Who’s Here?

• Trainers
  – Ivan Karnes
  – Ben Tucker

• Who is here?
  – Crews, Auditors, Inspectors, Others?

• Experience with Weatherizing Mobile Homes?
Materials

• Draft Mobile Home Site Assessment Guidance
• Draft Mobile Home Duct Leakage Modeling Guidance
• Sample Mobile Home Information
• Floor Repair Modeling Tool
• Mobile Home Air Leakage
• Mobile Home Duct Leakage Locations
• CAZ Definitions—BPI.org
• HVAC and Ductwork Diagrams
Session Goals

• Why MHEA?
  – MHEA’s place in the weatherization process
  – MHEA and conference content

• MHEA Methods
  – Modeling in the Audit
  – Changes
    • Belly Repair and Insulation
    • Duct Sealing
    • Duct Pressure Testing
  – NEAT and MHEA Differences
Agenda

• WA Overview
• MH Site Assessment
• MHEA modeling
  – MHEA Audit
    • Building shell
    • Heating Plant
    • Ducts and Infiltration
  – Mobile home belly repair
  – Mobile home duct sealing
  – Minor Portions of
    • Work orders
    • Libraries
• Questions and Feedback
Weatherization Assistant Overview

• References
  – Oak Ridge National Labs
    • WA Manual (March 2015)
    • Online training
      – Tells how the software works
  – Commerce
    • Minnesota Addendum
      – Clarifications and additions
Weatherization Assistant Overview

• WA Manual Addendum
  – Not a substitute for the manual
  – Additions, clarifications, and omissions
  – Read and understand the manual
Weatherization Assistant Overview

• What is Weatherization Assistant?
  – Energy modeling and Measure Selection tool
  – Data management
  – Access based “energy modeling engine”
  • Spread Sheets
Weatherization Assistant Overview

• What is Weatherization Assistant?
  – NEAT
  – MHEA
  – Libraries, set up/ supply
    • Accurate costs
# How WA Calculates SIRs

## Energy Saving Measure Economics

<table>
<thead>
<tr>
<th>#</th>
<th>Recommended Measure</th>
<th>Components</th>
<th>Measure Savings ($/yr)</th>
<th>Measure Cost ($)</th>
<th>Measure SIR</th>
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<tbody>
<tr>
<td>1</td>
<td>Fix roof leak</td>
<td></td>
<td>0</td>
<td>180</td>
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<tr>
<td>2</td>
<td>General Air Sealing</td>
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<td>155</td>
<td>250</td>
<td>6.0</td>
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<tr>
<td>3</td>
<td>Setback [heating]</td>
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<td>53</td>
<td>75</td>
<td>9.9</td>
</tr>
<tr>
<td>4</td>
<td>Roof Cellulose Loose</td>
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<td>282</td>
<td>701</td>
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<tr>
<td>5</td>
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<tr>
<td>7</td>
<td>Belly Fiberglass Loose</td>
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<td>76</td>
<td>555</td>
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<tr>
<td>8</td>
<td>Refrigerator Replacement</td>
<td></td>
<td>65</td>
<td>620</td>
<td>1.2</td>
</tr>
<tr>
<td>9</td>
<td>Fix Wiring Problems (Attic)</td>
<td></td>
<td>0</td>
<td>120</td>
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How WA Calculates SIRs

- **CFR 440.21 (e)** The energy audit procedures must assign priorities among individual weatherization materials in descending order of their cost-effectiveness.
How WA Calculates SIRs

• Understanding WA to make WA work for us
  – Ie. Interactivity “NEAT and MHEA evaluate the interaction between efficiency measures (e.g., since insulation reduces the amount of energy needed for space heating, it also reduces the energy savings from a space-heating system replacement). pg. 1-4 and Chapter 12 Page 4
# How WA Calculates SIRs

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**How WA Calculates SIRs**

- **Required Air/ducts**
- **SIR**
- **Other**
WA’s Place in Weatherization

Documentation Standards

• **Data Accuracy**
  – Ensure accurate energy modeling
  – Contractors and crews perform work efficiently and effectively.

• Standards
  • Nearest half foot for house dimensions
  • Nearest foot for door area
  • Nearest inch on windows and door dimensions
WA’s Place in Weatherization

Site Drawing Requirements

• Attic, Foundation and Wall dimensions
• Attic, Foundation and Wall Square footage calculations
• Information that affects scope of work
• Information needed by crews or contractors
WA’s Place in Weatherization

Documentation Standards

• Sufficient Documentation:
  – Conditions relevant to scope of work.
  – Contractors and crews understand
    • Scope of work
    • Required materials
  – Avoid duplication of effort *whenever possible.*
WA’s Place in Weatherization

Documentation Standards

• Program Compliance:
  – Work completed according to MNWAP Policy
Agenda

• WA Overview
• MH Site Assessment
• MHEA modeling
  – MHEA Audit
    • Building shell
    • Heating Plant
    • Ducts and Infiltration
  – Mobile home belly repair
  – Mobile home duct sealing
  – Minor Portions of
    • Work orders
    • Libraries
• Questions and Feedback
Can this MH be Weatherized?
Mobile Home Site Assessment

SWS 2.0402.2 calls for a moisture and installation site assessment

- Moisture Assessment
  - Standing Water
  - Positive Grade
  - Condition of Gutters
  - Vegetation/Shrubbery

- Installation Assessment
  - Settling of the home
  - Leveling of the home
  - Organic materials
  [DLI MH Bulletin #44]

Can weatherization proceed without deferral?

Can weatherization proceed without deferral? See SWS 2.0111.5
Mobile Homes Site Assessment

• Draft Site Assessment Policy
  – Follows SWS and DLI Guidance
  – Please send us feedback by 6/6/16

• Relates to Deferral Policy
  – Change in the Draft State Plan
    • Must Defer if the condition of the structure would make weatherization impossible or impractical (e.g. inability to meet SWS)
Mobile Home Site Assessment

• **Service Providers must defer:**
  – The condition of the structure would make weatherization impossible or impractical (e.g. inability to meet SWS)

• **Service Provider may defer:**
  – The building structure or its mechanical systems, including electrical and plumbing, are in such a state of disrepair that failure is imminent and the conditions cannot be resolved cost effectively.
  – Moisture problems are so severe they cannot be resolved under existing health and safety measures and with minor repairs.
  – In the judgment of the energy auditor, any condition exists which may endanger the health and/or safety of the work crew or subcontractor, the work should not proceed until the condition is corrected.
“Used manufactured homes (single and multi-section) may be installed without frost depth footings even if frost depth footings were required in the manufacturer’s installation manual.”
Mobile Home Site Assessment

**SWS 2.0402.2**

- Installer pre-work assessment will determine:
  - Standing water
  - Positive grade/drainage
  - Conditions of gutter system
  - Vegetation/shrubbery
  - Settling of home
  - Leveling of home
  - Ensure no organic material is under the supports, including topsoil and roots
Mobile Home Site Assessment

**SWS 2.0111.5**

a. Any installation deficiencies that may affect worker safety or integrity or installed measures will be repaired before starting work
Mobile Home Site Assessment

Minnesota is asking for a Variance for

**SWS 2.0403.4**

• a. If existing conditions of the ground and skirting mandates, a moisture barrier that covers the crawl space ground will be installed with allowances for structural supports (piers) and accessibility.
# Mobile Home Site Assessment

## Allowable Measures Chart

<table>
<thead>
<tr>
<th>ACTIVITY/MEASURE NAME</th>
<th>PREFERRED (1st choice)</th>
<th>ACCEPTABLE (2nd choice)</th>
<th>LEAST DESIRABLE (3rd choice)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulate from exterior of the home</td>
<td>Insulation</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Seal air leakage.</td>
<td>Air sealing</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Raise/change exterior grade.</td>
<td>HSM</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Structural repair or manufactured home raising or leveling</td>
<td>NOT ALLOWED</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Must have prior approval for raise/change exterior grade.
## Mobile Home Site Assessment

### Allowable Measures Chart

<table>
<thead>
<tr>
<th>ACTIVITY/MEASURE NAME</th>
<th>PREFERRED (1st choice)</th>
<th>ACCEPTABLE (2nd choice)</th>
<th>LEAST DESIRABLE (3rd choice)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repair mobile home belly.</td>
<td>Air Sealing</td>
<td>Insulation</td>
<td>IRM</td>
</tr>
<tr>
<td>Insulate mobile home belly.</td>
<td>Insulation</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Insulate floor of stick built mobile home addition.</td>
<td>Insulation</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Install poly underneath a mobile home.</td>
<td>NOT ALLOWED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Install/repair skirting on mobile home or addition to mobile home.</td>
<td>NOT ALLOWED</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Mobile Home Site Assessment

SWS 2.0402.2 calls for a moisture and installation site assessment

- Moisture Assessment
  - Standing Water
  - Positive Grade
  - Condition of Gutters
  - Vegetation/Shrubbery

- Installation Assessment
  - Settling of the home
  - Leveling of the home
  - Organic materials
  [DLI MH Bulletin #44]

Can weatherization proceed without deferral?

Can weatherization proceed without deferral? See SWS 2.0111.5
Agenda

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• Questions and Feedback
MHEA Modeling
MHEA Modeling—Questions

• Time is limited
  – Data entry questions—OK
  – Policy Discussions—Another Time
  • Please write other questions on feedback form
MHEA Modeling

• Data Plate
  – Age
  – Wall insulation R value
  – Attic insulation R value
  – Floor insulation R value
MHEA Modeling – Floor

• New Method from Oak Ridge National Labs
  – Replaces Current Method
  – New Method
    • Tested and defensible
    • Accurate energy modeling
    • Cost correction required
      – We need: square feet of belly repair vs.
      – MHEA gives us: amount of insulation blown into entire belly in bags
MHEA Modeling – Floor

• Data Plate
  – Total R value of floor
  – R value per inch of the existing material

• Total square footage of the floor (Length, Width)
  – MHEA assumes half wing, half belly

• Total square footage of damaged floor
  – Wing
  – Center

• Total cost per square foot of floor repair
  – Wing
  – Center
### MHEA Floor Repair Modeling Tool

#### Mobile Home Details

<table>
<thead>
<tr>
<th>Mobile Home Details</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of mobile home (ft)</td>
<td>50</td>
</tr>
<tr>
<td>Width with of mobile home (ft)</td>
<td>14</td>
</tr>
<tr>
<td>R-value of the undamaged area</td>
<td>19</td>
</tr>
<tr>
<td>R-value of existing insulation (R/inch)</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Averaged Insulation

<table>
<thead>
<tr>
<th></th>
<th>Belly</th>
<th>Wing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damaged area (sqft)</td>
<td>56</td>
<td>20</td>
</tr>
<tr>
<td>Averaged insulation (R-value)</td>
<td>14.6</td>
<td>19.1</td>
</tr>
<tr>
<td>Averaged insulation (inch)</td>
<td>3.5</td>
<td>5.0</td>
</tr>
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</table>

#### Cost Information

<table>
<thead>
<tr>
<th>Cost Information</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost/sqft of repair and insulation ($)</td>
<td>$5.00</td>
</tr>
<tr>
<td>Total cost of repair ($)</td>
<td>$380.00</td>
</tr>
</tbody>
</table>
Duct Sealing Modeling

Evaluate Duct Sealing: Yes

Duct Leakage Method: Pressure Pan Measurements

Whole House Blower Door Measurements:
- Before Weatherization (Existing):
  - Air Leakage Rate (cfm): 3000
  - at House Pressure Difference (Pa): 50
- After Weatherization (Target or Actual):
  - Air Leakage Rate (cfm): 1500
  - at House Pressure Difference (Pa): 50

Duct Operating Pressures:
- Before Duct Sealing: Supply (Pa) 35
- After Duct Sealing: Supply (Pa) 40

Pressure Pan Measurements:
- Before Duct Sealing: Sum of Pressure Pan Measurements (Pa) 20
- After Duct Sealing: Sum of Pressure Pan Measurements (Pa) 6
Duct Sealing Modeling

• **Sum of Pressure Pan Measurements**
  – Blower Door, Pressure Pan, Manometer
  – Post Duct Sealing Goal: The number of ducts x 1.0

• **Supply Duct Operating Pressures**
  – A total of four register readings *per trunk*
    • At the farthest ends of the trunk line
    • Closest to the furnace on either side
  – Long static pressure probe, Manometer
  – After Duct Sealing Goal: Add 5 PA to the pre-weatherization duct operating pressure.
Questions and Feedback

weatherization.commerce@state.mn.us
Thank You

weatherization.commerce@state.mn.us