related Incidental Repairs Measures (IRM) included in the work scope produced by the Department of Energy (DOE) approved energy audit tool[6].
Outer Ceiling Joist	The unconditioned floor area of attic behind the knee wall of a finished attic.
Output Capacity	The maximum amount of heat energy that an appliance is rated to supply to the conditioned space, or towards meeting the energy demand. It is sometimes referred to the amount of energy (fuel) that an appliance will effectively output. Depending on the efficiency of the appliance, and the fuel type, the Output Capacity will be equal to or less than the Input Capacity. This difference is usually equal to the amount of energy that is lost up a chimney or flue and is not used by the home to meet energy demand.
Primary Heat	The primary heat source is that installed unit which is most relied on by the client to provide heating throughout the season[7]. Portable heat units can never remain as the primary heat source in a home after weatherization is complete.
Quality Control Inspector	A QCI is a residential energy-efficiency expert who ensures the completion, appropriateness, and quality of energy upgrade work by conducting a methodical inspection of the building and performing safety and diagnostic tests[8].
Recovery Efficiency	For water heaters, it is the ratio of energy delivered (to the water) to the energy content of the fuel consumed by the water heater.
Roof Rafter	A sloped wooden structural member of the roof assembly.
Secondary Heat	Secondary heat is any source of heat intended and used to provide less than 50% of the heat in a home. This can be a supplemental heat source used regularly or an emergency heat source used at need. The auditor must judge, through discussion with the client, approximately what percentage of heat is provided through the year by secondary heat sources.
SEER	Seasonal Energy Efficiency Ratio is the most common measure of efficiency of a central air conditioner, including the cooling function of a heat pump.

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[6] WPN 19-4, Attachment 8
[7] WPN 22-7
[8] NREL Single-Family Quality Control Inspector JTA (2018)

Sill	The sill is the strong horizontal member at the base of any structure, which sits atop the foundation. For the purpose of the NEAT, we are considering the whole Sill-box that comprises the sill and rim/band joist. This is typically 2x6 to 2x10.
Space Heater	A non-ducted heating unit that, by definition, heats up the space around the heater. Can be vented or unvented.
Steady State Efficiency	Measures how efficiently a furnace converts fuel to heat, once the furnace has warmed up and is running steadily (i.e., stack temperature is steady). This is measured in the field on an existing furnace, using a combustion analyzer.
Storm Door	A secondary door, usually with a large percentage of glass, which buffers the primary door from the elements.
Stud	The vertical upright pieces of lumber in the walls of a "stick-built" home.
Tonnage (Capacity)	Air conditioners are often referred to in terms of tonnage. One ton is equal to 12000 BTU/hr.
Top Plate	Similar to the Sill Plate, but this sits at the top of the structure, on top of all walls both interior and exterior. It is an important location for air sealing.
Vapor Barrier	Another name for any of the three classes of vapor retarder. This is a membrane designed to limit the movement of water vapor. Typically, these are used in wall construction, but also can be laid to cover a crawlspace floor. • Class I – Very low permeability vapor retarders – rated at 0.1 perms or less. • Class II – Low permeability vapor retarders – rated greater than 0.1 perms and less than or equal to 1.0 perms. • Class III – Medium permeability vapor retarders – rated greater than 1.0 perms and less than or equal to 10 perms.
White Roof	To be deemed a white roof, the roof coating must effectively work at improving the SRI (Solar Reflectance Index) of the roof.

1. ENERGY AUDIT GENERAL REQUIREMENTS

1.1. ENERGY AUDIT

1.1.1. All Subgrantee Recipients are responsible for conducting an energy audit, following the National Energy Resource Laboratory's (NREL) [Energy Auditor (EA) Job Task Analysis (JTA)](#) on all weatherization eligible dwelling units for both the Department of Energy Weatherization Low-Income Assistance Program and the Department of Human Services Low Income Housing Energy Assistance Program Weatherization contracts.

1.2. ENERGY AUDIT SOFTWARE

1.1.2. Subgrantee Recipients shall work with DCA to comply with the requirements of [10 CFR 440.21 Weatherization Materials Standards and Energy Audit Procedures](#). The most recently approved release of the NEAT/MHEA audit software shall be used to assign priorities among individual weatherization materials in descending order of their cost-effectiveness ([Version 8.9.0.5](#)).

1.3. ENERGY AUDITOR

1.1.3. An assessment can only be completed by anyone who has met Energy Auditor training requirements of [NJ WAP State Plan](#). It is the responsibility of the qualified energy auditor to accurately assess the existing conditions in a client's home, based on visual and diagnostic testing. Accurate data entry is necessary for a reliable determination of energy conservation measures (ECMs) for a home. It is the auditor's responsibility to input the most accurate data possible based on the data collected during the audit of the home.

2. PHYSICAL ASSESSMENT/DATA COLLECTION

2.1. REQUIRED ENERGY AUDIT DOCUMENTATION

2.1.1. Data collected during a residential audit shall be collected by the auditor

    2.1.1.1. **[NEAT Energy Audit Data Collection Form](#)**

    2.1.1.2. **[MHEA Energy Audit Data Collection Form](#)**

2.1.2. Under all circumstances, client education MUST be provided by the Subgrantee Recipient when an issue is found in a home, even if a home is deferred or if the issue is abated. Client education must be documented with the client's signature.

2.1.3. An Energy Auditor must collect sufficient photo documentation of the home, including, but not limited to:

    2.1.3.1. Exterior views showing every wall of the home underlineentirely (STEP BACK).

    2.1.3.2. Legible photos of manufacturer's data plates for heating, cooling, refrigeration, and DHW appliances.

    2.1.3.3. Photos of the diagnostic test results, including

        2.1.3.3.1 Combustion Analysis – WCD of CAZ (manometer), Spillage, Comb. Analyzer showing CO AF, EFF % (SSE), and CO (as measured)

        2.1.3.3.2 Fridge Metering – Minutes, kWh (pay attention to decimal), Peak Watts (if over 550, check "Includes Defrost Cycle" in software), Data Plate

        2.1.3.3.3 Blower Door – BD setup with final ring configuration, Manometer

2.1.3.3.4 Duct Blower – DB setup, Manometer

2.1.3.4. Only those pressure pans which are an unusually high reading need to be photo documented.

2.1.3.5. Photo of wall insulation being investigated.

2.1.3.6. Photos of attic area including attic insulation being measured.

2.1.3.7. Photos of crawlspace area, including height, crawlspace entrance, and crawlspace joist size.

2.1.3.8. Photo of the existing condition(s) for any other item that is being installed or repaired.

2.1.3.9. Any health and safety issue to be addressed by weatherization.

2.2. DEFINING THE CONDITIONED BOUNDARY

2.2.1. The conditioned boundary defines the space of a home that is purposely heated and/or cooled. It can also be called the thermal boundary or the building envelope.

2.2.2. While the presence of ductwork to a room clearly marks it as part of the conditioned space, supply registers in a room are not required. Any area that is open to the rest of the house through a permanently or typically open passageway should be considered as part of the conditioned space.

2.2.3. Discussions with the client can help clarify where the boundary of the conditioned space should be set.

2.2.4. The conditioned boundary is always at least partly defined by the exterior walls. However, it can also be defined by interior walls. These may include:

2.2.4.1. Interior walls surrounding an unconditioned CAZ (if the CAZ receives direct combustion air from outside)

2.2.4.2. Stairways leading to unconditioned attics.

2.2.4.3. Stairways leading to unconditioned basements.

2.2.5. An area cannot be considered Unintentionally Conditioned when determining the conditioned boundary. It is either conditioned or unconditioned.

2.2.5.1. Unintentionally Conditioned is a designation used in NEAT/MHEA to adjust certain values (such as water heater heat loss).

2.3. AIR SEALING TARGETS

2.3.1. The determination of a realistic and achievable target, while maximizing the air sealing measure, is the first step in achieving a CFM target.

2.3.2. The goal must always be to ventilate right (ASHRAE) and tighten a house as much as possible using the infiltration funds that have been justified for the house. Reaching a minimum target number alone is not sufficient reason to stop infiltration reduction work, if there are additional opportunities to air seal. We need to maximize effective air sealing efforts in every house weatherized.

2.3.3. To determine the blower door after-weatherization target the auditor must use 35% reduction for 1-4 family homes and 25% reduction for mobile homes.

2.3.3.1. If auditor feels confident that the target as calculated cannot be met, they can adjust the target up or down to something more achievable and explain their decision in the comments.

2.3.4. Blower door target must be met for the measure to pass the final inspection and/or QCI. The result can be lower than the target but, if higher, must be within 10% of the target.

2.4. DUCT TESTING REQUIREMENTS

2.4.1. Evaluate and examine the duct system.

2.4.1.1. Visually inspect ducts, return and supply plenums, and distribution boxes that are <u>outside of the thermal boundary</u> to verify and check insulation values.

2.4.1.1.1. If existing (outside the thermal boundary) duct R-value is less than 4, or in poor condition, that section of duct work shall be modeled as uninsulated.

           2.4.1.1.2.   If existing duct insulation is R-4 or greater, and in good condition, do <u>not</u> model the ducts as uninsulated.

           2.4.1.1.3.   When adding duct insulation, final R-value shall meet or exceed the requirements of the SWS, which is an R-8.

       2.4.1.2.   Check for restrictions to airflow.

       2.4.1.3.   Check for large holes or gaps that may bring insulation into conditioned space from the attic when testing.

    2.4.2.   Ducts shall be tested for leakage to the outdoors with a duct tester and blower door running simultaneously in addition to total duct leakage using the duct tester only for all homes that have ducts located outside of the thermal boundary or residing in an intermediate zone like a ventilated attic or crawlspace.

       2.4.2.1.   When pressure pan measurements are all under 2 Pa and average less than 1 Pa, document this in the comments <u>and</u> do not evaluate duct sealing. Otherwise:

       2.4.2.2   Measure Total Leakage using the Depressurization Method

       2.4.2.3.   Measure Leakage to Outside using the Depressurization Method

           2.4.2.3.1.   Depressurize house to 25 Pa with BD

           2.4.2.3.2.   DB Manometer:

                  Ch. A Input – Hose to Duct

                  Ch. B Input – Hose to Fan

                  Ch. B Ref. – Hose to Collar

    2.4.3.   The pressure pan test must include testing of the return register (if present).

    2.4.4.   All manufactured homes with ducts and a functional forced air system must be tested with a pressure pan test.

2.5. DUCT SEALING TARGETS

    2.5.1.   Duct Sealing After weatherization target will be calculated as follows:

       2.5.1.1.   Total Leakage: 12% of total conditioned floor area of home

       2.5.1.2.   Leakage to Outside: 8% of total conditioned floor area of home

    2.5.2.   If auditor feels confident that the target as calculated cannot be met, they can adjust the target up or down to something more achievable.

    2.5.3.   An explanation for this change must be recorded in the Comments on the Infiltration page in NEAT MHEA.

    2.5.4.   Duct sealing target must be met for the measure to pass at final inspection and/or QCI. Result can be lower than target but, if higher, must be within 10% of target.

    2.5.5.   If target is not achieved at Final or QCI due to changes to the pressure boundary of the home that occurred after weatherization was completed, these changes must be clearly documented to determine if the measure should pass.

Sealing duct leakage to the outside is a high priority in weatherization because it can lead to a greater energy loss than other air leaks in the home.

    2.5.6   When modeling duct leakage," Total Leakage" and "Leakage to the Outside" must be measured and entered in the software.

    2.5.7   With ducts that are entirely contained within the pressure boundary of the home, there typically won't be any direct leakage from the ducts to the outside.

    2.5.8   When ducts are entirely within the pressure boundary, the only reason that duct sealing would be of interest is when it negatively impacts the depressurization of the CAZ and could cause an appliance to backdraft or be starved of combustion air. Focus primarily on sealing the return duct and air filter rack leaks. This is considered health and safety for combustion safety within the CAZ.

2.5.9   When there are sections of the duct system that are outside of the pressure boundary, and there is a more than <u>8 CFM of leakage to the outside per 100 SF of floor area</u>, priority should be given to leaks that are outside the pressure boundary and closest to the air handler.

2.5.10   Use the duct blower and blower door to ensure that the target leakage to the outside has been achieved – continue duct sealing until the target is reached.

2.6. DUCT OPERATING PRESSURE

2.6.1. Operating pressure of Supply and Return ducts is tested (procedure explained [here](#)) in a home with a ducted system where:

    2.6.1.1.   There is a functional blower motor for heating and/or cooling AND

    2.6.1.2.   Duct Leakage testing is being performed

2.6.2.   If there is no functional blower motor or for some other reason testing cannot be performed, auditor is to use 25 Pa as the Pre result for both Supply and Return and 30 Pa as the Target for both Supply and Return.

    2.6.2.1.   In a manufactured home it is recommended that 30 Pa be used for the Pre and 35 Pa for the Post when estimating

2.6.3.   An explanation for why this test could not be performed must be provided in the Comments of the Infiltration page.

2.7. INSULATION DIAGNOSTIC / REQUIREMENTS

2.7.1.   All building cavities that define the thermal boundary between the conditioned space and unconditioned must be inspected and documented for existing insulation thickness, type, quality, and location.

2.7.2.   It may be necessary to inspect multiple areas of the thermal boundary using a combination of methods (e.g., visual inspection, non-conductive probe, borescope, and/or non-destructive imaging) to determine insulation R-value.

2.7.3.   Photo documentation showing the investigation and measurement of insulation is required.

2.7.4.   Existence of gaps or voids which would reduce the effective R-value must be documented and photographed where possible.

2.7.5.   Degrading of existing insulation R-value due to gaps, voids or age is allowable if it is well documented with notes and photographs.

2.7.6.   Attic spaces with significant voids or gaps may be modeled as multiple attics: one with no insulation

2.7.6.   Wall insulation needs to be assessed for the existence, type, and thickness of insulation.

    2.7.6.1.   At least one exterior wall of the original home must be inspected.

    2.7.6.2.   At least one exterior wall of each addition must be inspected.

    2.7.6.3.   Inspection for wall insulation shall be performed by drilling a minimum 1" hole in a wall. Examine wall cavity through this hole and photograph presence or absence of insulation.

    2.7.6.4.   Holes shall be sealed with an appropriately sized cap. Use caulk to air seal the cap to the wall.

2.8. FOUNDATION

2.8.1.   Note the foundation type(s) (e.g., slab on grade, crawl space, basement), construction type (e.g., stone, brick, poured concrete), location of the thermal boundary, and exposure above grade. When feasible, note location and condition of the pressure boundary and the moisture barrier.

2.8.2.   If a foundation is a basement or crawlspace, note any intentional venting, and note whether the space is fully conditioned, semi-conditioned (unintentionally conditioned), or intentionally unconditioned.

2.8.3.   Note any insulation on foundation walls, ceiling (if a basement or crawlspace), and/or floor, as well as any degradation or installation issues with existing insulation.

2.8.4.   Note any thermal bypasses observable from the basement or crawl space(s), such as chases or open wall cavities that extend up into the structure, as well as air leaks from the foundation space to the ground or outside.

2.8.5.   When home energy upgrades for foundation insulation are proposed, indicate the surface area(s) and construction type, recommended effective R-value, and the thickness, type, and performance characteristics (e.g., perm rating) of insulation. Insulation recommendations shall be based on the building's moisture barrier, thermal barrier, air barrier, and drainage plane (as applicable)

2.8.6.   All foundation data must be input accurately regardless of whether any measure will be performed in the crawlspace.

2.8.7.   Foundation wall height must be the average height of the foundation area. Do not input the lowest height.

2.8.8.   A crawlspace area will not be insulated where the average height in that area is less than 2 feet as measured from the ground to the bottom of the floor joists. This is automatically determined by NEAT – do not choose NONE for insulation type.

2.8.9.   Crawlspaces in which part of the area has an average height over 2 feet and part has an average height below 2 feet must be input as separate foundations in NEAT. The intent is to have insulation provided for those areas that have a height at or above 2 feet.

2.9. HVAC

2.9.1.   If it is known that an HVAC system will be replaced entirely with non-DOE funds (e.g.: Heating Improvement Program (HIP), then the new unit must be modeled as if it is already existing in the home.

2.9.2.   The appliance shall be placed in operation only after it has been determined that it is safe to operate the appliance.

2.9.3.   Evaluate the furnace. Complete a visual inspection of the forced-air furnace and document information.

2.9.4.   Check the condition of the following on the furnace -

    2.9.4.1.   Document information from the manufacturer's tag.

    2.9.4.2.   Furnace cabinet and removable panels

    2.9.4.3.   Return and supply duct connections

    2.9.4.4.   Filter and filter slot cover

    2.9.4.5.   Temperature rise and compare to manufacture specifications.

    2.9.4.6.   If the Furnace is a condensing model, check the condensate drains, connections, and condensate pump if one exists.

2.9.5.   Evaluate air-conditioning and heat-pump. Complete a visual inspection of the air conditioning and heat pump and document information.

    2.9.5.1.   Examine the outdoor coil cabinet

    2.9.5.2.   Check clearances.

    2.9.5.3.   Examine the condition of coils.

    2.9.5.4.   Examine the condition of insulation on refrigerant piping.

    2.9.5.5.   Document information from the manufacturer's tag.

2.9.6. Examine the indoor coil/air handler
- 2.9.6.1. Check filter and filter slot cover.
- 2.9.6.2. Check condensate pan, connections, drain lines, and the condition of condensate pump if it exists.
- 2.9.6.3. Check the integrity of the accessible refrigerant piping insulation in the interior of the building.
- 2.9.6.4. Examine the inside of the air handler cabinet for a dirty blower and restricted coils.
- 2.9.6.5. Document information from the manufacturer's tag.

2.9.7. If the HVAC system is a different type (e.g., minis-split, combo package, window units…), it still needs to be examined and modeled in NEAT MHEA.

2.9.8. Combustion Analysis must be performed on any forced air combustion heating system following ANSI/BPI 1200 Standards. If analysis could not be performed, indicate your reason on [Heating System & Hot Water Heater Improvement Survey](#) and in the NEAT/MHEA Energy Audit comments.
- 2.9.8.1. This includes but is not limited to diagnostic testing for CAZ depressurization, spillage, carbon monoxide levels, and combustion efficiency.

2.9.9. It is allowable to drill into B-vent for the purpose of combustion analysis so long as:
- 2.9.9.1. No drilling allowed into PVC flue pipe on 90% furnaces.
- 2.9.9.2. The hole drilled is no bigger than required for testing.
- 2.9.9.3. The holes are sealed with high-temperature caulk to seal both the inner and outer sleeves. Use metal tape for extra assurance to seal around the outer hole.

2.9.10. Manual J must be performed by the HVAC contractor for any new HVAC install. Manual J must be calculated based on conditions in the home AFTER weatherization.

2.9.11. Window AC EER must be converted to SEER (NEAT only):
- 2.9.11.1. For the continuous-run formula (0.9xEER+0.1) to be used, the window AC should be documented and/or photographed as having a continuously-running fan at the time of the audit.
- 2.9.11.2. In all other cases, the formula should be the more conservative (1.2xEER)-0.7.

2.9.12. If a CAZ is found to have direct combustion air from outside, or will have outside combustion air installed through a weatherization measure:
- 2.9.12.1. The door and walls of that closet must be considered as exterior components and modeled appropriately so that they can be air sealed and/or insulated.
- 2.9.12.2. Alternatively, the auditor may seal the existing combustion air supply in order to bring the CAZ into the conditioned space of the home. The following rules apply:
- 2.9.12.3. It must be determined that the volume of the home will provide enough combustion air by using the following calculation: Required volume = 50 cubic feet per 1000 BTU of combustion appliance.
- 2.9.12.4. If a door to this CAZ exists, there must be a louvered door or other type of opening providing sufficient access for combustion air[9]. The minimum is 100 square inches net free air vent both at the high end and low end of the door. 100 square inches net free is roughly equivalent to a 10"x15" grill.

2.9.13. If the primary heating system is non-operational, there are three options:
- 2.9.13.1. If a replacement system will be installed using funds from another funding source like Heating Improvement Program, model the new system as the existing unit and note this in the Comments. HIP funds are used if system is operational non-efficient, non-operational, or a safety issue.

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[9] NFPA 54

2.9.13.2. If DOE funds are braided with other funds (recommended) the existing unit may be modeled and the replacement cost used in the model may be discounted to achieve a Measure SIR 1.0 or greater.

2.9.13.3. To attempt an ECM replacement: Model the heat that exists and is functional. It can be as little as a few space heaters, or even just an oven. There is no minimum to what truly exists. Choose Evaluate All and enter appropriate replacement data.

2.10. DOORS AND WINDOWS

2.10.1. Inspect and evaluate windows -

2.10.1.1. Frame material (wood, metal, vinyl, etc.)

2.10.1.2. Glass type (number of panes, presence of storm windows)

2.10.1.3. Condition and operation (For guidance determining leakiness, see "Window Leakiness Guidelines" in the WA Help (F1)).

2.10.1.4. Interior Shading (Blinds, Drapes, and/or Shades)

2.10.1.5. Exterior Shading Percentage (approximate percentage of window area that is shaded by trees, overhangs, or other exterior buildings. This is wintertime shading that is in addition to shading due to orientation.

2.10.2. Inspect and evaluate doors -

2.10.2.1. Determine if the door is insulated.

2.10.2.2. Determine whether the door is wood, metal, or fiberglass.

2.10.2.3. Inspect and evaluate the door frame, trim, and door components

2.10.2.4. Note and document if the door does not open, close, or lock properly.

2.10.3. Doors and windows can no longer be replaced with air sealing funds, under any circumstances.

*Replacement of 5 windows or more must be approved by the assigned State Monitor. *

2.10.4. Doors are to be input as Loose only if it is not possible to air seal that door.

2.10.5. Photo documentation is mandatory showing existing conditions that lead to replacement for all door and window replacements.

2.10.6. Additional window replacement guidance:

2.10.6.1. Existing storm windows must be removed before installing new windows. Clients must be informed of this policy. If refused, new windows cannot be replaced and must be documented in the client file.

2.10.6.2. Exterior framing repairs and finishing components (e.g., capping) must be added into additional cost of measure or considered as an incidental repair (IRM).

2.10.6.3 Low-E window replacements must have a U-value of .3 or less.

2.11. REFRIGERATORS

2.11.1. Document refrigerator model number, the date of manufacture, and condition. Photograph data plate and any visible damages

2.11.2. Fridges must be metered if they are to be replaced with Weatherization funds

2.11.2.1. A meter must run for no less than 120 minutes.

2.11.2.2. A legible photo of the metered result is required.

2.11.3. If the fridge is not metered, do not choose a replacement option in NEAT MHEA.

2.11.4. Replacement refrigerators shall be sized based on existing comparable size and/or the number of occupants

2.12. WATER HEATERS

2.12.1. Note the location, type, and general condition of the domestic water heater

2.12.2. Inspect for signs of soot, debris, and spillage.

2.12.3. Check and document the presence and condition of tank insulation wrap.

2.12.4. Check and document the presence and condition of the overflow pan if DWH is located where moisture could cause a problem.

2.12.5. Document temperature control setting and water temperature.

2.12.6. Check and document the presence and condition of the pipe insulation.

2.12.7. Check and document the presence of the TPR valve and piping. Check and document rating of TPR valve and compare to manufacturer's specifications for DWH.

2.12.8. Inspect for leaks.

2.12.9. If an ECM replacement of the existing water heater is desired and the existing water heater does not exist in NEAT's internal database:

    2.12.9.1. You can research the Energy Factor (EF) of the existing unit. If found, keep a copy of the model information. At this point, you can choose a similar model from the database with the same EF as the existing unit.

2.12.10. If a combustion water heater has, or will receive, dedicated combustion air directly from outside, follow the rules in 2.9.12.

2.13. LIGHTBULBS

2.13.1. Non-LED bulbs may be evaluated for replacement

2.13.2. LED lightbulb replacement can be input directly on the Lighting page.

2.13.3. CFL bulbs are no longer allowable with weatherization grant funds.

2.13.4. In the Setup Library, under Library Measures, Lighting Retrofits (NEAT and MHEA):

    2.13.4.1. Use 20 Years as the Life

    2.13.4.2. Input costs for bulbs with wattages of 5 – 25 using LEDs with similar wattages (WA will interpolate cost for replacement wattage).

2.13.5. Use <u>4 hours</u> as the default daily usage (this calculates the SIR for the correct number of hours over 20 years, based on DOE approved lifetime for LED bulbs)

2.13.6. Use the following table to estimate LED wattage to substitute for the CFL wattage in that input.

Incandescent	NEAT CFL Equivalent	LED Equivalent
100W	26W	20W
75W	18W	14W
60W	13W	10W
40W	7W	6W
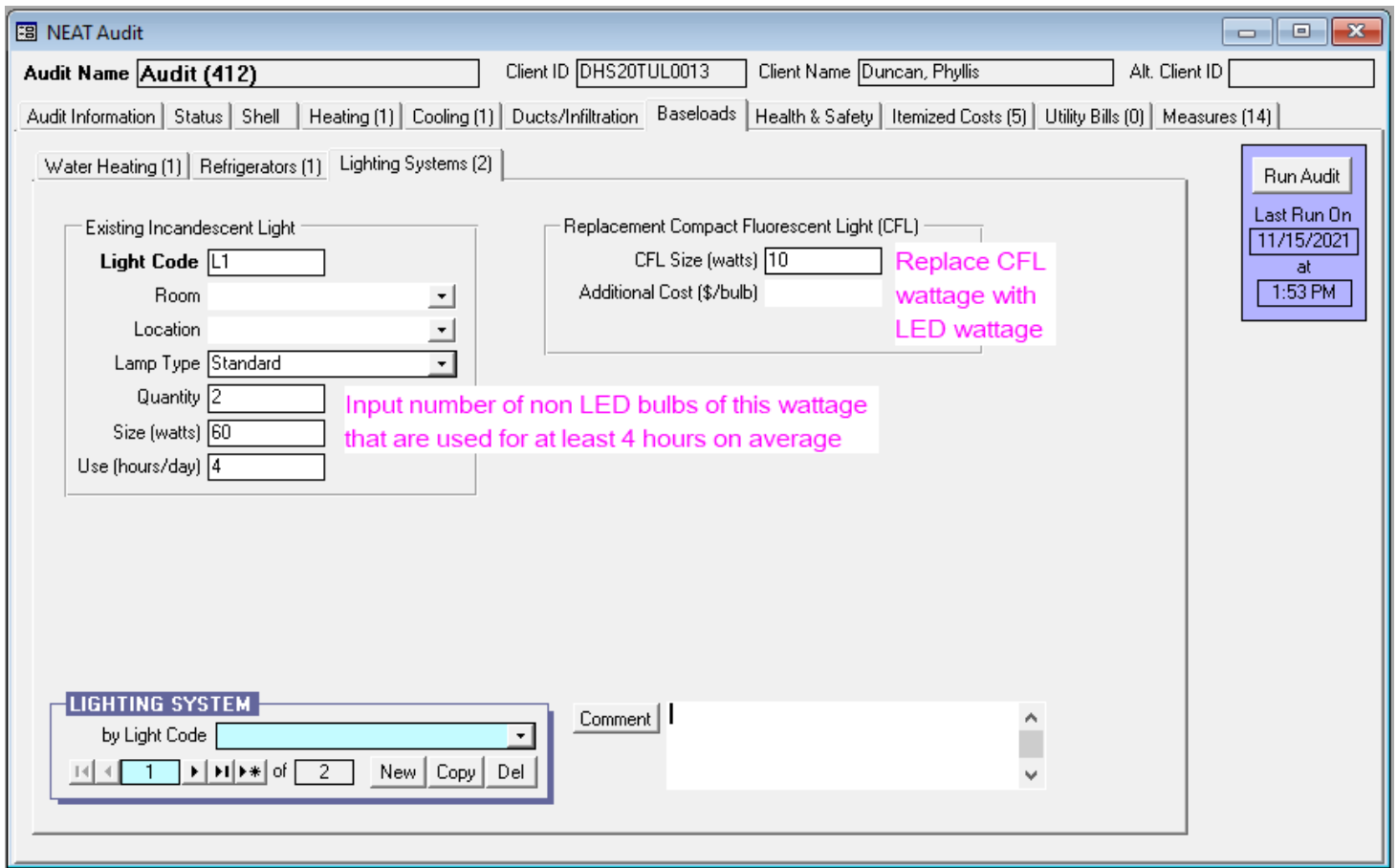
2.14. HEALTH AND SAFETY CONSIDERATIONS

2.14.1. Health and Safety measures must satisfy the rules set forth in DOE WPN 22-7, and NJ WAP Policy Chapter 3 Health and Safety.

2.14.2. A list of allowable H&S measures can be found in APPENDIX H. Inclusion in this list does not necessarily mean a measure is an allowable health & safety expense.

2.14.3. If unsure, auditor must request a decision by the Office of Low-Income Energy Conservation (OLIEC).

2.15. EXHAUST FANS

- Measure the flow rate of existing bath and kitchen fans
- Determine if they are vented to the outside and note any access problems
- Determine if venting meets SWS
- Document ventilation requirements using BD Target in the Residential Energy Dynamics (RED) ASHRAE 62.2-2016 calculator.

- o If required ventilation is less than 15 CFM, no additional ventilation is needed
- o If required ventilation is slightly higher than 15 CFM with existing fans, ventilation requirement might be met in the kitchen and/or bathroom by adding Local Ventilation (not continuous or intermittent), if adding that fan brings the required ventilation below 15 CFM.
- o Otherwise, ASHRAE requirements may be met by installing:
  - Continuous or intermittent Whole House Ventilation in a central portion of the house, or connected to the return duct
  - Continuous or intermittent Whole House Ventilation AND Local Ventilation (same fan) in a bathroom
  - Continuous Whole House Ventilation AND Local Ventilation (same fan) in a kitchen
- o If a new fan is to be installed in the kitchen and/or bathroom, the flow rate must be updated in the calculation. This may change the need for continuous/intermittent ventilation
- The ventilation requirements shall be verified during the QCI using the RED ASHRAE 62.2-2016 calculator, QCI blower door, and local (spot) ventilation rates in bathrooms and kitchen.
- Any functioning exhaust fan that will remain in the home after weatherization must be vented to the outside and insulated where not in conditioned space. This shall be funded with Health and Safety funds. (Non-functioning fans are not required to be replaced unless needed for ventilation requirements.)
- When multiple fans are installed (new or replacement), each must be justified as necessary to achieve ASHRAE 62.2-2016 compliance (without that additional fan, a single fan would not provide sufficient CFM/Hr. for that dwelling), OR written justification must be on file describing why this home needs additional ventilation (health issues, visible mold, high kitchen/bathroom usage, etc.)

3. ENERGY AUDIT SOFTWARE MODELING
3.1. INTRODUCTION
3.1.1.   New Jersey has been DOE approved for Site Built and Mobile Home using Weatherization Assistant 8.9.

3.1.2.   NEAT may be used on buildings with 1 – 4 dwelling units that are on autonomous heating systems.

## 3.2. GENERAL RULES FOR USE OF WEATHERIZATION ASSISTANT 8.9 (NEAT/MHEA)
3.2.1.   Cost of a measure must include the total estimated cost of both the labor and material for that measure.

3.2.2.   Agencies with in-house crews must calculate estimated labor costs based on a consideration of the cost, time and number of staff involved with each individual measure.

3.2.3.   Choose EVALUATE ALL for all measures.

3.2.4.   Mandatory Replacements as an ECM ("Include in SIR" checked) is allowed only with written State approval.

3.2.5.   Mandatory H&S measures are allowed ("Include in SIR" NOT checked) so long as the measure satisfies the requirements of a Health and Safety measure.

3.2.6.   Choosing NONE is also a Mandatory choice. Do **NOT** choose NONE.

3.2.7.   If for any reason a non-major measure is not possible to install, the reasons for not installing an ECM measure must be clearly explained in the NEAT/MHEA comments and noted on Form 44.

3.2.8.   If for any reason a major measure is not possible to install, contact DCA for guidance. A major measure cannot be skipped or otherwise deactivated in the software program unless you have DCA written approval to do so.

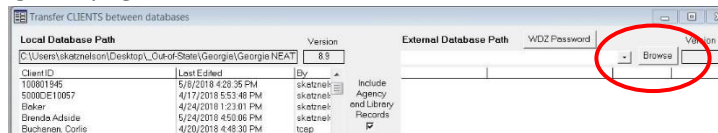## 3.3. DATA LINK - CREATE A NEW WDZ FILE FOR EXPORT:
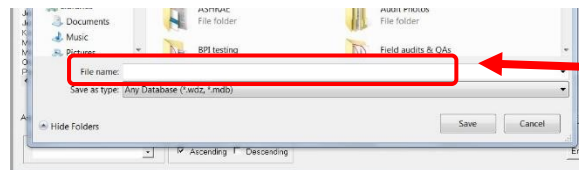
1. Hit the **Data Link** button
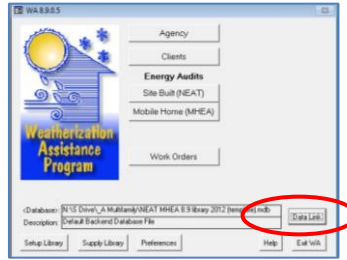
2. Press **GO** at bottom of page (Import/Export Data with another MS Access Database)
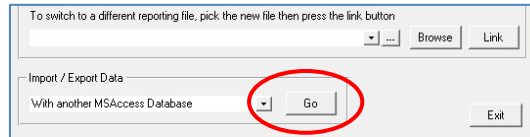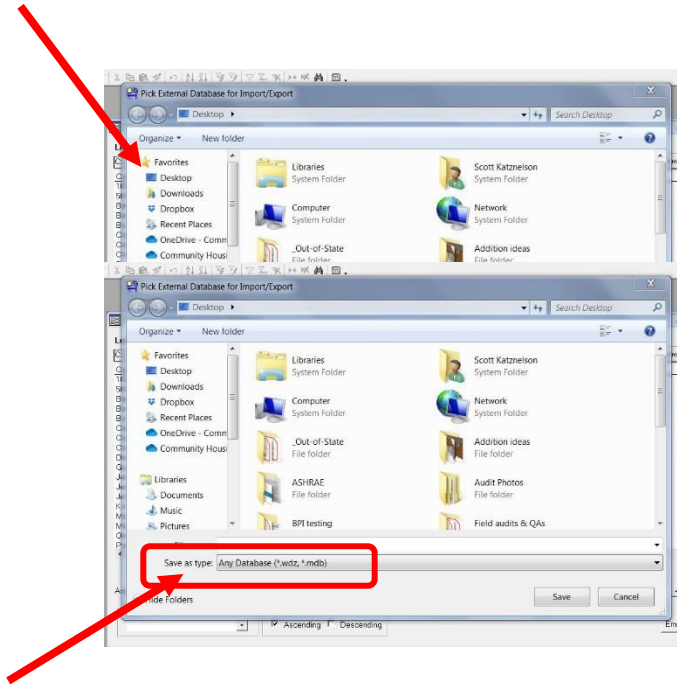

3. Press **BROWSE** (near top right of page)

4. A new window will pop up. Type in a file name near the bottom of that window

File Name Here

5. Choose <u>Desktop</u> in the top left column as the location to save this new WDZ file so that it is easy to find. (You may have to scroll up or down to find Desktop)

6. Under SAVE AS TYPE, choose 'Access Database (*.mdb)'. Press **SAVE** (bottom right of window)

7. A box will pop up asking you if you want to create this file. Click on: <u>Create New Database File</u>. Press **OK**
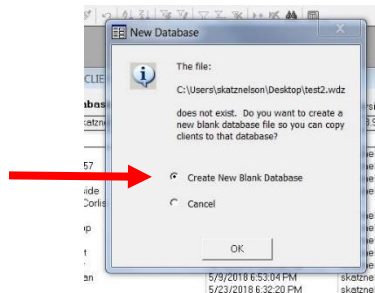
8. Choose client or clients you wish to export from the list on the left (multiple clients can be chosen by holding down the control button while you choose all clients you wish copied).
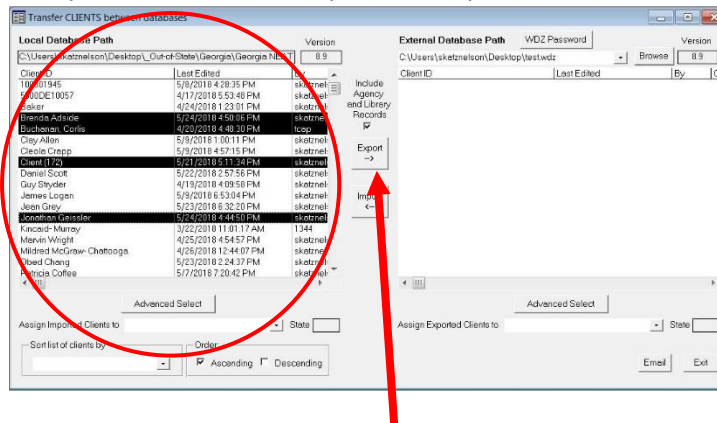
9. With chosen client(s) highlighted in black, press **EXPORT** button in middle of page.

10. Once you have exported, the screen will look like this, with the one or more clients you chose in the box on the right:
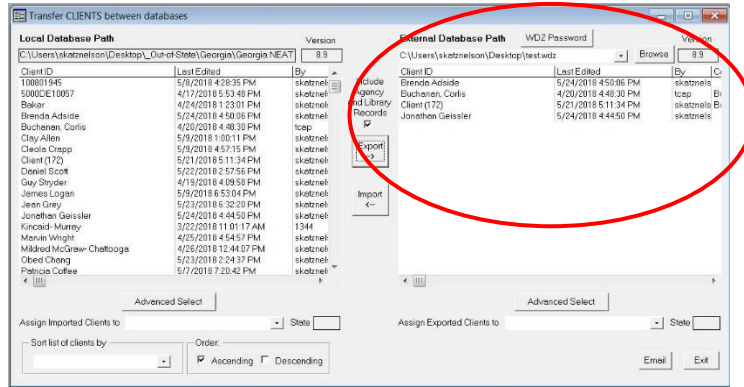
11. Find file you have created and send by email or copy it on to a memory stick.

3.4. TO LOAD A NEW DATABASE/LIBRARY

TO LOAD A NEW DATABASE:

1. Once in the Data Link section, press BROWSE button near top of page
2. Find the new database file you want to link to. Select and press 'Open'.
3. Press LINK button (to right of BROWSE button)
4. Click OK twice, when asked.

3.5. SETUP LIBRARY

1. Most Setup Library Tabs have both NEAT and MHEA options. Changes have to be made in both manually. Look in

the lower left corner.

These 3 tabs are the most critical to getting NEAT right.

We'll look at those next…

Name your library so you know what you're looking at. Including the date it was made is a good idea.

How many Setup Libraries do you have? The fewer the better. 1 is best.

But sometimes it's worth having more than 1, like if you use different contractors with very different prices

3.6. KEY PARAMETERS

1. The three tabs to keep updated are Insulation, Equipment and Windows.

   a. Insulation

These two need to be updated based on the minimum R-Value you are installing.

Name	Value	Units
Avg annual outside film coeff	2.25	BTU/hr-sqft-F
Uninsulated R-value for 'Other' wall type	4.42	F-sqft-hr/Btu
R-value for 'Other' exterior siding type",	0.6	F-sqft-hr/Btu
R-value per Inch for the 'Other' existing ceiling insulation type	3.09	F-sqft-hr/Btu-in
Added duct insulation R value	8	F-sqft-hr/Btu
Water heater wrap added R value	10	F-sqft-hr/Btu
Base value of free heat from internals	2600	BTU/hr

   b. Equipment

All these need to be updated based what you are typically installing.

Name	Value	Units
Window A/C replacement SEER	11	Btu/wh
Central A/C replacement SEER	14	Btu/wh
Heat pump replacement SEER (Cooling)	14	Btu/wh
SEER used to impute cooling savings	14	na
Low flow shower head flow rate	2.5	gal/min
Refrigerator defrost cycle energy	0.08	kWh

   c. Windows

These two need to be updated based on what you are typically installing.

Name	Value	Units
Replacement Window U-Value	0.48	Btu/F-sqft-hr
Replacement Window Solar Heat Gain Coefficient	0.62	na
Replacement LowE Window U-Value	0.34	Btu/F-sqft-hr
Replacement LowE Window Solar Heat Gain Coefficient	0.42	na
Retrofit Storm Window Emittance	0.82	na
Retrofit Storm Window Solar Heat Gain Coefficient	0.895	na
Retrofit Window Film Surface Emittance	0.84	na
Retrofit Window Film Solar Heat Gain Coefficient (incl frame)	0.49	na

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3.7. FUEL COSTS

Fuel Cost Table Name should have, at the minimum, the agency name and date of creation.

Usually one Fuel Cost Library is enough. More than one may be useful if an agency serves an area in which significantly different fuel costs are encountered.

If so, press **COPY** and change only the cost(s) that are different. Each Fuel Cost Library should be carefully named for the county and/or utility provider so that the auditor knows which library to choose for any given audit.

1. Correct fuel costs are essential for correct NEAT results. It is with these costs that NEAT converts its heat loss calculations into dollars, from which the SIR is calculated.
2. These costs must be updated with application at beginning of program year.
3. Costs can best be determined from utility bills. Add all per unit fees and surcharges (i.e., per KWH or per CCF, etc.…) and add the appropriate tax to get the most accurate fuel costs. Do not include fixed monthly charges.
4. Note that Natural Gas must be input as Mcf.
   a. Convert cost per CCF to Mcf: multiply CCF by 10
   b. Convert cost per therm to Mcf: multiply them by 10.25
5. State average fuel costs will be used by all agencies.
   i. Use current fuel prices provided DCA.
   ii. Agencies wishing to modify state fuel prices based on local costs must request permission from DCA before any changes are allowed.

3.8. FUEL PRICE INDECES

1. Open the Fuel Price Indices tab [13]:

2. Updating the number in the Price Index column will recalculate the UPW Factor for that year.
3. Use the Fuel Price Indices and UPV Factors from the latest update to the NIST Handbook 135 by searching "NIST Energy Price Indices and Discount Factors [year]" on the internet.
4. Use Table Ca-1 Price Indices, and the rows for Residential Fuel for Years 1 – 23 for each fuel.
5. For year 24, use a Price Index that will result in a UPW Factor that needs to be the same as the FEMP UPV Factor for year 30, in Table Ba-1, under the Residential columns. Use a Price Index for year 24 that will result in the correct UPW factor for Year 30.
6. In the Library Measures, use 24 Years as the Life of any measure that meets the requirements for 30-year measures so that the correct UPW Factor will be used.
7. For year 25, use a negative number that will result in the correct UPW Factor for that year.

3.9. LIBRARY MEASURES

Uncheck measures in this column for any measure that should **NOT** be considered. Follow state rules.

Life Expectancy of a measure should be adjusted based on current State rules only

1. For every (active) measure in the Library Measures list, you must input:
   a. Material cost and Labor cost: These can be separated or combined. If combined, you must input a zero (0) in one of the boxes and the total cost in the other.
   b. All measures must include both labor and material cost, whether combined or separated.
   c. Other Cost: this is a flat per job cost. Basically, a setup cost that is constant regardless of the size of the job. Optional.
2. When a new material is created in the NEAT Insulation Types section that material will appear in the Unit Cost list for the appropriate measure. It will show up with a default cost of **$9999** and will not be an option until a more reasonable price is calculated and input.
3. All typical costs for a measure should be included when calculating the measure cost. For example, rulers and flags for attic insulation are added to every job and should be included.
4. The following measures must be de-activated (unchecked).

   NEAT Turned off measures:
   8 - White Coat Roofing
   17 - Window Sealing
   20 - Window Replacement
   22 - Window shading (awning)
   23 & 24 - Sun Screen Fabric or Sun Screen Louvered

25 - Window Film

26 - Thermal Vent Damper

27 - Electric Vent Damper

28 & 29 - IID & Electric Vent Damper IID

30 - Flame Retention Burner

34 – High-Efficiency Boiler (unless pre-existing)

35 - Smart Thermostat (if installed using HIP funding)

38 - Evaporative Cooler (unless pre-existing)

MHEA turned off measures:

9 - Floor Cellulose

10 - Floor Cellulose addition

13 - Roof Cellulose

26 & 27 - Window sealing (unless pre-existing)

30 & 31 - Plastic Storms (unless pre-existing)

34 & 35 - Awnings

36 & 37 - Shade Screen

38 – Setback Thermostat (if installed using HIP funding)

40 - Evaporative Cooling (unless pre-existing)

3.10. NEAT INSULATION TYPES

1. NEAT Insulation Types must be set up as follows[13]:

Setup Library Information | Key Parameters | Fuel Costs (2) | Fuel Price Indices | Library Measures | User Defined Measures (4) | NEAT Insulation Types

Attic	Name	Rs/Inch
Type 1	Blown Cellulose	3.75
Type 2	Blown Fiberglass	3.09
Type 3	EPS Rigid Foam	3.8
Type 4	XPS Rigid Foam	4.8
Type 5	Fiberglass Batts	3.2
Type 6	2 Part Spary (Frothpak)	6.6

Knee Wall	Name	R-Value
Type 1	Fiberglass Batts	13
Type 2	Fiberglass Batts/R19	19
Type 3	EPS Foam Board/R13	13
Type 4	EPS Foam Board/R19	19
Type 5	XPS Foam Board/R13	13
Type 6	XPS Foam Board/R19	19

Wall	Name	Value	Units
Type 1	Blown Cellulose	3.71	R/in
Type 2	Fiberglass Batts/R13	13	R
Type 3	Fiberglass Batts/R19	19	R
Type 4	Blown Fiberglass	4	R/in
Type 5			
Type 6			

Floor	Name	Rs/Inch
Type 1	Fiberglass Batts	3.2
Type 2		
Type 3		
Type 4		
Type 5		
Type 6		

Sill	Name	R-Value
Type 1	Fiberglass Batts	19
Type 2	EPS Rigid Foam	19
Type 3	XPS Rigid Foam	19
Type 4	2 Part Spary (Frothpak)	13
Type 5		
Type 6		

Foundation Wall	Name	R-Value
Type 1	Rigid Foam Board	5
Type 2	XPS Rigid Foam	5
Type 3	2 Part Spray (Frothpak)/R13	13
Type 4		
Type 5		
Type 6		

2. Note that there are two changes from DCA WPN 19-2. The R-value for blown fiberglass in walls is changed from R10 to R4 per inch, and R-49 is now an allowable measure. WPN 20-2 will address this.

3. Boxed Insulation types cannot be altered except to change their insulation value.

4. All other blanks are designed to allow the introduction of new insulation materials into the NEAT. This does not work on MHEA.

5. Note that none of the above-added insulation types will be active until their price is changed in the COSTS of Library Measures from the default $9999 to something more reasonable.
6. After costs are adjusted, the new insulation materials will show up as part of the dropdown choices for each appropriate shell measure.

---

[13] DCA WPN 19-2

3.11. SUPPLY LIBRARY

1. Typically used for only 2 things. The details input here provide the choices for replacement options in NEAT/MHEA for Refrigerators and DHW:
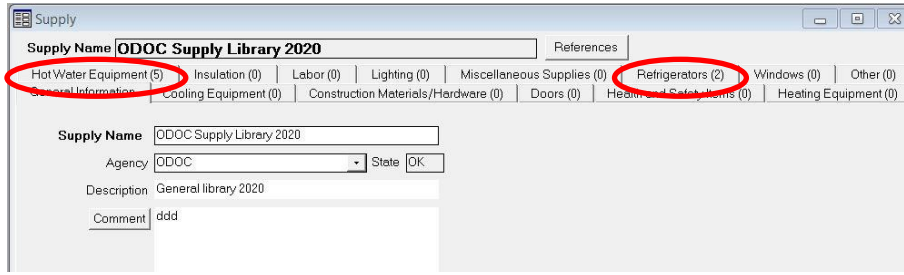
2. Only 1 Supply Library should be required.
3. Energy details of each replacement must be accurate otherwise NEAT will make incorrect choices. Prices can be adjusted in the audit, if needed, but not energy details.
4. Most important details are the Energy Factor for water heaters and the KWH per Year for refrigerators. You can find correct details by checking hardware or appliance store websites for relevant appliances or talk to your purchasing agent.
5. Typical Water heater details (use exact details for audit, these are examples):
   a. Electric: Energy Factor 0.93, Recovery Efficiency 99%, Input 4.5 KWh
   b. Gas: Energy Factor 0.64, Recovery Efficiency 75%, Input varies (roughly 30-100 KBTU)

6. Typical refrigerator details (use exact details for audit, these are examples):
   a. 18 Cu Ft: approximately 350 KW/yr.
   b. 21 Cu Ft: approximately 475 KW/yr.
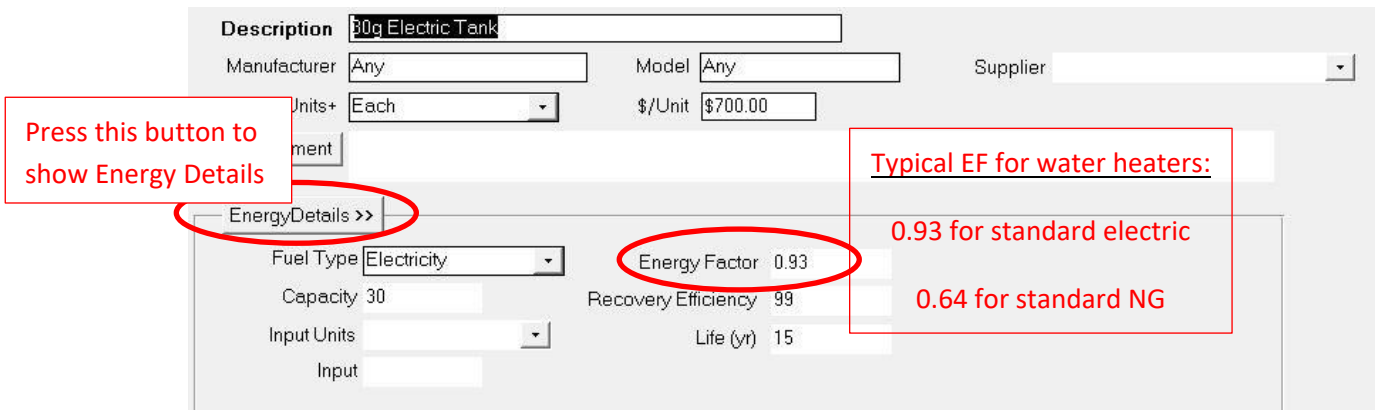
3.12. STARTING IN NEAT/MHEA

1. Open using this logo on your desktop screen
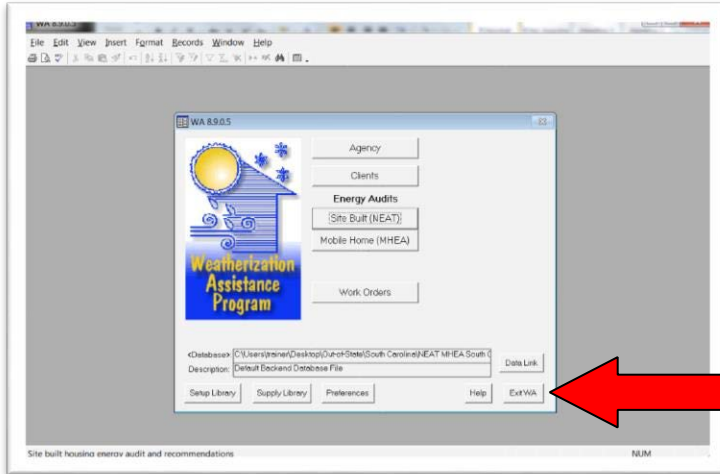
Always close the program using the button **Exit WA**. If you do not, there is some chance that the work you have done will not be saved.

AGENCY Tab – To create or modify your agency data

CLIENT Tab – To create or modify client data

SITE BUILT (NEAT) – To enter or view data for an audit of a site-built home

MOBILE HOME (MHEA) – To enter or view data for an audit of a manufactured home

SETUP LIBRARY – Source of Measure Costs, Fuel Costs, Replacement Equipment Efficiencies, etc...

SUPPLY LIBRARY – Source for prices of replacement Fridges and Water Heaters. More functionality is possible but rarely used.

DATA LINK – To input/export client files; Also, to change Database (Library)

PREFERENCES - To alter certain preferences including Range Check and Report Sections

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NEAT MHEA Master Rule # 1

With the cursor blinking in any input box in NEAT or MHEA, press **F1.** This will provide HELP specific to what that input box is looking for.

3.13. AGENCY TAB

Enter your name under Contacts and check yourself as Auditor. This will allow you to "sign" your audits

Close Here

Unless you are working for more than one single agency, only one record is needed. Look on the lower left corner of the page to determine how many agency records you have on your database. If there is more than one, make sure that your primary agency is checked as DEFAULT. Only one agency should be checked as DEFAULT.

Close the page by clicking on the red **X** at the top right corner of the Agency box.
You do not need to SAVE.

3.14. CLIENT TAB

DO THIS FIRST: Press the **NEW** button to create a new client. Not creating a NEW record means that you will be overwriting the data of an existing client.

Type Client Name or Job #

Input the number of Occupants. This data affects calculations for water use and Cooling Load.

Close Here
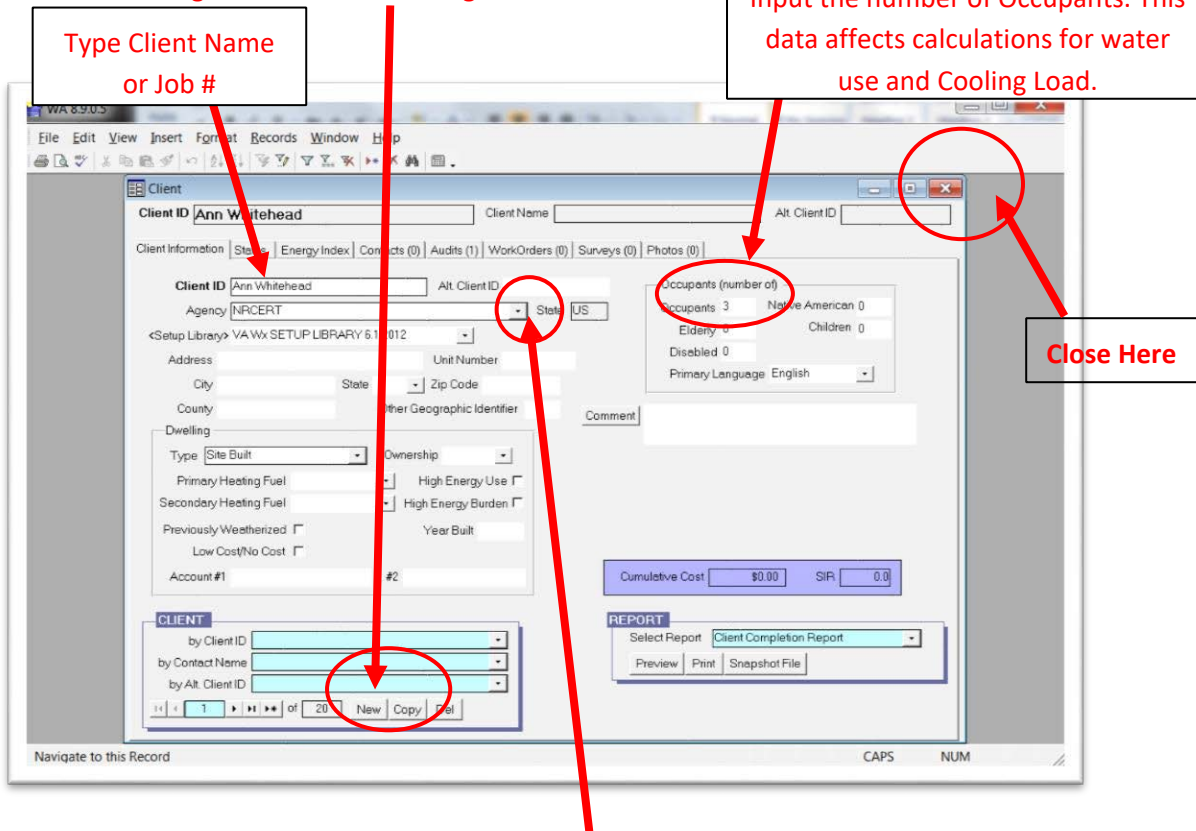
NEAT/MHEA Master Rule # 3
Note the downwards arrow in the right edge of some input boxes.
That designate this as a dropdown List.
You can only choose from items in this dropdown list.
To speed things up, you can type the first letter(s) of the choice you wish to make.

1. Ensure that the appropriate agency and Setup Library are chosen. If you have only one of each, this will occur automatically.

2. Enter the **TYPE** of the dwelling: Choose from the dropdown list.

3. If desired, go to the **CONTACTS** tab to enter client name, address and phone number.
4. Enter the **YEAR BUILT**. This entry is required for NJWAP.

3.15. SITE BUILT (NEAT) ENERGY AUDITS

1. Audit Information

DO THIS FIRST:
Press the **NEW** button, at the bottom left of the screen, to create a new audit.

Not creating a NEW record means that you will be overwriting the data of an existing audit.

Choose the client for whom you want to create an audit from the dropdown list

Comments can include a brief description of home or other helpful information
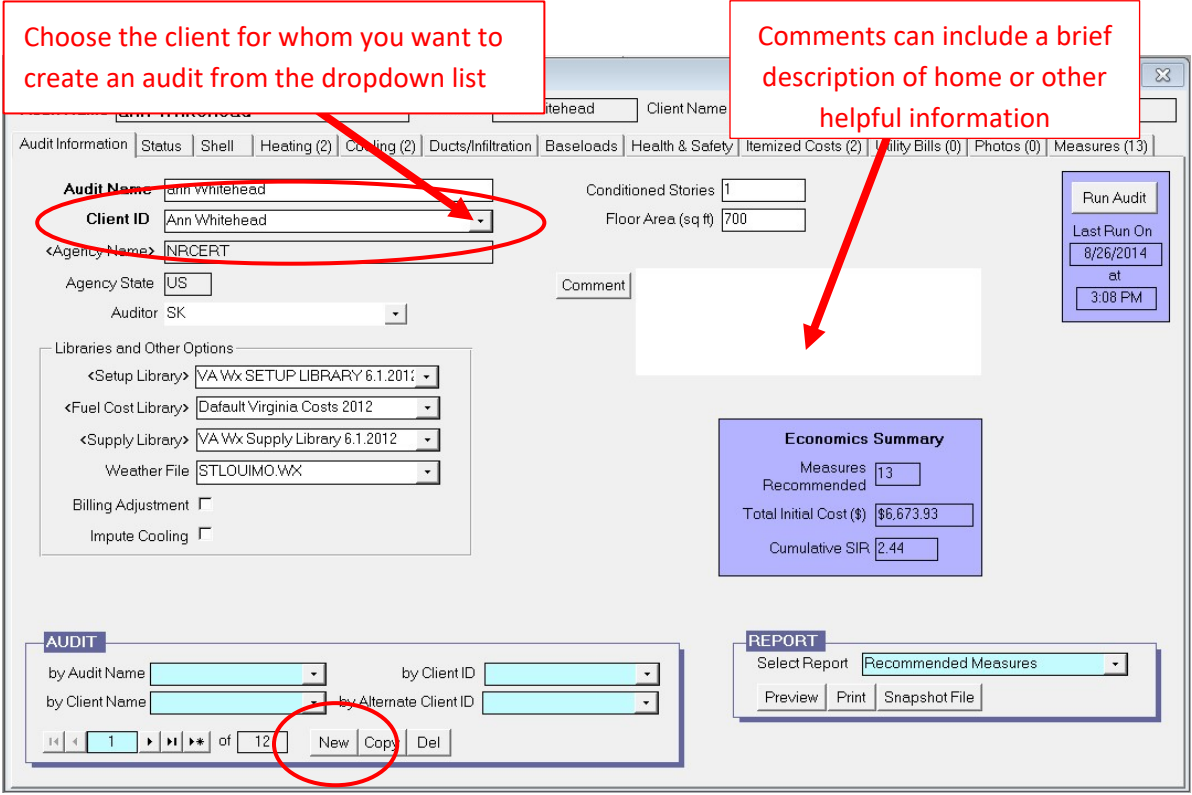
2. Under Auditor, choose yourself from the dropdown of auditors.
3. Make sure <Setup Library>, <Fuel Cost Library> and <Supply Library> boxes are all populated. If not, choose the appropriate ones from the dropdown.
4. Choose the Weather File. You can use the dropdown, or if you know the code for the city you wish to choose, you can type the first few letters until you see the city of your choice.
5. The WEATHER LOCATION city you choose will not always be the geographically closest city to your client. It might even be in another state. You are looking for the weather file that most closely approximates the Heating Degree Days (HDD) and Cooling Degree Days (CDD) of your client's location.
6. Conditioned Stories. Input the number of conditioned stories in the home. Think Stack Effect: What is the distance from the lowest point air might enter the home to the highest point air might leave. Must be input in terms of stories, each about 8'.

> **Input only 1; 1.5; 2; 3 or 4 floors**
> **1 story = about 8'-9'**
> **1.5 story = about 12'-13'**
> **2 story = about 16'-18'**
> **3 story = about 24'-27'**
> **4 story = about 32'-36'**

      a.   Therefore, a conditioned basement counts as a story so long as that basement is either mostly above grade and/or has a door directly accessing the outdoors.

7. Floor Area. Input the total square footage of ALL conditioned floor areas in the home. The value is total floor area, not footprint area, (e.g., enter 2400 for a two-story house with 1200 square feet in each story).

8. Billing Adjustment, if checked, will allow the model to be modified by the utility data you can optionally input under the Utility Bills Tab.

9. Impute Cooling implies that there is a cooling load in the home that cannot be defined under the Cooling tab. It also allows the possibility that a new AC can be recommended even when none currently exist. Do Not Check This Box.

<div style="border:1px solid red; color:red; text-align:center">

NEAT/MHEA Master Rule # 4

The **ESCAPE** button (top left of most keyboards)
Use this button to "escape" when NEAT prevents you from moving out of a record.

It is needed most when:
(1) You have mandatory but empty inputs on a page but wish to back out,
(2) You cannot proceed due to an error with repeated (window) codes

</div>

3.16. ENTERING SHELL DATA

1. This is where we input all the data for the physical characteristics of the home. Note that there are six subtabs under the Shell tab. It is recommended that you complete each sub-tab before proceeding to the next.

3.17. WALLS
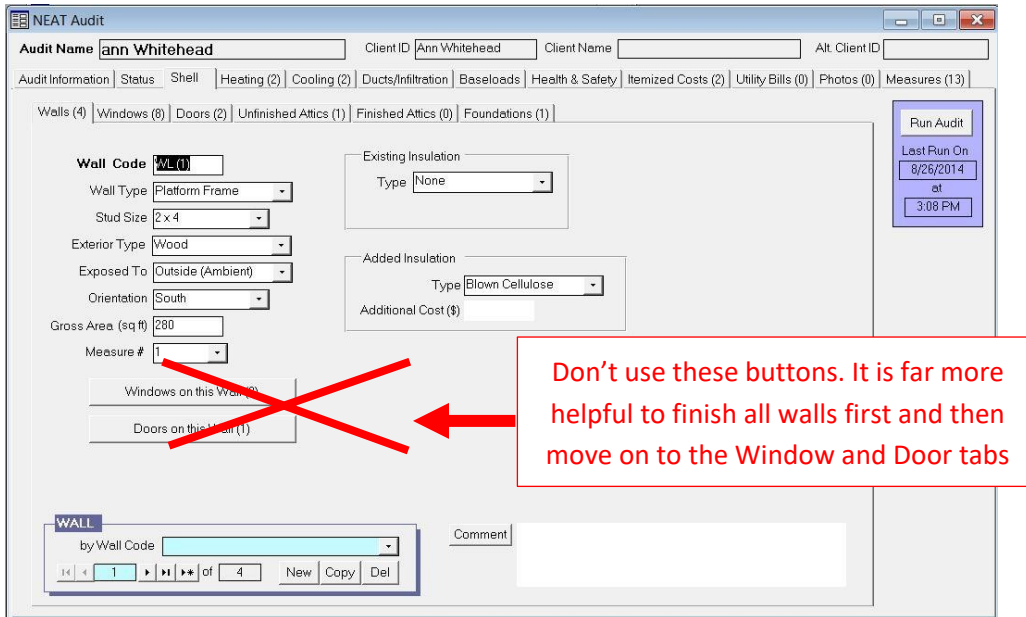
1. Input a unique Wall Code for each wall. Try to keep the codes for all walls sequential and matching the codes you wrote on your footprint diagram, so that anyone can easily determine which wall is referenced by each Wall Code.

2. Define the Wall Type of the home. Use the dropdown to make your selection or type the first letter of the type you want to choose.

3. Stud Size will show up for wood framed homes only and will, by default, show up as 2x4. Change this if necessary.

4. Exterior Type. What is the siding type of this home? Choose from the dropdown.

5. Is the wall you are describing exposed to:
   a. Outside (Ambient)
   b. Buffered Space: This refers to an unconditioned space that buffers this section of wall from the outside. Typically to consider a space buffered, the air in the buffered space will have a temperature at least several degrees different from the outside ambient temperature.
   c. Attic Space: This is usually the top triangular section of wall in a cathedral or vaulted space that is adjacent to unconditioned attic. It is treated the same in NEAT as a knee wall.
      i. A small glitch with the software… If choosing a wall adjacent to ATTIC SPACE, NEAT will not provide you insulation for that wall if it is uninsulated. If that is the situation, instead model this section of wall as a Knee Wall under Finished Attics. Do not model it in both places. Choose one only.

6. What is the Orientation of this wall? Choose one: N-S-E-W.

7. Calculate the Gross Area of this wall. It is the width of the wall x the ceiling height. If the home is two or more stories, you can calculate the wall area as the width x the full height of all floors combined. Or model the walls of different floors as separate walls. Comment on the procedure used.

8. Measure #. This number should stay the same for every wall that has all the same essential structural characteristics such as framing type and existing insulation. Buffered and Outside walls can share the same

measure number. Choose a new measure number for a wall that, for example, is insulated while other walls are not. You can choose to make all walls their own measure if you wish.

9. Input the Type and R-Value of Existing Insulation.

   a. One wall minimum of each home must be inspected for insulation levels. If there is an addition, the addition walls must also be inspected.

   b. Best practice: drill a 1" hole (or bigger) in an exterior wall, preferably in a closet or from outside; examine cavity and seal with a plastic plug & caulk. Take photos of each wall hole being inspected.

   c. R11 vs R13: This is very difficult to determine. Base your assumption on when the house and/or addition was built. R11 was used only until about 1995.

10. In most cases, there will be no Additional Cost. This is to be input if there is an unusual and unique extra cost to insulate this particular wall that is beyond the price defined in the library. Examples could include the extra cost to blow insulation from the inside; or a repair to the siding that is necessary before insulation can be added.

11. Do not include H&S costs such as LSW.

12. To input a new wall, there are two choices. In the lower left hand of the screen, choose NEW to create a blank record; or choose COPY to copy all the data of this wall to a new record. If COPY is chosen, be sure to change the Wall Code, so that all wall entries remain sequential and match the numbering on the footprint diagram.
   Then change only those fields that are different from the previous wall.

3.18. WINDOWS

1. Input a unique Window Code for each window. Try to keep the codes for all windows sequential and matching the codes you wrote on your footprint diagram, so that anyone can easily determine which window is referenced by each Window Code.

2. What is the Window Type? Choose the appropriate selection from the dropdown list.

3. Choose the appropriate Frame Type and Glazing Type from the dropdown list.

4. Choose the appropriate Interior Shading from the dropdown list or ignore this input.

5. Exterior Shading %. This input asks you to judge the amount of shade provided by trees or shrubs, and by such things as roof eaves, nearby buildings and porch roofs. It does **NOT** ask you to consider what orientation the wall is facing. This must **NOT** be input as the default 20% across all windows. Each window, or in some cases, multiple windows on one wall, must be inspected and the amount of exterior shading determined.

6. Choose the most appropriate Leakiness level for this window. This is always a judgment call but try to back up your claim with photos, especially if you are defining the window as Very Loose. This refers only to the body of the window itself, not to the glass. A broken pane of glass is much cheaper to replace than a whole window and will be dealt with as an Infiltration issue.
    a. Press F1 for more information.
    b. A functional storm window can be considered to provide some air sealing. Set the leakiness of the window one level higher than you would were the storm window absent.
7. Average Size. Input the Width and Height of the window you are defining. It is not recommended to average the size of multiple similar windows.
8. Wall Code. Choose from the dropdown the Wall Code for the wall on which this window exists.
9. Number. This input allows you to define how many windows of the exact same characteristics exist on this wall. It is recommended to leave this number always as '1', and to create a unique record for each window, even if they are identical.
10. Retrofit Options. Choose Evaluate All in all cases unless there is some rare particular reason to not do so. If choosing anything other than Evaluate All, explain in the comments why you made that choice and seek State approval.
11. In most cases, there will be no Additional Cost. This is to be input if there is an unusual and unique extra cost to apply a weatherization measure to this particular window that is beyond the price defined in the library. Examples could include the extra cost to remove and reattach security bars that cover the window; or repairs necessary to the window frame to allow the replacement of the window. This should not include LSW costs.
12. To input a new window, there are two choices. In the lower left hand of the screen, choose NEW to create a blank record; or choose COPY to copy all the data of this window to a new record then change only those fields that are different from the previous window.

3.19. DOORS

1. A Door Code must be input. Type in your own (the Tab function does not work here)
2. Choose the appropriate Door Type from the dropdown list.
3. Calculate the area of the door in square feet. Doors are typically measured in inches, so use the following equation:

$$\text{Width (in)} \times \text{Height (in)} / 144$$

4. Choose the appropriate Storm Door Condition from the dropdown list. Remember: the storm door is considered only due to its help in blocking air movement. If the storm door doesn't block air flow, then it should be considered Deteriorated or None.
5. Choose the appropriate Leakiness from the dropdown list.
   a. Tight = door doesn't need any work
   b. Medium = door good but needs weather-strip and/or door sweep
   c. Loose = Door cannot be air sealed. Door is warped, rotted or broken.
6. Wall Code. Choose the Wall Code for the wall on which this door exists.
7. Number. It is recommended to leave this number always as '1'.
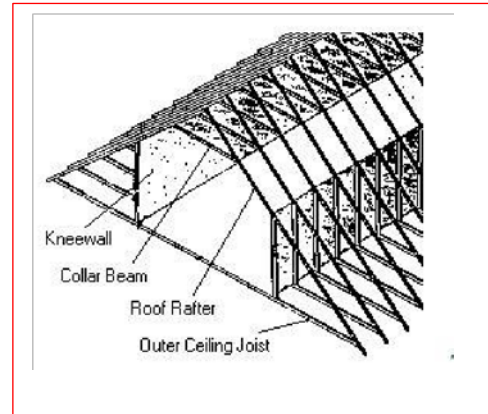8. Optional Dimensions can be input but will be ignored by NEAT.

3.20. UNFINISHED ATTICS

1. An Attic Code must be input.
2. Choose the appropriate Attic Type from the dropdown list.
3. The default Joist Spacing is 24", which you can achieve by hitting the TAB key. NEAT does not consider this number so use the default or put in actual. It makes no difference.
4. Define the Area of the attic. In many homes, this will be the same as the conditioned area of a single-story home. If there are multiple attics, the sum of all attics must equal the area of the floor above which the attics sit.
5. The Roof Color is almost always Normal or Weathered. Choose White, Reflective, Shaded only if the roof color is clean enough to effectively function as a white or reflective roof (or its primarily in shade all the time)
6. Choose the Type and Depth for the Existing Insulation in the attic. Note that Depth is in inches, not in R-Value. If the insulation is degraded; or there are many gaps; or it is very uneven, calculate (or estimate) the actual R-value and convert that back into inches (Roughly, 1 inch = R3.5). If this is done, explain in the Comments.
    a. Useful link to calculate weighted average: https://www.redcalc.com/parallel-path-r-value/
7. If there is more than one type of existing insulation, choose the type that seems to be in the majority. Combine them together when calculating depth and mention in Comments.
8. Added Insulation: Choose Measure # 1. If there is more than one attic, each must have its own measure number.
9. Choose the appropriate Added Insulation Type from the dropdown list. Typically, blown fiberglass is added on top of existing fiberglass.
10. In most cases, it is optimal to leave inputs for Added R-Value and Max. Depth blank.
    a. Added R-Value is an input that forces NEAT to provide the requested R-Value of insulation regardless of SIR. It will show up in the Recommended Measures as User-Spec Ceiling, even if the SIR is below 1.0. This should never be used.
    b. Max. Depth MUST BE INPUT for attics that are floored or cathedral, or any other circumstance when the cavity depth is limited. Input the total floor joist or roof rafter width. Do not use this input for any open attic space.
11. With attics, there will usually be Additional Costs. All additional costs must be explained in the comments. a. These are typical Additional Costs:
    i.   Dams for hatch, flue pipes and/or separating attic areas
    ii. Baffles (only if soffit vents exist)
    iii. Extra time to maneuver through a tight attic area iv. Labor cost to remove client's stored goods
    b. The following are NOT Additional Costs:
    vii. Air sealing in the attic (this should be part of air sealing only)
    viii. New attic ventilation (this should be an Incidental Repair)

       ix.   Flags and rulers (these should be included in the per square foot cost)

       x.   Building a new attic access (this should be an Incidental Repair)

c.   If there is more than one attic, press NEW at the lower left of the screen to create a new record. All attic spaces in a home must be modeled.

       i.   NOTE: An attic that is partly floored must be input as two attics, one floored and one un-floored with appropriate square footage for each.

3.21. FINISHED ATTICS

1. A unique Attic Code must be input for each record
2. Attic Area Type. Most Finished Attics have all four elements that are described here, and each type must be modeled individually (using the NEW button at the bottom left to create a new record for each). However, to save time, it is acceptable to combine the square footage of both areas of the same type (say, both Knee walls, and both Roof Rafters) into a single record.
   a. Use the F1 Key if you need help to understand what each element describes.
3. All inputs here are essentially the same as on the Unfinished Attics page. Three things to note:
   a. When modeling the Roof Rafters, you must input Max. Depth. Use the width of the Rafters (usually 6 or 8").
   b. The Outer Ceiling Joists are understood by NEAT to be unconditioned space. Do NOT model this area as a separate attic under Unfinished Attics.
   c. If a measure is not provided (SIR<1.0), you may want to try and choose a cheaper insulation option instead.
4. Choose a separate measure number for each element of a finished attic.
5. The gable end walls of a typical finished attic must be modeled as exterior walls under the Walls tab.

3.22. FOUNDATIONS

1. A unique Foundation Code must be input for each foundation area.
2. Choose the appropriate Foundation Type from the dropdown list.
   a. Conditioned: A conditioned space is heated and/or cooled either directly, or indirectly through a permanently open doorway.
   b. Non-Conditioned: Unvented and non-conditioned. Usually a non-conditioned basement. Could be a closed crawlspace also.
   c. Vented Non-Conditioned: This is a typical vented crawlspace. If there are foundation vents, it is vented.
   d. Unintentionally Conditioned: Do not use this classification. It will only consider floor insulation as a measure, never sill insulation.
   e. Uninsulated or insulated slab: Always choose Uninsulated unless you know otherwise.
   f. Exposed Floor: This is an overhang (such as a cantilevered floor) or the foundation of a house that sits on stilts or piers.
3. Choose a unique Measure # for each foundation.
4. Floor - Area. Input the square footage of the foundation.
5. Define the Existing Insulation R-Value here and for Foundation Wall. Use '0' for none.
6. Choose the appropriate Added Insulation Type from the dropdown list. Do this for all 3 elements of most foundation types (Do not choose NONE)
7. Sill – Floor Joist Size. Input only the blank: 2 x __? __
8. Perimeter to Insulate. Perimeter is the sum of the lengths of all the foundation walls. Do not use the TAB key. This should be calculated from the footprint diagram. You can input this same number for Foundation Wall Perimeter. Enter only uninsulated perimeter.
9. Foundation Wall – Height. This is the height from the subspace floor, or crawlspace ground, to the bottom edge of the floor joists. If the floor is uneven, estimate an average height over the whole area. Do NOT input the minimum height measured in the crawlspace.
10. Height Exposed is the percentage of the Foundation Wall Height that is above grade.

% Exposed = (1 / 4) x 100 = 0.25 x 100 = 25%
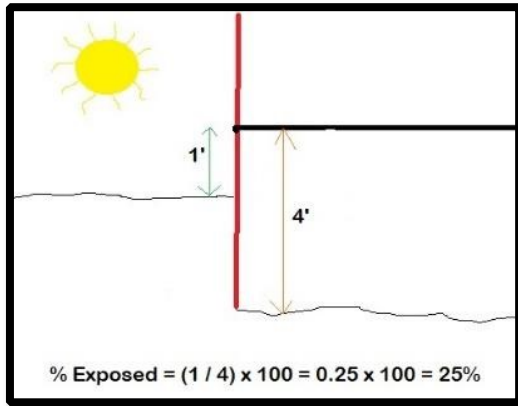
11. MULITPLE FOUNDATIONS: A home may have more than one foundation. All foundation areas must be modeled.
    a. Example 1: the floor of a bonus room over a garage must also be input as a foundation if the bonus room is part of the home's conditioned space.
    b. Example 2: additions often have a separate foundation that could be the same or a different type as the main house.
12. SPLITTING A SINGLE FOUNDATION: It is acceptable to model a single foundation as two.
    a. Example: If part of the previously insulated floor is in good condition and the other needs new insulation, model as two foundations – one insulted and one not. Use the appropriate square footage for each area, so long as the total is true to the actual area of the foundation.
13. PARTIALLY INACCESSIBLE CRAWLSPACE: Many crawlspaces in New Jersey have significant areas that have a height below 2 feet.
    a. Document, on Form 28 and in the NEAT, the total area of the crawlspace and the approximate area that is below 2-foot height.
    b. Use the above example to model the accessible crawlspace as a separate crawlspace.
14. If there is more than one foundation, press NEW at the lower left of the screen to create a new record. All foundation spaces in a home must be modeled.

3.23. HEATING

1. If the primary heating system is non-operational, there are three options:
    a. First, an ECM replacement may be modeled using the data plate capacity and efficiency, to see whether or not it would be replaced with the option Evaluate All, if it were functional.
    b. If not (and a replacement system will be installed using funds entirely from another funding source (Heating Improvement Program), model the new system as the existing unit and note this in the Comments. You may have to estimate the efficiency and the size of a new unit.
    c. Model the heat that is truly being used. It can be a few space heaters or an oven. There is no minimum to what truly exists. Choose Evaluate All and enter appropriate replacement data.
2. If the unit is working but will be replaced with DOE H&S or HIP funds, choose option b from above.
3. Choose the appropriate Equipment Type from the dropdown list. Note the following:
    a. Both Vented and Unvented Space Heaters refer to combustion heaters. Follow policy regarding unvented space heaters in WAP Chapter 3.
    b. Wood stoves are vented space heaters.
4. Choose the appropriate Fuel Type and Location from the dropdown lists.
    a. OTHER fuel type shall be chosen for wood pellets only.
5. Heat Supplied is the percentage of the home's conditioned floor area that is heated by this unit. If there is more than one unit, estimate the percentage from each. The total must add up to 100.
6. Enter the Manufacturer and Model # if desired.
7. For Combustion Appliances:
    a. Input Units and Input Rating are not used by NEAT except to input AFUE as SSE if no SSE measurement was taken at the job site. Not useful if you know the AFUE already.
    b. Output capacity can sometimes be taken from the nameplate of the heating unit. Otherwise, you must calculate based on the system type and Input Capacity
    c. Output = Input x AFUE

d. Steady State Efficiency must be measured in the field. If this is not possible, then the AFUE can be entered instead. It is NOT allowed to input any other number as SSE.

8. Choose the appropriate Condition. This is used only to estimate SIR for tune-up. Note that the worst option you can choose is poor (BUT WORKING). See the beginning of this section for options when the heating system is broken.

9. Check the "Programmable Thermostat" box if the home has a Programmable Thermostat. This means that the thermostat not only CAN be programmed to setback for specific times but IS being used in that capacity. A digital thermostat is not necessarily programmable. Look carefully!

10. Automatic Vent Damper. Not typically used.

11. Pilot Light / IID. Check if it is an IID or Pilot light. Check, too, if the Pilot Light remains on throughout the summer.

12. Power Burner. Only for oil or coal-fired systems that have been converted to gas.

13. For Electric resistance heat: Input either the KW (this can be combined for multiple space heaters) or KBTU per hr.

14. Multiple electric space heaters can be added together as a single input. Combine the wattage of each and input that value (in KW).

15. For Heat Pumps: Input the HSPF or the year of manufacture only.
    a. Do not use Year Manufactured for any unit newer than 2008. The list has not been updated beyond efficiencies as they existed in 2008.

16. You can degrade the HSPF using the degrading formula (Appendix D).

17. Replacement System – Options. Choose Evaluate All (or equivalent option) unless a state exception is provided.

18. Note that fuel switches are not permitted. Contact DCA for further guidance.

19. Both material and labor cost must be estimated but they do not need to be separated. You can put total cost in one box and put $0 in the other.

20. Typical replacement efficiencies are:
    a. Natural Gas & Propane: 80% standard; 90% High Efficiency.
    b. Oil: 80% standard; 85% High Efficiency.
    c. Heat Pump: 8 HSPF or higher. Be accurate based on actual unit to be installed.

21. Look back up to near the top right of the page of the audit software. Press the Uninsulated Supply Ducts button if there are uninsulated supply ducts or plenums that you wish to insulate.

22. If you input a secondary heating system, note that there will be a checkbox that, if checked, tells NEAT that this secondary system will no longer be used if a replacement of the primary unit is allowed. Check this only if client agrees to secondary heat removal.

23. OPTIONAL Heating System Details can be input but will not be used by NEAT in any calculation.

24. See Appendix B and C for help to determine efficiency of existing unit where manufacturer's tag is missing, or data cannot be found online.

25. All new HVAC system installs must be correctly sized with Manual J and Manual S calculations.

26. Complete calculations – based on post-WX description of home -must be provided by the HVAC contractor. Keep a copy in the client file.

3.24. COOLING

1. Choose the appropriate Equipment Type from the dropdown list.
2. Enter the Manufacturer and Model # if desired.
3. What is the Floor Area Cooled by this unit? If it is a ducted system, it will likely be every room in the home with the possible exception of rooms not supplied by the duct system.
4. Enter the Capacity of the unit in KBTU/hr. Remember that 1 ton is equal to 12 KBTU/hr.
5. Enter either the SEER or the Year Manufactured. Choose one.
    a. Do not use Year Manufactured for any unit newer than 2008. The list has not been updated beyond efficiencies as they existed in 2008.
6. You can degrade the SEER using the degrading formula (Appendix D)
7. If the unit being modeled is a Window AC, the efficiency will be given as EER. EER must be converted to SEER. The appropriate calculation is available by hitting the F1 key while the cursor is in the SEER box.
    (1) For the continuous-run formula (0.9xEER+0.1) to be used, the window AC should be documented and/or photographed as having a continuously-running fan at the time of the audit.
    (2) In all other cases, the formula should be the more conservative (1.2xEER)-0.7.
8. Room Air Conditioning Policy:
    1) If the customer has non-working air conditioner(s) and has an "at-risk" occupant in the household with a medical condition documented by a physician that requires air conditioning, the sub-grantee must request Program State Monitor permission to replace the room air conditioner(s) under LIHEAP or DOE Health and Safety.
    2) Verifying that Room Air Conditioner Qualifies for replacement as an ECM.
        a. Recommended room air conditioner(s) with a Savings to Investment Ratio (SIR) of 1 or greater for replacement justification.
        b. Replacement can only be assessed for existing room air conditioner(s). Maximum allowable replacement is 3 room A/C units.
        c. The agency must retain pre/post-pictures of the replacements.

3.25. MANUFACTURED HOMES ENERGY AUDITS (MHEA)

Audit Information

DO THIS FIRST:
   a. Press the NEW button, at the bottom left of the screen, to create a new audit.
   b. Not creating a NEW record means that you will be overwriting the data of an existing audit.

Choose the client for whom you want to create an audit from the dropdown list

Comments can include a brief description of home or other helpful information
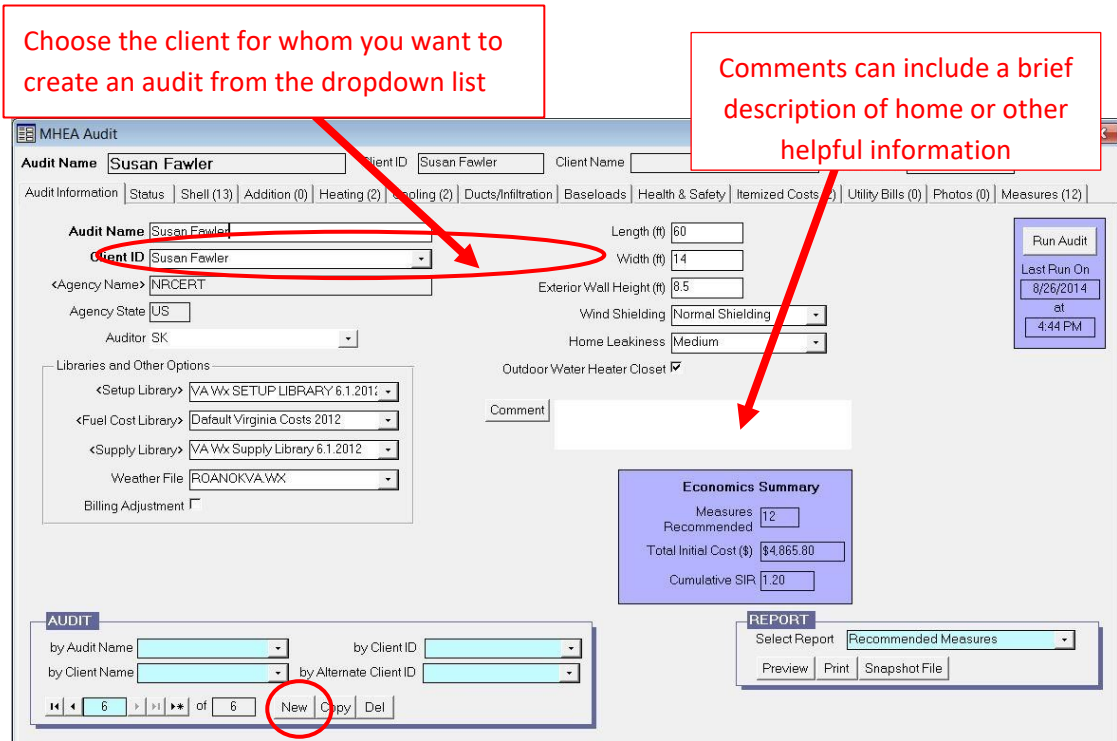
1. Under Auditor, choose yourself from the dropdown of auditors.
2. Made sure <Setup Library>, <Fuel Cost Library> and <Supply Library> boxes are all populated. If not, choose the appropriate one from the dropdown.
3. Choose the Weather File. You can use the dropdown, or if you know the code for the city you wish to choose, you can type the first few letters until you see the city of your choice.
   a. The WEATHER LOCATION city you choose will not always be the geographically closest city to your client. It might even be in another state. You are looking for the weather file that most closely approximates the HDD and CDD of your client's location.
4. Billing Adjustment, if checked, will allow the model to be modified by the utility data you can optionally input under the Utility Bills Tab.
5. Input the Length and Width of the original mobile home body only. If there are any additions, they are considered only in the Additions tab.
6. Input the Exterior Wall Height. This usually can be measured as the ceiling height inside the mobile home. a. Typically, 7' or 7.5'.
   b. If cathedral ceilings are present throughout the home, measure the height of the walls up to the beginning of the sloped ceiling.
7. Choose the appropriate Wind Shielding from the dropdown list.
8. Choose the appropriate Home Leakiness from the dropdown list. Note that this entry is disregarded by MHEA as soon as actual blower door data is input.

9. Check the box for Outdoor Water Heater Closet if the mobile home as an exterior access to the water heater closet. If checked, this will automatically reduce the volume of the home by the appropriate amount (about 60 cubic feet).

3.26. ENTERING THE SHELL DATA WALLS

1. Choose the appropriate Wall Stud Size from the dropdown list. This can be determined by measuring the depth of a door frame.
2. Choose the appropriate Orientation of Long Wall from the dropdown list. This can be either direction, i.e., if the long wall faces East and West, then you can choose either East or West. Both would be correct.
3. Choose the appropriate Wall Ventilation from the dropdown list. In almost all cases, the appropriate response will be Not Vented. Vertically corrugated metal siding can be considered Vented.
4. Define the Existing Insulation. MHEA allows for the possibility that there is more than one type of insulation. Enter the thickness of each, with a 0 where there is none.
5. Input the Uninsulatable Wall Area, if any. This would be an area of wall that cannot be insulated. This is rarely used.
6. If there is a carport or porch attached to the mobile home, input the Carport/Porch Roof – Length, Width and Orientation. Note that the Length should be the dimension that is parallel to the manufactured home.

3.27. WINDOWS

1. Input windows on the original manufactured home only, not on the addition (if any)
2. Choose the appropriate Window Type from the dropdown list. Unlike in NEAT, this is required.
3. Choose the appropriate Frame Type, Glazing Type and Interior Shading from the dropdown list.
4. Choose the appropriate Exterior Shading from the dropdown list. Note that there is no option to input the % shading, so a lot of auditor judgment is involved here.
    a. If a window is partially shaded, the auditor must decide if this should be defined as NONE or AWNING.
    b. The presence of a Low E film on the windows can be described here only.
5. Choose the appropriate Leakiness from the dropdown list. Press F1 for guidance.
6. Input the Width and Height of the window(s) being modeled
7. Number Facing. MHEA allows you to input every identical window on ANY wall in a single record. Each window modeled together MUST have EVERY characteristic except orientation the same. Enter 0 for any orientation that does not have one of these windows.
8. Retrofit Options. You are required to choose Evaluate All. Any other option requires State approval. Apply Additional Costs if necessary and this input should be explained in the comments section.

3.28. DOORS

1. Input doors on the original manufactured home only, not on the addition (if any).
2. Choose the appropriate Type from the dropdown list.
3. Check if a storm door is present. There is no ability to define the condition of the storm door, so if it is in poor condition, it is best to claim there is none. This must be mentioned in the Comments.
   a. Storm Doors are only relevant in terms of their ability to limit air infiltration though the door. A security door does not count as a Storm Door.
4. Enter the Width and Height of the door.
5. Number Facing. As with windows, you can input every identical door on any wall within the same record. Each orientation requires an input even if that is 0.

3.29. CEILING
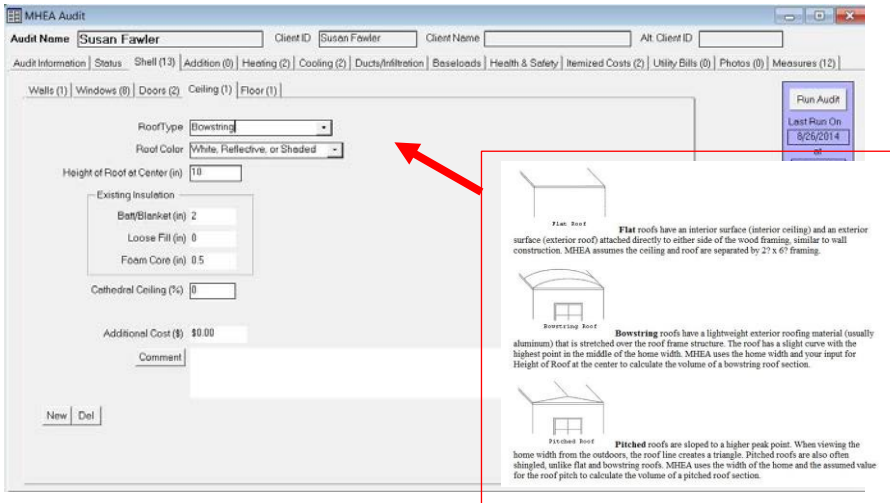
1. Input ceiling details on the original manufactured home only, not on the addition (if any).
2. Choose the appropriate Roof Type from the dropdown list. Use F1, if needed, to get a better visual of each different Roof Type.
3. The Roof Color is almost always Normal or Weathered. Choose White, Reflective, shaded only if the roof color is clean enough to function as a white roof (or is mostly shaded).
4. The following entry will change depending on Roof Type but is always asking how much space there is for more insulation.
    a. Height of Roof at Center (for Bowstring roof): Input height from top of existing insulation to highest point of roof.
    b. Insulation to Add at Center (for Pitched roof): Input total available height from ceiling to roof ridge. c. Joist Size (for Flat roof): Choose 2x4, 2x6 or 2x8
5. Define the Existing Insulation. Enter the thickness of each type, with a 0 where there is none of any given insulation type.
6. If the home has Cathedral Ceilings, calculate the percentage of total floor area that has cathedral ceilings.
    a. ((cathedral room length / total mobile length) x 100)
7. Enter Step Wall Orientation if there is one (rare).

3.30. FLOOR

1. Input Floor details on the original manufactured home only, not on the addition (if any).
2. Floor Joist Direction. Choose whether joists run Widthwise or Lengthwise.
3. Check if there is a mobile home Skirt Present. If it covers only part of the home, the auditor must make a judgment call whether to call it present or not. Consider its ability to prevent wind across the belly.
4. MHEA allows for the possibility that the Floor Wings and the Floor Belly may be different, which is rare in most manufactured homes. You will have to model both.
5. Choose the appropriate Floor Joist Size and input the Loose Insulation Thickness and/or Batt/Blanket Thickness.
   a. Choose the appropriate Location for the Batt/Blanket insulation.
6. The following 3 inputs ask you to consider the belly material (belly board).
   a. Belly Cavity Configuration. Rounded is most common. Press F1 for help.
   b. Condition of Belly (good, average, poor)
   c. Maximum Depth of Belly Cavity. Measure from the deepest part of the belly, if rounded.

3.31. ADDITION

1. All shell elements of the Addition must be modeled here only, not in the Shell section.
2. All inputs are essentially the same as what you have input previously in the Mobile Home Shell with one exception:
   a. Wall Configuration. There are three choices here and they all refer to the slope of the ceiling from within the addition.
      i. Maximum Wall Height at Interior Wall: ceiling is shed type sloping away from mobile home.
      ii. Maximum Wall Height in Center of Addition: ceiling is Cathedral.
      iii. All Addition Walls the Same Height: ceiling is flat.

3.32. HEATING (EXISTING)

1. Input for the Primary Heating System first. Use the Secondary input only if there is a secondary unit.
2. Choose the appropriate Equipment Type and Fuel from the dropdown list.
3. Choose the appropriate Capacity (KBTU/hr.) from the dropdown list. Note that, unlike NEAT, this asks for INPUT capacity, not the output.
4. Choose the appropriate Efficiency and Efficiency Units:
   a. Electric furnace or space heat: 100% AFUE
   b. Combustion furnace: SSE or AFUE (SSE is better but must be measured)
   c. Heat pump: HSPF
5. Choose the appropriate Duct Location and Duct Insulation Location.
6. Heat Supplied. Input 100% if the primary unit is the only source of heat. Otherwise estimate the % of conditioned floor area heated by each of the primary and secondary units. Must total 100%.
7. Choose a Secondary unit on the next tab, if there is one.

3.33. COOLING (EXISTING)

1. Inputs are essentially the same as for Heating.
2. Capacity. Remember that 1 ton equals 12000 BTU.
3. Efficiency Units. Note that, unlike with NEAT, it is possible to input EER without the need to convert the EER to SEER.
4. Choose a secondary unit on the next tab, if there is one.

3.34. HEATING AND/OR COOLING (REPLACEMENT)
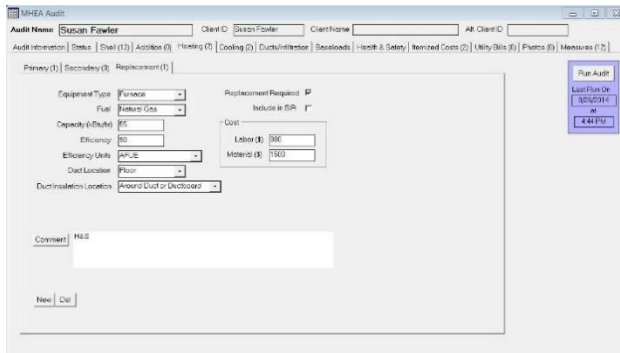
1. Choose a Replacement Heating and/or Cooling System. Note that if the Replacement details are not filled out, MHEA is not able to consider whether a replacement is needed because it has nothing to compare with the existing unit.
2. Inputs are the same as for the existing Heating and/or Cooling Systems.
3. Efficiency units. Remember that a new combustion unit that has not been installed CANNOT have a Steady State. Choose AFUE.
4. HEAT PUMP REPLACEMENT AS ECM. MHEA, unlike NEAT, does not recognize that a heat pump serves both heating AND cooling functions. Therefore, if a new heat pump is sought, the total cost for that heat pump can be divided between the Heating Replacement and the Cooling Replacement. Those costs can be divided ANY way that works, so long as both the Heating and Cooling Replacements provide an SIR of 1.0 or greater.

    For example: A total install cost of $5000 can be divided as:

Heating	Cooling
$2500	$2500
$1000	$4000
$4990	$1000

5. Any combination of costs is OK, so long as the combined cost equals the total install cost.

3.35. NEAT AND MHEA COMBINED

3.36. DUCTS / INFILTRATION

1. Check the box Evaluate Duct sealing to get additional funds for duct sealing. Extra on-site measurements will be required. (See next page).
    a. Evaluate Duct Sealing MUST be checked if any pressure pan measurements are 2 Pa or greater and average more than 1 Pa.
2. Before Weatherization. Enter the blower door result achieved at pre-audit.
3. After Weatherization. Enter the target blower door result.
4. Target must be met for the measure to pass at QA and/or final. If you don't believe the target as calculated above is achievable, you can write in your own target. You MUST explain your reasoning for this in Comments.
5. If target is not achieved at Final or QCI due to changes to the pressure boundary of the home that occurred after weatherization was completed, these changes must be clearly documented to determine if the measure should pass.
6. Costs - Infiltration Reduction. Enter here the amount of money you wish to receive for ALL air sealing measures on this home. Leaving it blank will eliminate the air sealing measure.
7. You may choose to type in Comments some or all the specific air sealing needs noted by the auditor. This is helpful but not required.

3.37. EVALUATE DUCT SEALING – DUCT BLOWER MEASUREMENTS

1. Duct Operating Pressures:
   a. Before Duct Sealing. Both Supply and Return operating pressures need to be measured in the field. Typically, one is measured and then the other. Testing does not have to be simultaneous. Duct pressures are measured with the furnace air blower on. The blower door must NOT be running. Registers open.
   b. Supply static pressure: It is best to insert the manometer hose in the supply plenum. If this is not possible, or not practical, insert the hose in the nearest supply register and snake the hose as close as you can to the plenum.
   c. Return static pressure: It is best to insert the manometer hose in the return plenum. If this is not possible, or not practical, insert the hose in the nearest return register and snake the hose as close as you can to the plenum.
2. After Duct Sealing: In most cases, add 5 Pa to the Before Duct Sealing result.
3. Before Duct Sealing (Existing): Input the data as measured in the field.
4. After Duct Sealing (Target or Actual):
   a. Total Leakage: 12 CFM per 100 SF of conditioned floor area of home
   b. Leakage to Outside: 8 CFM per 100 SF of conditioned floor area of home
5. Duct sealing target must be met for the measure to pass at final inspection and/or QCI. Result can be lower than target but, if higher, must be within 10% of target.
6. If target is not achieved at Final or QCI due to changes to the pressure boundary of the home that occurred after weatherization was completed, these changes must be clearly documented to determine if the measure should pass.
7. If you don't believe the target as calculated above is achievable, you can write in your own target. You MUST explain your reasoning for this in Comments.
8. Duct Sealing Cost. Input amount needed for duct sealing. SIR must be 1.0 or greater.
9. NEAT will not accept $0 for duct sealing. If you cannot achieve a duct sealing measure with an SIR >= 1.0, then uncheck Evaluate Duct Sealing. See below for more information.
10. Evaluate Duct Sealing – Pressure Pan Measurements (MHEA only)

a. Use this option for all MHEA audits with ducted systems.

b. Input the sum of all pressure pan readings in the home. The target is usually the number of registers in the home (1 Pa per register).

c. You can increase this if needed to ensure you have an achievable target.

11. Note that no register should have a pressure pan greater than 3.0 Pa when work is completed, and not more than 3 registers should have pressure pans greater than 1.0.

12. Target must be met for the measure to pass at QA and/or final.

13. If you enter the data correctly, but cannot get the measure with an SIR >= 1.0:

a. Consider your target. Can you input a target tighter than what you calculated that is still achievable? (Remember, you must achieve target for the measure to pass at QA). If so, change the target and run the audit again. If not, move on to step 2.

b. If you still cannot get an SIR >= 1.0, then your only option is to turn off the Evaluate Duct Sealing:

c. Explain in Comments that you attempted duct sealing but could not get the measure with an SIR above 1.0.

d. Your comment will remain even after you uncheck Evaluate Duct Sealing, as will the data you entered to attempt duct sealing.

14. Note that it is allowable to use Infiltration funds to seal ducts. However, it is not allowable to use duct sealing money for other air sealing measures.

3.38. BASELOADS – WATER HEATERS

Choose a replacement only if an existing water heater has been chosen from the internal database.

1. NEAT holds a large database of water heater data. If you can locate your client's water heater in the database, choose that. If not, you can manually type in the Manufacturer and Model without pulling data from the database.
    a. Do NOT choose a model that is different from the one in the client's home.
2. Choose the appropriate Fuel and Location from the dropdown lists.
3. Enter the Rated Input and define the Input Units, if you desire. This is not required. Remember, a typical electric tank is 4.5 KW, not 45 or 0.45
4. Enter the Size of the storage tank. Typically: 30, 40 or 50 gallons.
5. Check if Water Heater Wrap Present. NEAT will not provide water heater wrap if this is checked.
6. Check if Water Heater Pipe Insulation Present. NEAT will not provide water heater pipe insulation if this is checked.
7. Original Tank Insulation. Enter EITHER the R-value OR the Thickness and Type of the internal tank insulation. This is rarely marked on the tag. You can:
    a. Measure existing insulation by removing an access cover and measuring thickness & type. OR:
    b. Input an existing R5. This is fairly accurate for most water heaters.
8. Shower Heads. Enter the Number of Showerheads in the home; the total Shower Use per day; and the Avg. GPM (gallons per minute).
    a. Typically, you can count 10-15 minutes per resident.
9. GPM must be measured or taken from the manufacturer's data imprinted on the showerhead.
    a. If measuring: Time how many seconds it takes to fill a 4-cup measuring cup.
    b. GPM = 15 / result (in seconds)

3.39. REFRIGERATORS

Choose a replacement only if fridge has been metered.

This data comes from the Supply Library.

1. Existing Equipment: NEAT holds a large database of refrigerator data. If you can locate your client's refrigerator in the database, you can do so. Note that many of the Model numbers use asterisks to indicate any variety of number or letter.
2. Do not choose any fridge other than the one in the client's home.
3. If the model is not found, you can leave the information blank or fill it out manually.
4. Consumption – Label/Database Annual Consumption. If you did not find the fridge in the database, then you will need to fill out these fields (ignore if you are metering the fridge):
   a. KWh/yr.: Go online to find estimate of fridge usage.
   b. Age: Find on manufacturer's tag or hidden in serial number.
   c. Door Seal Condition: If you choose POOR be sure to take photos.
5. If you Metered the fridge, enter the following data (Label Consumption and door seal condition will be ignored):
   a. Metering Minutes: Enter the number of minutes you metered the fridge (must be 120 minutes or greater).
   b. Enter the Meter Reading in KWh. This is rarely higher than 0.4 KWh
   c. If you noticed a spike during metering that may indicate the fridge entered a Defrost Cycle during metering. Check the box Includes Defrost Cycle. Used rarely.
6. Replacement refrigerators shall be sized based on the size of the existing unit or size of the family.

3.40. LIGHTING SYSTEMS

1. A Light Code must be input.
2. Only input existing lights that are used 4 hours/ day or more on overage.
3. It is recommended inputting, as a single record, every light in the home that is the same wattage and is used for approximately the same amount of time.
4. Choose the appropriate Lamp Type (usually: Standard).
5. Input Quantity and Size (Watts) of this type of light, and the average hours used per day.
   a. The replacement wattage of an equivalent CFL will automatically be projected. This can be changed if you are using LEDs but NEAT will still refer to them as CFLs.
6. CFL bulbs are no longer an allowable material. Use LEDs only.
7. Use this table to help you choose the appropriate LED equivalent wattage:

Incandescent	CFL	LED
100W	26W	18W
75W	18W	9 or 13W
60W	13W	7W
40W	7W	5W

3.41. HEALTH AND SAFETY
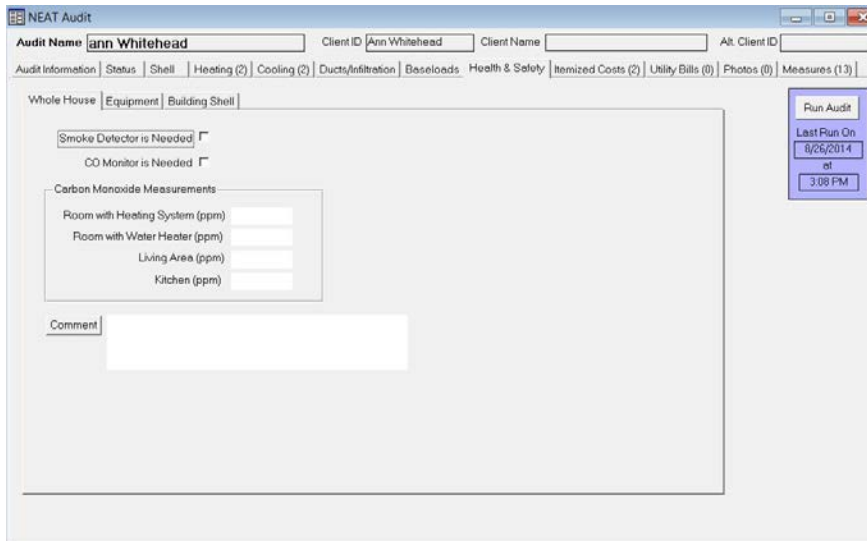
1. This tab can be skipped over entirely.

2. Any Health & Safety items can be input directly under Itemized Costs and will be defined as H&S simply by NOT checking the Include in SIR box.

3. If you want to complete data in the three sub-tabs of Health & Safety, know that NEAT will NOT automatically provide any measure based on these inputs.

4. The only exception to this is if function #11 under Preferences / Features is checked. This will allow NEAT to automatically add checked H&S items to Itemized Costs. However, quantities and prices MUST be adjusted on a case-by-case basis.

3.42. ITEMIZED COSTS
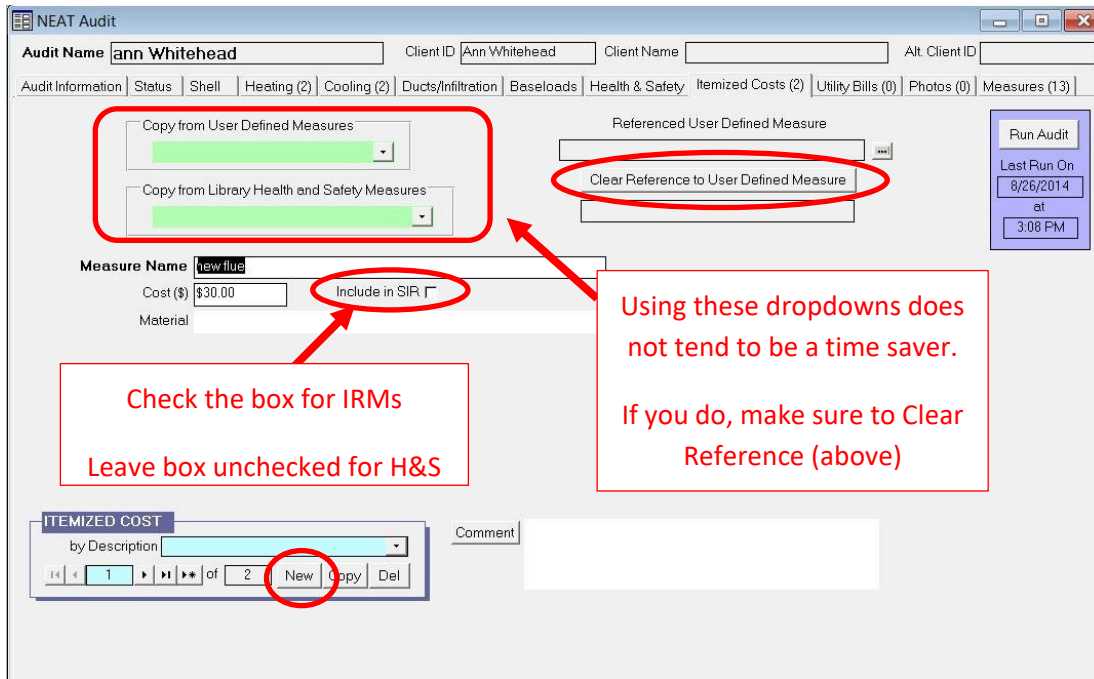
1. The easiest and fastest way to input data here is simply to type it yourself.
2. Input an appropriate Measure Name, which will be understandable by both yourself and others. Include the number of units of that item (such as 5x smoke detector).
3. Input a Cost for this measure.
4. Include in SIR. This is asking: Is this measure to be included in the calculation to determine the Cumulative SIR?
   a. Incidental Repairs will have the "Include in SIR" box checked because the zero SIR of an Incidental Repair is meant to bring down the Cumulative Whole House SIR of this job and thus limit the amount that can be spent as IRMs. (Incidental Repairs will show up on the Report with an SIR = 0)
   b. IRMs must state in Comments to which ECM they are linked.
   c. With Health & Safety measures, "Include in SIR" is **NOT** checked, because they do not affect the Cumulative Whole House SIR.
5. Press NEW in the lower left of the page to create a new blank record for additional Itemized Costs.
6. See next page for further instruction, guidance, and examples.

Incidental Repair SIR = 0 and at the top

IRMs reduce the Cumulative SIR of a job. H&S measures do not.

Energy Saving Measure Economics

Index	Recommended Measure	Components	Measure Savings ($/yr)	Measure Cost ($)	Measure SIR	Cumulative Cost ($)	Cumulative SIR
1	ROOF REPAIR		0	300	0.0	300	0.0
2	vapor barrier		0	421	0.0	721	0.0
3	Seal Ducts		33	300	1.0	1021	0.3
4	Infiltration Redctn		81	700	1.1	1721	0.6
5	Lighting Retrofits	LT1,LT2,LT3	48	16	33.7	1737	0.9
6	DWH Pipe Insulation		8	8	11.9	1745	1.0
7	DWH Tank Insulation		9	33	3.3	1778	1.0
8	Storm Windows	WD7	11	67	2.2	1845	1.1
9	Attic Ins. R-30	A1	80	727	2.1	2572	1.3
10	Door Replacement	Dr2	35	319	1.9	2891	1.4
11	ASHRAE bath fan - 29 CFM continuous		0	800	0.0	3691	0.0
12	Fix water heater venting		0	35	0.0	3726	0.0
13	Install 2 C.O		0	180	0.0	3905	0.0
14	Install Smoke Detector		0	29	0.0	3934	0.0

H & S

SIR = 0 and at bottom

INCIDENTAL REPAIR	Include in SIR	☑
WEATHERIZATION (ENERGY SAVING) MEASURES		
HEALTH & SAFETY	Include in SIR	☐

3.43. RECOMMENDED MEASURES

1. After the Run Audit button is pressed, this report will be generated.
2. The most important information will be in the section called Energy Saving Measure Economics.

NEAT Recommended Measures

| Agency | | State US | Run On 11/12/2019 2:49:18 | RunID 1573588158 |
| Client ID | | | Version 8.9.0.5 (2/10/2012) | AuditID 1627546875 |

Audit Name test	Audit Date 11/12/201
Client Name	Auditor
Weather File	Setup Library Name
Comment	

Annual Energy and Cost Savings

Index	Recommended Measure	Components	Heating (MMBtu)	($)	Cooling (kWh)	($)	BaseLoad (kWh)	($)	Total (MMBtu)
1	Seal Ducts		3.6	33	0	0	0	0	3.6
2	Infiltration Redctn		6.9	64	159	17	0	0	7.5
3	Lighting Retrofits	LT1,LT2,LT3	0.0	0	0	0	446	48	1.5
4	DWH Pipe Insulation		0.0	0	0	0	242	8	0.8
5	DWH Tank Insulation		0.0	0	0	0	294	9	1.0
6	Storm Windows	WD7	1.0	9	19	2	0	0	1.0
7	Attic Ins. R-30	A1	5.2	48	297	32	0	0	6.2
8	Door Replacement	Dr2	3.4	31	39	4	0	0	3.5

Energy Saving Measure Economics

Index	Recommended Measure	Components	Measure Savings ($/yr)	Measure Cost ($)	Measure SIR	Cumulative Cost ($)	Cumulative SIR
1	ROOF REPAIR		0	300	0.0	300	0.0
2	vapor barrier		0	421	0.0	721	0.0
3	Seal Ducts		33	300	1.0	1021	0.3
4	Infiltration Redctn		81	700	1.1	1721	0.6
5	Lighting Retrofits	LT1,LT2,LT3	48	16	33.7	1737	0.9
6	DWH Pipe Insulation		8	8	11.9	1745	1.0
7	DWH Tank Insulation		9	33	3.3	1778	1.0
8	Storm Windows	WD7	11	67	2.2	1845	1.1
9	Attic Ins. R-30	A1	80	727	2.1	2572	1.3
10	Door Replacement	Dr2	35	319	1.9	2891	1.4
11	ASHRAE bath fan - 29 CFM continuous		0	800	0.0	3691	0.0
12	Fix water heater venting		0	35	0.0	3726	0.0
13	Install 2 C.O		0	180	0.0	3905	0.0
14	Install Smoke Detector		0	29	0.0	3934	0.0

Audit Name: test   Client: Maria Gonzales DOE 19 OKL   Date: 11/13/2019   Page 1 of 4

3.44. ENERGY SAVING MEASURE ECONOMICS

Incidental Repairs
SIR = 0

Cumulative SIR
Must be 1.0 or greater

Energy Saving Measure Economics

Index	Recommended Measure	Components	Measure Savings ($/yr)	Measure Cost ($)	Measure SIR	Cumulative Cost ($)	Cumulative SIR
1	ROOF REPAIR		0	300	0.0	300	0.0
2	vapor barrier		0	421	0.0	721	0.0
3	Seal Ducts		33	300	1.0	1021	0.3
4	Infiltration Redctn		81	700	1.1	1721	0.6
5	Lighting Retrofits	LT1,LT2,LT3	48	16	33.7	1737	0.9
6	DWH Pipe Insulation		8	8	11.9	1745	1.0
7	DWH Tank Insulation		9	33	3.3	1778	1.0
8	Storm Windows	WD7	11	67	2.2	1845	1.1
9	Attic Ins. R-30	A1	80	727	2.1	2572	1.3
10	Door Replacement	Dr2	35	319	1.9	2891	1.4
11	ASHRAE bath fan - 29 CFM continuous		0	800	0.0	3691	0.0
12	Fix water heater venting		0	35	0.0	3726	0.0
13	Install 2 C.O		0	180	0.0	3905	0.0
14	Install Smoke Detector		0	29	0.0	3934	0.0

All ECMs (after air sealing) are listed in decreasing order of SIR.

Measures cut due to budget MUST be cut from the lowest upwards.

Health & Safety
SIR = 0

1. No weatherization measure is allowed that has a Measure SIR of less than 1.0, with one exception:
   a. An SIR below 1.0 is only possible for blower door guided air sealing if the package SIR remains 1.0 or greater.
2. Incidental Repairs (if any) will always show up at the top of the list and have an SIR = 0.0
3. Health and Safety items will always show up at the bottom of the list. Most H&S items will have an SIR = 0.0, except for weatherization measures that are replaced as a mandatory H&S item.
4. Such measures may have a measure SIR higher than 0.0 but their SIR in the Cumulative SIR column will always be 0.0.
5. Once approved, all Energy Conservation Measures (ECMs) from the audit must be installed in the unit, as funding allows.
6. If required by budget limitations, cut measures (ECMs and related IRMs, but **NOT** H&S measures) from the lowest SIR measure and continue upwards until cost is within budget. See Appendix E for more information about Measure Skipping.

3.45.   TYPICAL RANGES FOR SIRS

This list is meant as a guide to help auditors and QCI gauge the accuracy of an audit. It is based on an examination of 25 random NEAT audits run with different Setup Libraries and from different states. An SIR higher than the Highest Expected is not necessarily wrong but should be examined more carefully to confirm accuracy.

Measure Name	Average SIR	Highest Expected SIR (rounded up)
Air Sealing	2.0	3
Attic Insulation	3.4	8
Floor insulation	2.7	5
Wall insulation	3.4	9
Knee wall insulation	8.1	14
Duct insulation	9.9	17
Low E Windows	1.6	3
Storm windows	1.2	2
DHW Tank Wrap	4.7	8
DHW Pipe Wrap	12.6	21
Low-flow Showerhead	68.6	209
Refrigerator	1.8	3
CFL or LED lights	11.5	22

3.46. MATERIALS AND ENERGY & LOADS

Materials

This is the NET wall area to be insulated.
Gross area of all walls minus area of windows and doors.
You won't find this number anywhere else.

Index	Material		Quantity	Units
1	Wall Insulation	Blown Cellulose - 2x4 Filled	836	SqFt
2	Compact Fl.	13 Watt	10	Each Lamp
3	DHW Pipe Insulation		1	Each
4	Attic Insulation	Blown Fiberglass - R-38	800	SqFt
5	CO monitor (+)		1	Each
6	Bathroom exhaust fan (+)		1	Each
7	Kitchen exhaust fan (+)		1	Each
8	Pressure relief piping (+)		1	Each
9	Smoke detector (+)		1	Each
10	Smoke detector (+)		1	Each

Material section can help by providing a summary of all material being called for by the audit.

Pre/Post Retrofit Energy and Loads

	Pre Retrofit		Post Retrofit	
	Heating	Cooling	Heating	Cooling
Annual load (MBtu/yr)	32.1	36.6	9.7	21.3
Annual Energy (MBtu/yr)	33.8	12.3	10.2	7.2
Heat loss/gain (kBtu/hr)	50.5	26.3	16.5	9.6
Output required (kBtu/hr)(ton)	50.5	2.5	16.5	1.0

BEFORE WX

AFTER WX

This is a fairly accurate **Manual J** of the home before and after Weatherization. This can be used by the auditor as a quick verification of the Manual J submitted by the HVAC contractor.

However, DCA rules state that an ACCA -certified Manual J must be run. The Manual J must be run based on post-weatherization data (i.e., new insulation levels, etc.)

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3.47. DUAL FUNDING POLICY

Dual Funding in a single-family unit can be eligible for shell weatherization measures from both DOE and LIHEAP Weatherization grant funds if it meets the criteria of a minimum of $2,000 in materials must be installed.

Application and or selection of funds to measures:

1) Measures with the highest SIR must be applied to DOE grant funds.
2) The Work-Scope can be split among the dual shell grant funds. For example: Blower Door Air Sealing would go under DOE and a Refrigerator would go under LIHEAP (based on highest to lowest SIR measures). Splitting of a measure among the two funding sources is not allowed.
3) LIHEAP funds can be used for a broader range of measures. SIR in NEAT/MHEA audit must be lowered to 0.5.
4) Energy Conservation Measures (ECM) not meeting the DOE required SIR of 1.0 or above will be allowed with LIHEAP WX grant funds.

4. LOCAL QUALITY CONTROL INSPECTION OF THE ENERGY AUDIT

4.1. BLOWER DOOR AND DUCT SEALING TARGETS

1. QCI shall assess the accuracy of the blower door and duct sealing target calculations following the guidance in section 2.3.3.

2. QCI shall perform appropriate testing in the home to confirm the results from infiltration and duct sealing.

3. Results achieved at QCI may be lower than target but must be not more than 10% higher than target.

4. If results achieved at QCI are greater than 10% higher than the target, the air sealing and /or duct sealing measure(s) will not pass.

4.2. OTHER QCI PROCEDURES

1. The QCI must complete Form 44 and Form 45

2. A desk review of the job should occur before an in-field visit of the home being assessed. The desk review shall include:

   a. Confirmation of the accuracy of the NEAT MHEA inputs.

   b. Confirmation that work was completed followed the NEAT MHEA work order.

   c. Confirmation that invoiced items did not exceed the amounts allowed for in the NEAT MHEA work order.

3. It is the QCI's responsibility to ensure that all measures performed "will result in work that achieves the desired outcomes in the SWS."[10]

4. The QCI must repeat all diagnostic tests performed on the home by the auditor at pre- and/or post inspection to verify those results.

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[10] DOE WPN 15-4

WPN 19-5 Definition Flow Chart
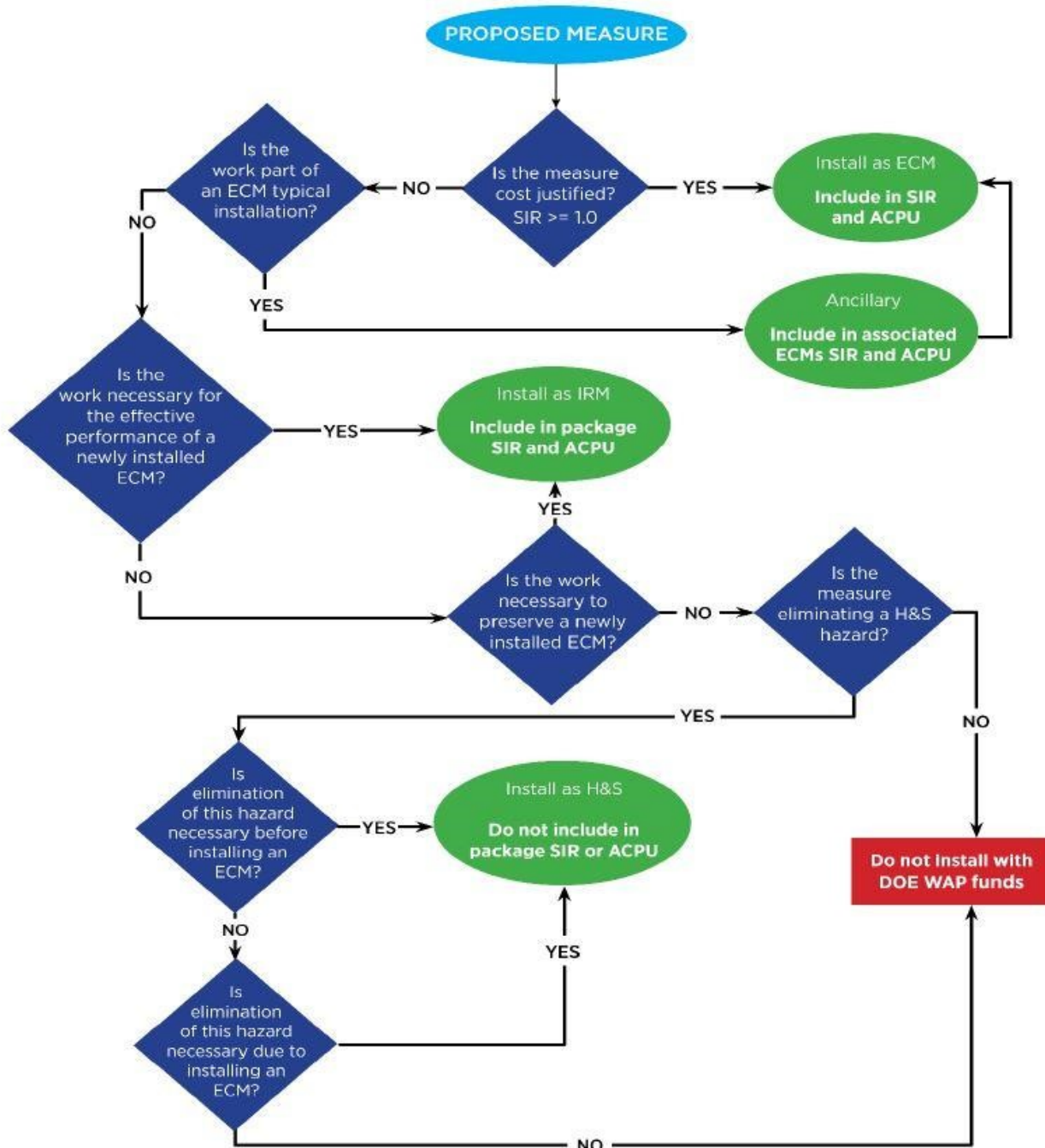
ACRONYMS
ACPU: Average Cost Per Unit
ECM: Energy Conservation Measure
H&S: Health & Safety

IRM: Incidental Repair Measures
SIR: Savings to Investment Ratio

APPENDIX B – Missing or Illegible Data Tag

When the manufacture's tag is missing or illegible:

- Age can only be estimated
- Ask client – unit was often purchased on a memorable year
- Capacity can only be estimated
- For Efficiency, use the following guide (summarized from Equipment Efficiencies sheet, Appendix C):

Unit Type	< 1970	~ 1980	~ 1990	~ 2000
Central AC or Heat Pump (SEER)	6.0	7.7	9.5	11.0
Heat Pump (HSPF)	5.0	5.8	6.5	7.2
Window AC (EER)	6.0	7.0	8.3	9.3

Heating and Cooling Efficiencies Based on Manufactured Date
March 20, 2015

| Manufactured Date | Cooling Efficiency | | | | Heat Pump Heating Efficiency |
| | Central Air Conditioner or Heat Pump | Room or Window Air Conditioner | | | |
	(SEER)	(EER)	(SEER)[1]	(SEER)[2]	(HSPF)
<1970	6.0	6.0	5.5	6.5	5.0
1970	6.0	6.0	5.5	6.5	5.0
1971	6.1	6.0	5.5	6.5	5.2
1972	6.3	6.0	5.5	6.5	5.2
1973	6.5	6.1	5.6	6.7	5.3
1974	6.6	6.3	5.7	6.8	5.4
1975	6.8	6.4	5.9	7.0	5.4
1976	7.0	6.5	6.0	7.1	5.5
1977	7.2	6.7	6.1	7.3	5.6
1978	7.4	6.8	6.2	7.4	5.6
1979	7.5	6.9	6.3	7.6	5.7
1980	7.7	7.0	6.4	7.8	5.8
1981	7.9	7.2	6.6	7.9	5.8
1982	8.1	7.3	6.7	8.1	5.9
1983	8.2	7.4	6.8	8.2	6.0
1984	8.4	7.6	6.9	8.4	6.1
1985	8.6	7.7	7.0	8.5	6.1
1986	8.8	7.8	7.1	8.7	6.2
1987	9.0	8.0	7.3	8.8	6.3
1988	9.1	8.1	7.4	9.0	6.3
1989	9.3	8.2	7.5	9.2	6.4
1990	9.5	8.3	7.6	9.3	6.5
1991	9.7	8.5	7.7	9.5	6.5
1992	9.9	8.6	7.8	9.6	6.6
1993	10.0	8.7	8.0	9.8	6.7
1994	10.2	8.9	8.1	9.9	6.7
1995	10.4	9.0	8.2	10.1	6.8
1996	10.6	9.0	8.2	10.1	6.9
1997	10.7	9.0	8.2	10.1	6.9
1998	10.8	9.0	8.2	10.1	7.0
1999	10.9	9.0	8.2	10.1	7.1
2000	11.0	9.25	8.4	10.4	7.2
2001	11.1	9.5	8.7	12.1	7.2
2002	11.1	9.75	8.9	11.0	7.3
2003	11.2	9.75	8.9	11.0	7.3
2004	11.6	9.75	8.9	11.0	7.4
2005	11.9	9.75	8.9	11.0	7.5
2006	12.3	9.75	8.9	11.0	7.6
2007	12.7	9.75	8.9	11.0	7.6
2008	13.0	9.75	8.9	11.0	7.7
>2008	13.0	9.75	8.9	11.0	7.7

[1] Fan runs continuously (assumed in Version 8.3)
[2] Fan runs only when cooling

APPENDIX D – Derating Efficiency by Appliance Age

AGE (years)	ORIGINAL EFFICIENCY (SEER, EER or HSPF)								
	5	6	7	8	9	10	11	12	13
1	5.0	5.9	6.9	7.9	8.9	9.9	10.9	11.9	12.9
2	4.9	5.9	6.9	7.8	8.8	9.8	10.8	11.8	12.7
3	4.9	5.8	6.8	7.8	8.7	9.7	10.7	11.6	12.6
4	4.8	5.8	6.7	7.7	8.6	9.6	10.6	11.5	12.5
5	4.8	5.7	6.7	7.6	8.6	9.5	10.5	11.4	12.4
6	4.7	5.6	6.6	7.5	8.5	9.4	10.4	11.3	12.2
7	4.7	5.6	6.5	7.5	8.4	9.3	10.3	11.2	12.1
8	4.6	5.5	6.5	7.4	8.3	9.2	10.2	11.1	12.0
9	4.6	5.5	6.4	7.3	8.2	9.1	10.0	11.0	11.9
10	4.5	5.4	6.3	7.2	8.1	9.0	9.9	10.9	11.8
11	4.5	5.4	6.3	7.2	8.1	9.0	9.8	10.7	11.6
12	4.4	5.3	6.2	7.1	8.0	8.9	9.8	10.6	11.5
13	4.4	5.3	6.1	7.0	7.9	8.8	9.7	10.5	11.4
14	4.3	5.2	6.1	6.9	7.8	8.7	9.6	10.4	11.3
15	4.3	5.2	6.0	6.9	7.7	8.6	9.5	10.3	11.2
16	4.3	5.1	6.0	6.8	7.7	8.5	9.4	10.2	11.1
17	4.2	5.1	5.9	6.7	7.6	8.4	9.3	10.1	11.0
18	4.2	5.0	5.8	6.7	7.5	8.3	9.2	10.0	10.8
19	4.1	5.0	5.8	6.6	7.4	8.3	9.1	9.9	10.7
20	4.1	4.9	5.7	6.5	7.4	8.2	9.0	9.8	10.6

DERATING EFFICIENCY BY AGE

For appliances older than 20 years, you must use the formula:

Derated efficiency = original efficiency x $(0.99)^{age}$

(See: DOE WPN 19-4 for more details)

APPENDIX E – Measure Skipping Guidance

MEASURE SKIPPING

"**Measure skipping**" is defined as follows: Not installing, in order of decreasing Savings to Investment Ratio (SIR), the cost-justified Energy Conservation Measures (ECMs) and related Incidental Repairs Measures (IRM) included in the work scope produced by the Department of Energy (DOE) approved energy audit tool or priority list.

"**Major Measure**" is defined as follows: A high priority measure, which if skipped, would result in "partial" weatherization of a unit. Major measures are as follows: air sealing, duct sealing of ducts outside the thermal boundary, attic insulation, wall insulation and floor or belly insulation.

Measure skipping of cost-justified major measures is not permitted at any time.

Alteration of the cost-justified work order must be addressed in the following ways:

Funding limitations: If all funds available to be spent on the job will not cover the entire work scope, then measures may be removed from the work order starting with the lowest SIR measure and working up the list from there. The work order must remain overall cost effective or the job must be deferred. Necessary Health and Safety (H&S) measures may NOT be removed from the work order; however, ECMs can be removed.

Prior to work beginning: Client education is important to inform a client of planned measures and material use. Resistance from a client to install any measures and/or materials planned for an energy audit directed work order or priority list should be addressed with either additional education and/or re-running the energy audit with a different - but acceptable - material to determine if the substitute material is cost-effective. If no cost-effective option for the material can be identified, the auditor should again explain and discuss the situation with the building owner or occupant. If the building owner or occupant still declines a measure, not defined as a major measure, **the auditor must include in the client file a comprehensive justification, including background/source documents that support the decision to skip a specific measure**. All other weatherization measures must be installed**. If the auditor cannot access background/source documents that justifies the building owner/occupant's decision to decline a measure or the measure is defined as a "major measure,"** the situation must be fully documented in the client file and the job must be deferred due to client refusal.

Inadequate training: A lack of training for Subgrantees is not an allowable reason to skip measures. Standard procedure should be to postpone job(s) requiring priority measures that cannot be installed due to lack of trained staff until adequate training is acquired. After a job has begun: Due to scheduling, measures are sometimes installed with a lower priority first. If during the installation process, the client declines a higher priority measure, work must stop at the time the client declined the higher priority measure. No further installations are allowed and the job must be inspected by a Quality Control Inspector (QCI) and closed out as a completed unit. This should be clearly explained in client file documentation. Some agencies include a statement for client signature that states the client is aware and accepts all WAP rules, including the specific services and measures determined by an energy audit.

A General Heat Waste (GHW) measure, as previously approved in the Grantee's energy audit, may be skipped for any documented reason (including declined by client). GHW measures are not prioritized by the energy audit tool. The measures may be at the top of an approved priority list; however, there is no strict prohibition from skipping an individual GHW measure. If a Grantee chooses to include ECMs in the SIR calculations that could have been approved as GHW, then the prioritized measure must be treated as other prioritized measures and skipping is not allowed.

APPENDIX F – ASHRAE using RedCalc

ASHRAE 62.2 (Using RedCalc)

When you are done, print on paper or print as a PDF

Choose the best match weather station. Could be in another state.

Input # bedrooms plus 1 (or # of occupants, whichever is greater)

Input your <u>Target</u> **blower door (post WX), not the pre- blower door. Run this calculation again when you have the final** <u>Actual</u> **blower door result.**

You can input 50 here for a NEW ASHRAE fan that <u>will</u> **be installed if:**

(a) The fan can increase, when needed, to pull 50 CFM or more.
OR
(b) The fan has a flow rate of at least 20 CFM continuous

Check the box if the room has an operable window

Required Continuous fan flow rate

If you want to use a timer, input here the ACTUAL flow rate of the installed fan to discover its required run time per hour

Because the target rate is set at 15 CFM (the point at which no fan is needed), this tells us the minimum blower door at which no fan will be needed.

NOTE: A **half bath** is not counted as a bathroom for the purposes of 62.2. Even if there is a fan in it, neither the room nor the fan should be entered in the 62.2 calculation.

APPENDIX G - Resources

ONLINE RESOURCES

Weatherization Rules and Regulations Resources – Federal statutes that congress passed about WAP

Weatherization Program Notices and Memorandums – Guidance/instructions provided by DOE to help states follow the federal regulations and answer questions about them

Standard Work Specifications – Most recent specifications for installed weatherization measures

State Plan – Google search for link to most recent version

Audit Policies and Procedures – State Specific WAP Policy

WAP Field Guide – Technical manual for installing weatherization measures

ASHRAE 62.2-2016 RED Calc – Calculator for dwelling unit ventilation rate

Weatherization Assistant – Download the desktop version or request access to the online version. Also contains user manuals and online training

ANSI/BPI 1200-S-2017 Standard – Standard practice for basic analysis of buildings

EIA NJ Electric Prices – Statewide Annual Average

EIA Natural Gas Prices – Annual Average

EIA Heating Oil and LP Prices – Weekly Prices

NIST Energy Price Indices – Google search. Change to most recent year as needed and search. Select the first nist.gov link

Google Earth Pro Desktop – Free desktop version of Google Earth, useful for remote modeling or desktop reviews of audits

SketchUp Make 2017 – Free desktop version of SketchUp that has Match Photo feature

Google Earth/SketchUp for Wx Tutorial – Video tutorial for remote modeling of homes

Google Earth/SketchUp for Wx PowerPoint – Companion to the video tutorial

Refrigerator Database – Lookup information on refrigerators

HANCOCK™ SOFTWARE

SHELL (allowable H&S Measures)

Hazards to occupants & workers

(H&S) Asbestos Testing

(H&S) Asbestos Removal (LIHEAP ONLY)

(H&S) Asbestos Encapsulation

(H&S) Radon Repair (LIHEAP ONLY)

(H&S) Radon Testing

(H&S) Radon Mitigation System (LIHEAP ONLY)

(H&S) Lead Paint (RRP) Containment, Occupant Protections and Cleanup

(H&S) Lead Paint Testing

(H&S) Code Compliant Issues (ADD COMMENT)

(H&S) Removal of Pollutants (VOC's)

(H&S) Biological Hazard Removal (ADD COMMENT)

(H&S) Biological Hazard Repair (ADD COMMENT)

(H&S) Pest Removal

(H&S) Pest Barrier Repair

(H&S) Minor Carpentry Repair

(H&S) Space Heater Un-Vented Remove

Electrical Issues

(H&S) Construct Shielding for Knob and Tube Wiring

(H&S) Mitigate Knob & Tube Wiring & Upgrade (LIHEAP ONLY $2,500 limit)

(H&S) Lighting Fixture Repair

(H&S) Lighting Fixture Replace

(H&S) Electrical Junction Box Install

(H&S) Junction Box Cover Install

(H&S) Electrical Outlet/Switch Plate Install

(H&S) Electric Upgrades (ADD COMMENT)

HIP (allowable H&S Measures)

Fuel Issues

(H&S) Oil Filter Replace

(H&S) Oil Line Repair/Replace

(H&S) Fuel Oil Pump Replace

(H&S) Oil Tank Replacement (Above Ground Only)

(H&S) Gas Pipe Repair

(H&S) Gas Pipe Replace

(H&S) Propane Tank Replace

Operational Issues

(H&S) Heating Repair (ADD COMMENT)

(H&S) Clean and Tune (for CO abatement)

(H&S) Hot Water Tank Repair

(H&S) Refrigerant Recharge

(H&S) A Coil Replace

Spillage/Combustion Venting

(H&S) Air Filter Slot Cover Install

(H&S) Combustion Air Vent Install

(H&S) Mastic Air Sealing (Return Only)

(H&S) Zone Isolation for Natural-Draft Appliances

(H&S) Chimney Repair

(H&S) DHW Orphaned- Chimney Liner

(H&S) Chimney Liner Install

(H&S) Chimney Cap Install

(H&S) Heating Flue Pipe Repair/Replace

(H&S) DHW Flue Pipe Repair/Replace

Moisture Issues
(H&S) Gutter Down Spout Repair/Replace
(H&S) Downspout Ground Extension
(H&S) Gutter Repair/Replace
(H&S) Gutter Cleaning
(H&S) Roof Repairs   (Limit $2,500)
(H&S) Dehumidifier Install
(H&S) Moisture/Vapor Barrier (6 MIL)
(H&S) Sump Pump Install
(H&S) Sump Pump Replace
(H&S) Sump Pit Cap Install
(H&S) DHW Water Lines Insulate (NON CONDITIONED AREA)
(H&S) Water Pipe Repair/Replace
(H&S) Plumbing Leaks Repair
(H&S) Window Well Dome
(H&S) Drain Line Clear
(H&S) Mold Remediation (LIHEAP ONLY/ Limit $2,500)

Safety Devices
(H&S) Smoke Detector Install
(H&S) C/O Detector Install
(H&S) Fire Extinguisher (Solid Fuel Only)
(H&S) Combo C/O Smoke Detector Install

Ventilation
(H&S) Insulate Exhaust Vent R-8 (Non Conditioned Area)
(H&S) Ventilate Kitchen Exhaust to Outside
(H&S) Ventilate Bathroom Exhaust to Outside
(H&S) Kitchen Exhaust (100 CFM on-demand)
(H&S) Bathroom Exhaust (50 CFM on-demand)
(H&S) Ventilation Replace Termination Fitting Backdraft Damper
(H&S) Exhaust Fan Motor Repair
(H&S) Clothes Dryer Vent Outside
(H&S) Dryer Vent Replace

Distribution Issues
(H&S) Blower Motor Replace
(H&S) Zone Valve Replace
(H&S) Circulation Pump Replace
(H&S) Boiler Leak Repair
(H&S) Steam System Repair
(H&S) Duct System Repair
(H&S) Electric Baseboard Replace
(H&S) Hydronic Baseboard Replace
(H&S) Radiator Replace
(H&S) Register Replace
(H&S) Cold Air Return Install
(H&S) In-door Return Air Pathway/Under-cut door

Safety Devices
(H&S) Smoke Detector Install
(H&S) C/O Detector Install
(H&S) Fire Extinguisher (Solid Fuel Only)
(H&S) Combo C/O Smoke Detector Install

Combustion Safety Components
(H&S) Back Flow Preventer Install
(H&S) Boiler Pressure Relief Valve Replace
(H&S) Boiler Pressure Relief Extension Pipe
(H&S) DHW Temp/Pressure Relief Valve Replace
(H&S) DHW TPRV Extension Pipe Install
(H&S) Mechanical Issues Repairs (ADD COMMENT)
(H&S) High Limit Switch Replace
(H&S) Fan Control Switch Replace
(H&S) Barometric Draft Regulator
(H&S) Transformer Replace (Oil)
(H&S) Pressure Reducer Valve Replace
(H&S) Air Filter Install
(H&S) Gas Burners Replace

ASHRAE 62.2 2016
(H&S) Bathroom Exhaust (Continuous based on ASHRAE)
(H&S) Kitchen Exhaust Install (Continuous based on ASHRAE)
(H&S) Fan Exhaust Timer Switch (used with ASHRAE 62.2 complaint fan)
(H&S) In-door Return Air Pathway/Under-cut door
(H&S) Whole Building Ventilation (Balanced)
(H&S) Whole Building Ventilation (Supply only)
(H&S) Whole Building Ventilation (Exhaust only)

Stoves/Ovens
(H&S) Replace Gas Stove (LIHEAP ONLY/Requires Monitor Approval)
(H&S) Replace Electric Stove (LIHEAP ONLY/Requires Monitor Approval)
(H&S) Gas Range Pilot light
(H&S) Gas Range Clean and Service (for CO abatement)
(H&S) Gas Range Burner Assemblies

Fuel Issues
(H&S) Oil Filter Replace
(H&S) Oil Line Repair/Replace
(H&S) Fuel Oil Pump Replace
(H&S) Gas Pipe Repair
(H&S) Gas Pipe Replace

Combustion Venting/Spillage
(H&S) Heating Flue Pipe Repair/Replace
(H&S) DHW Flue Pipe Repair/Replace
(H&S) Chimney Repair
(H&S) Chimney Cap Install
(H&S) Chimney Liner Install
(H&S) DHW Orphaned- Chimney Liner
(H&S) Air Filter Slot Cover Install
(H&S) Mastic Air Sealing (Return Only)
(H&S) Zone Isolation for Natural-Draft Appliances
(H&S) Combustion Air Vent Install

(H&S) Oil Filter Replace
(H&S) Thermostat Replace
(H&S) Low Water Cut Off Install
(H&S) Automatic Water Feeder Install
(H&S) Emergency Cut Off Switch Install
(H&S) Expansion Tank Replace
(H&S) Electric Upgrades (ADD COMMENT)

Replacement Units
(H&S) Central Air Conditioning Replace (Monitor Approval)
(H&S) Heating Repair (ADD COMMENT)
(H&S) Hot Water Heater Replace
(H&S) Well Pump Replace
(H&S) Well Pressure Tank Replace
(H&S) Oil Furnace Replace
(H&S) Gas Furnace Replace
(H&S) Heat Pump Replace
(H&S) Oil Boiler Replace
(H&S) Gas Boiler Replace
(H&S) Space Heater Vented Install (ONLY IF PRIMARY HEAT)

Hazards to occupants & workers
(H&S) Asbestos Removal (HIP ONLY)
(H&S) Code Compliant Issues (ADD COMMENT)
(H&S) Space Heater Un-Vented Remove
(H&S) Removal of Pollutants (VOC's)
(H&S) Biological Hazard Removal (ADD COMMENT)
(H&S) Biological Hazard Repair (ADD COMMENT)
(H&S) Pest Removal
(H&S) Minor Carpentry Repair

Cooling

(H&S) Replace Room Air Conditioner (ONLY IF MEDICALLY NECESSARY)

Combustion Safety Components

(H&S) Mechanical Issues Repairs (ADD COMMENT)

(H&S) Hot Water Tank Repair

(H&S) Air Filter Install

(H&S) Hot Water Heater Replace

(H&S) Back Flow Preventer Install

(H&S) Boiler Pressure Relief Valve Replace

(H&S) Boiler Pressure Relief Extension Pipe

(H&S) Clean and Tune (for CO abatement)

(H&S) High Limit Switch Replace

(H&S) DHW Temp/Pressure Relief Valve Replace

(H&S) DHW TPRV Extension Pipe Install

(H&S) Fan Control Switch Replace

(H&S) Barometric Draft Regulator

(H&S) Transformer Replace (Oil)

(H&S) Pressure Reducer Valve Replace

(H&S) Gas Burners Replace

(H&S) Thermostat Replace

(H&S) Low Water Cut Off Install

(H&S) Automatic Water Feeder Install

(H&S) Emergency Cut Off Switch Install

(H&S) Expansion Tank Replace

(H&S) Heating Repair (ADD COMMENT)

Distribution Issues

(H&S) Zone Valve Replace

(H&S) Circulation Pump Replace

(H&S) Duct System Repair

(H&S) Boiler Leak Repair

(H&S) Steam System Repair

(H&S) Register Replace

(H&S) Blower Motor Replace

(H&S) Cold Air Return Install

APPENDIX I – Minimum Photo Requirements

Minimum Photo Requirements

Pro Tips:
• Use a good smartphone camera, and check each photo for good focus and exposure
• A selfie stick can be very helpful for getting hard-to-reach photos of roofs, attics, and foundations
• Step back and capture as much as possible in each photo – stand on the opposite side of the street, the back corners of the yard, or opposite corner of the room from what is being photographed
• Take several photos of the data plates and testing equipment from different angles to make sure there are legible photos showing all the needed info

Each single-family dwelling unit initial audit documentation shall contain legible digital photos of:

- Each entire side of the home exterior, including the roof and any chimney (if existing)
- Close-up of any windows or doors considered for replacement/repair
- Close-up of any other exterior measures to be addressed, e.g., ventilation terminations
- Foundation, showing:
    - Each accessible sub-space
    - Sub-space access
    - Any existing insulation (if visible), and any voids
- Attic, showing:
    - Each accessible attic-space
    - Attic access
    - Any existing insulation, average depth measurement, and any voids
- HVAC Data Plates & Equipment
- Water Heater Data Plate & Equipment
- Refrigerator Data Plate & Equipment
- Refrigerator Meter (if the unit is older than 10 years, or door seal in poor condition), showing:
    - Metering Minutes
    - KW Used
    - Peak Watts
- All Diagnostic Testing/Equipment, including:
    - Worst Case Depressurization of CAZ WRT Outside (if there is a CAZ)
    - Steady State Combustion Analysis on each combustion appliance (if any), showing:
        - Fuel Type
        - Stack Temperature
        - Steady State Efficiency
        - Carbon Monoxide
    - Blower Door Measurement/Setup
    - Zonal to Attached Garage (if any)
    - Pressure Pan Measurements (if there are ducts)
    - Duct Blower Measurements/Setup (if pressure pan numbers over 1 Pa), including:
        - Total Leakage
        - Leakage to Outside
- Any other building component/appliance/venting to be addressed in the work order, e.g., a drywall repair
- Any physical evidence documenting the reason for a deferral (if being deferred without confrontation)

APPENDIX J – Minimum Drawing Requirements

Minimum Drawing Requirements

Pro Tips:
• Google Earth and Street View can be helpful for verifying some building measurements, but onsite measurements are best
• Use SketchUp or similar software to improve the legibility and accuracy of drawings – the Match Photo feature can be very helpful when there are good photos to work with
• MS Paint is an easy software to use for labeling drawings exported from SketchUp

Each dwelling unit initial audit documentation shall contain a drawing that reasonably represents the footprint of each level, detailing:

- Wall dimensions of thermal boundary
- Orientation
- Window and door location
- All building components in drawing clearly labeled as they are in the NEAT/MHEA Audit

Minimum Quality:
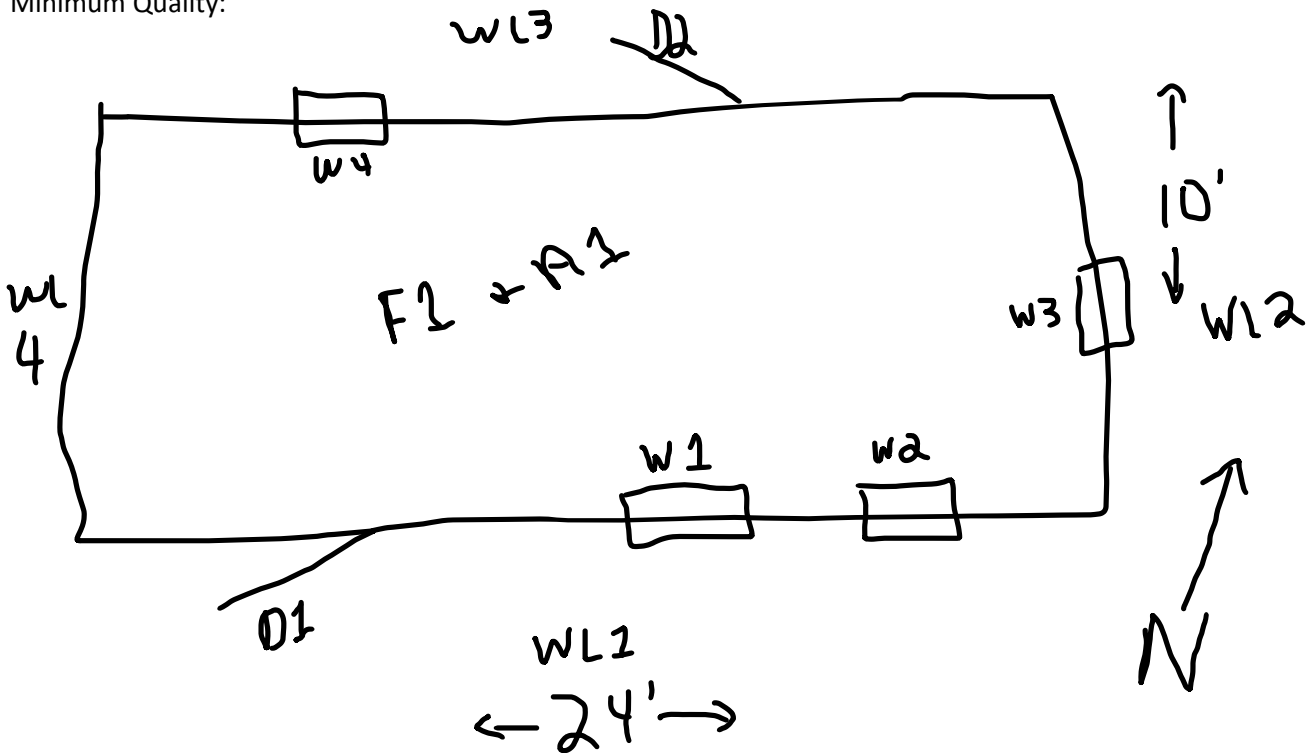
APPENDIX K – Minimum Work Order and Invoice Requirements

Minimum Work Order and Invoice Requirements

Recommended Measures	Work Orders	Invoices
List of all Measures in Package, including IRM, ECM, and H&S	List of Measures from Recommended Measures	List of Measures from Work Orders
Measure Costs	Material Quantities for each measure	Material Quantities and Costs detailed for each measure
Measure Savings	Targets for Air Sealing/Duct Sealing	Labor Costs detailed for each measure
Measure & Package SIR	Signature of Work Provider	Measure Costs equal to or less than those in Recommended Measures

All three documents are similar and build off each other, but they each have their own distinct purpose:

- Recommended Measures provide cost/savings analysis of the measures and package
- Work Orders provide the quantities of materials and necessary information for correctly installing each measure
    - *Best Practice – Don't make assumptions: provide a link to the SWS detail for each measure*
- Invoices provide material and labor costs for each measure