



ENERGY STAR HVAC Quality Installation

An Opportunity for Program Savings

AESP Spring Implementation Conference
May 6, 2008

Presented by Ted Leopkey, ENERGY STAR Residential Branch

Why EPA is Involved?

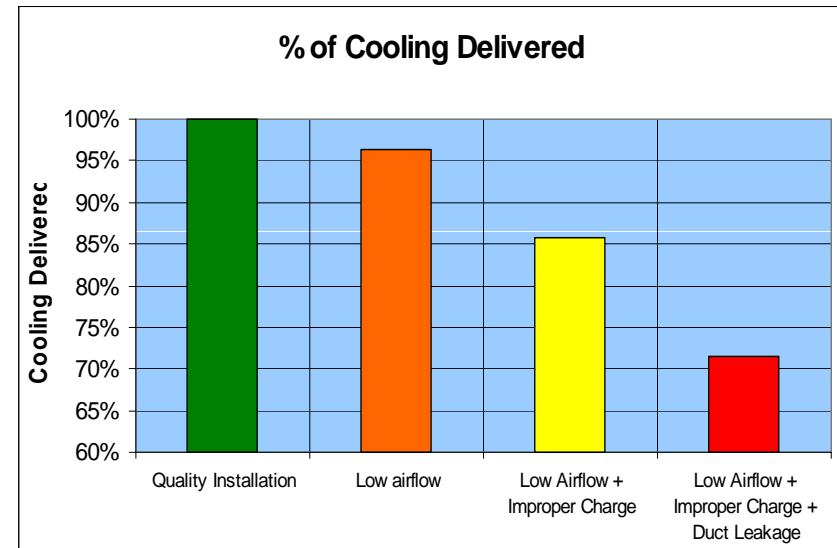


- Studies show that half of all air conditioners in U.S. homes perform poorly due to one or more installation issues.
- Raise consumer awareness on the importance of QI and meet expectations
- The ENERGY STAR Brand can influence consumer choices
- NAECA SEER requirements have reduced the energy savings potential from promoting high-efficiency equipment. The ENERGY STAR HVAC QI program provides an opportunity for additional kW and kWh savings.

Potential Losses Caused by Poor Installation



- **Air Flow over Indoor Coil**
 - *(70% inadequate)*
- **Refrigerant Charge**
 - *(62% improperly charged)*
- **Equipment Sizing**
 - *(50% oversized)*
- **Duct Leakage is significant**
 - *(Total leakage averaged 35% in the pilots)*



Source: C. Neme, J. Proctor, S. Nadel, *National Energy Savings Potential from Addressing Residential HVAC Installation Problems*, 1999

Installation issues may reduce capacity by up to 30 percent!
Or put another way...

a SEER 13 performs like a SEER 10

Benefits of Promoting QI



Residential Building Permits Issued in Selected Texas Metropolitan Areas* and Texas, 2004 - 2007 (continued)

| Year | Month | Austin | | Dallas | | Fort Worth | | Houston | | San Antonio | | Texas | |
|------|-------|---------------|-------------|---------------|-------------|---------------|-------------|---------------|-------------|---------------|-------------|---------------|-------------|
| | | Single family | Total units | Single family | Total units | Single family | Total units | Single family | Total units | Single family | Total units | Single Family | Total units |
| 2007 | Jan | 828 | 1,136 | 1,563 | 2,731 | 931 | 1,261 | 3,180 | 4,623 | 745 | 776 | 9,381 | 13,120 |
| | Feb | 1,149 | 1,755 | 1,511 | 2,554 | 812 | 1,124 | 3,440 | 5,146 | 855 | 1,720 | 10,243 | 15,676 |
| | Mar | 1,388 | 1,453 | 1,778 | 2,464 | 1,088 | 1,502 | 4,376 | 6,554 | 891 | 1,075 | 12,406 | 16,414 |
| | Apr | 1,281 | 1,360 | 1,871 | 2,032 | 964 | 1,344 | 3,491 | 4,126 | 795 | 1,443 | 11,074 | 13,769 |
| | May | 1,330 | 1,931 | 1,792 | 2,429 | 930 | 1,154 | 3,752 | 5,441 | 810 | 1,151 | 11,465 | 16,006 |
| | Jun | 1,145 | 1,200 | 1,793 | 3,514 | 869 | 1,272 | 3,292 | 6,007 | 711 | 806 | 10,214 | 15,822 |

The U.S. Census Bureau estimates that 3% of HVAC units fail each year.

Air Conditioning = Peak Load

Improperly sized and installed equipment can be a burden for 10-15 years

Estimated Energy Savings



| | Per House |
|---|------------------|
| Annual energy savings (KWh) | 1300 - 1900 kWh |
| Estimated peak electricity demand savings (KW) | 1 - 1.3 KW |

Assumptions:

New system corrects typical install problems

- Duct leakage reduced from 35% to 20%
- Duct insulation increased from R2 to R6
- Proper charge
- Proper airflow
- Proper sizing

Customer Savings



| Location | 13 SEER Annual Operating Cost | 30-percent Savings from QI | QI Savings over 5 Years |
|-----------------|-------------------------------|----------------------------|-------------------------|
| Boston, MA | \$266 | \$80 | \$400 |
| Washington, DC | \$291 | \$87 | \$435 |
| Dallas, TX | \$605 | \$182 | \$908 |
| Los Angeles, CA | \$375 | \$112 | \$562 |
| Miami, FL | \$875 | \$262 | \$1313 |

* Savings based on state average retail price of electricity (Source: EIA)

Program Scope



- Residential installations
- New and replacement systems
- Central air conditioning and air-source heat pump with rated capacity up to 65,000 BTU/H
- Homes with multiple systems must verify each unit separately
- ENERGY STAR qualified equipment encouraged

ENERGY STAR HVAC QI Guidelines



- Installations under the program must meet the ANSI/ACCA HVAC Quality Installation Specification
- The QI Specification identifies consensus requirements associated with quality installations.



Verification



Level 1 Verification:

Data review of Manual J calculations and commissioning report. The data review will include confirming that all required installation elements were performed using an approved method and check for data inconsistencies

Level 2 Verification:

In-field verification of the installation that follows established protocols.

**ENERGY STAR in Cooperation with TXU Electric Delivery
Installation Pilot Commissioning Report**

Date: _____ Time: _____

Site Information

Address 1: _____
Address 2: _____
City: _____ State: _____ Zip: _____

Design

Heat Gain Method: Manual J v7 Manual J v8 None Other (specify): _____
Duct Design Method: Manual D None Other (specify): _____
Equipment Specification method: Manual S OEM Recommendation Other (specify): _____

Latent Heat Gain: _____ RTU h Sensitive Heat Gain: _____ RTU h
Total Heat Gain: _____ BTUh Design Airflow: _____ CFM
Duct Design Static Pressure: _____ IWC
Type of Installation: Replacement New System - Existing Home New System - New Home
Square Feet of Zone: _____ sqft

Equipment

Condenser: Manufacturer: _____ Model: _____
Serial Number: _____
Evaporator: Manufacturer: _____ Model: _____
Serial Number: _____

System

Metering Device: TXV Fixed Orifice Other (specify): _____
Refrigerant: R-22 R-410a Other (specify): _____
Refrigerant Charge Goal (for TXV): _____ Subcooling _____ Approach (for Lennox only)
Fan Motor Type: Fixed Speed (e.g. PSC) Variable (e.g. GE - ECM)
Latent Capacity: _____ BTUh Sensible Capacity: _____ BTUh
Total Capacity: _____ BTUh
ARI EER/SEER: _____ (14 or higher) ARI Ref #: _____

Air Flow Tests

Static Pressure: Return Static _____ IWC Supply Static _____ IWC
Measured Air Volume @ evaporator: _____ CFM
Volume Measurement Method Used: TrueFlow Anemometer Pressure Matching (w/ Duct Blaster) Other: _____

Evaporator/Air Handler Fan Power: Pre: _____ Amps _____ volts _____ watts
Post: _____ Amps _____ volts _____ watts
Condenser Fan Power: Pre: _____ Amps _____ volts _____ watts
Post: _____ Amps _____ volts _____ watts
Compressor Power: Pre: _____ Amps _____ volts _____ watts
Post: _____ Amps _____ volts _____ watts

Speed Setting: Fixed: Low Med-Low Med Med-High High CFM (for setting): _____
OR
Speed Setting: Variable: Fan set for: _____ CFM

Please mail completed forms to: Siobhan Steyn at The Cadmus Group Inc., 57 Water St, Watertown, MA 02472
or fax: (617) 673-7310 or email: ssteyn@cadmusgroup.com

Verification



➤ Costs

- In-field verifications cost approximately \$300 per system
- Costs could decrease with the use of an automated remote verification systems (i.e. Checkme, Enalasy, Testo)
- Verifications costs are paid by the program administrator
- Contractors cannot self verify

➤ Challenges

- Scheduling second visit with homeowners
- Verification should occur soon after system start up
- Verification measurements on the borderline of the allowed tolerance

Understand Your Market



- Asses your Market
- Select a pilot market to launch program
- Developing a marketing plan

Develop Policies and Procedures



- Strategy to recruit contractors and verifiers to participate
 - Training, incentives, or equipment
 - Find leading contractors, engage them early
- Contractor participation agreement
 - Eligibility criteria, expectations/goals, reporting, and logo use
- Contractor reporting and quality assurance procedures
 - Commissioning report and verification

Partner with ENERGY STAR



- Implementation guide
- Marketing material
- Sample commissioning and verification reports
- Certificate
- Training for participating contractors
- Well known Energy Star brand



Utility Role and Benefits



➤ Roll

- Manage program
- Train and mentor qualified contractors
- Ensure installations meet program standards
- Issue ENERGY STAR certificates to homeowners
- Track and evaluate program success
- Report data to EPA

➤ Benefits

- Long term KW Savings
- Savings over rebate only program structure
- Actual verification of program effectiveness

Contractor Role and Benefits



➤ Role

- Commit to program specs
- Market program to customers
- Collect data and allow verification
- Train technicians

➤ Benefits

- Increased customer satisfaction and reduced call backs
- Potential financial incentive
- Company differentiation
- Training opportunities
- Opportunities to sell add-ons or upgrades such as high SEER equipment, programmable thermostats, duct repairs, IAQ products, etc.

Contact Information



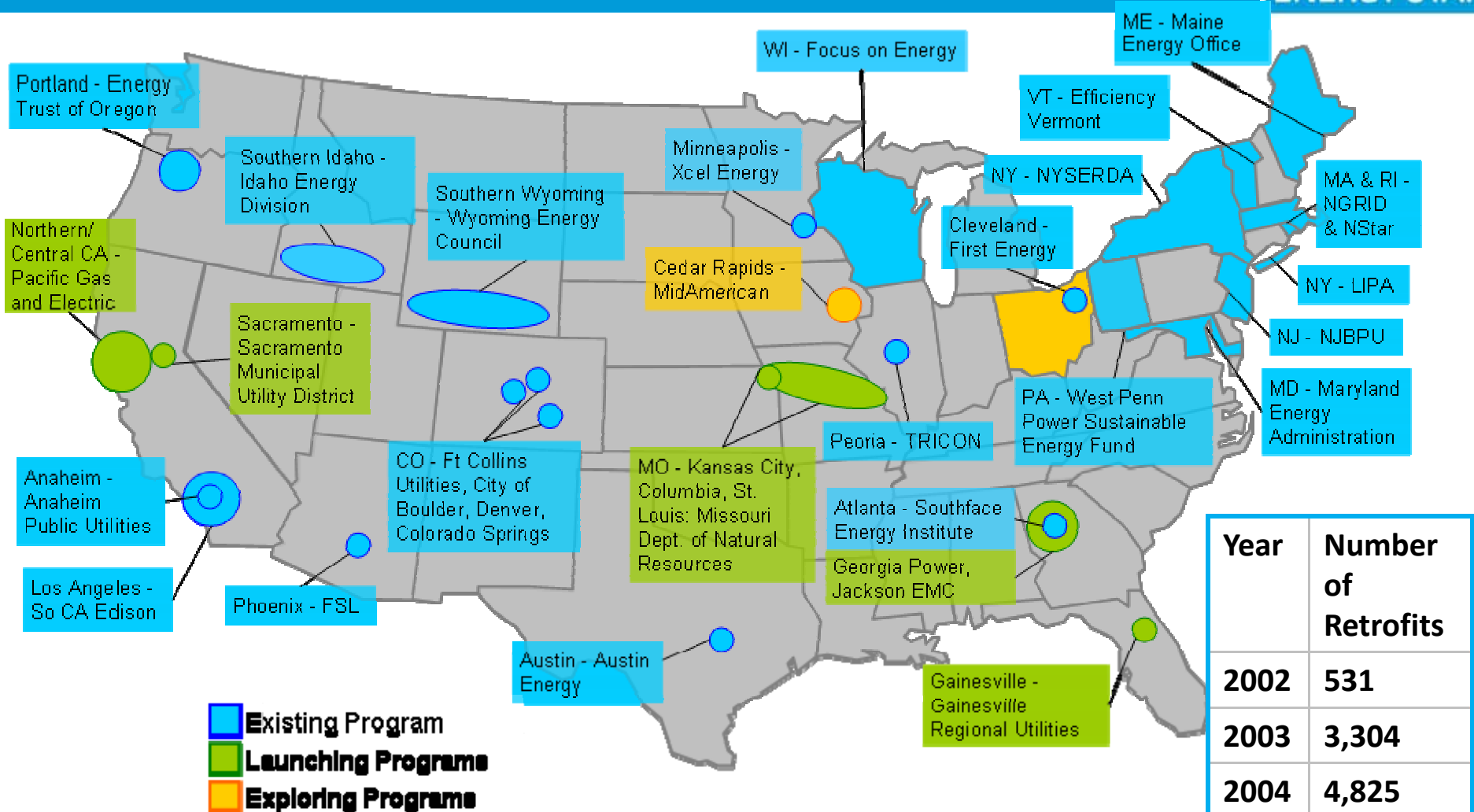
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Where is National HPwES Activity?



| Year | Number of Retrofits |
|------|---------------------|
| 2002 | 531 |
| 2003 | 3,304 |
| 2004 | 4,825 |
| 2005 | 6,947 |
| 2006 | 10,455 |

Pilot Results - Sizing



➤ Results

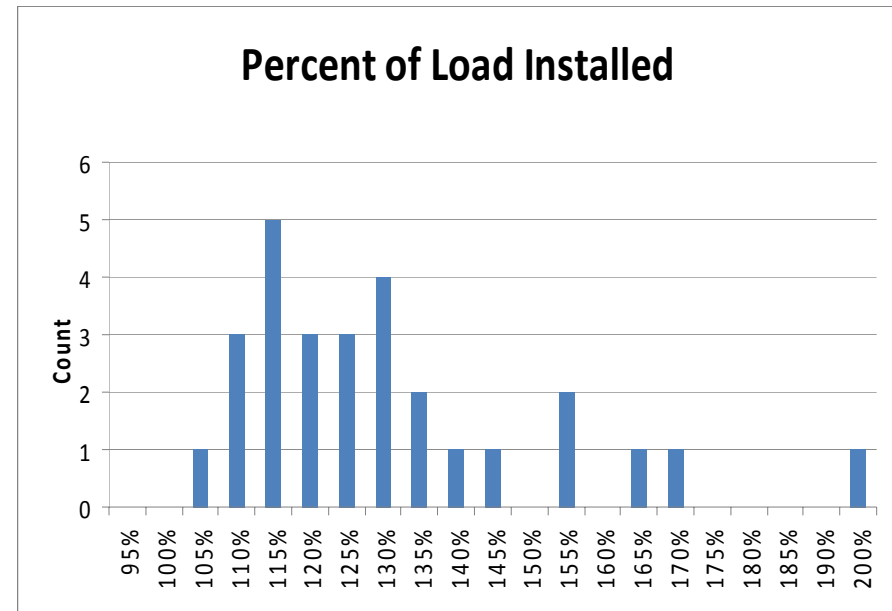
- Replacement units were typically 0.5 to 1.0 tons smaller but still oversized per the guidelines

➤ Issues

- Sizing is essentially self reporting (difficult to verify)
- 1% design temperatures

➤ Strategy

- Focus on downsizing
- Allow for micro climate design temperatures
- Manual J training is an entry requirement



Pilot Results - Charge



➤ Results

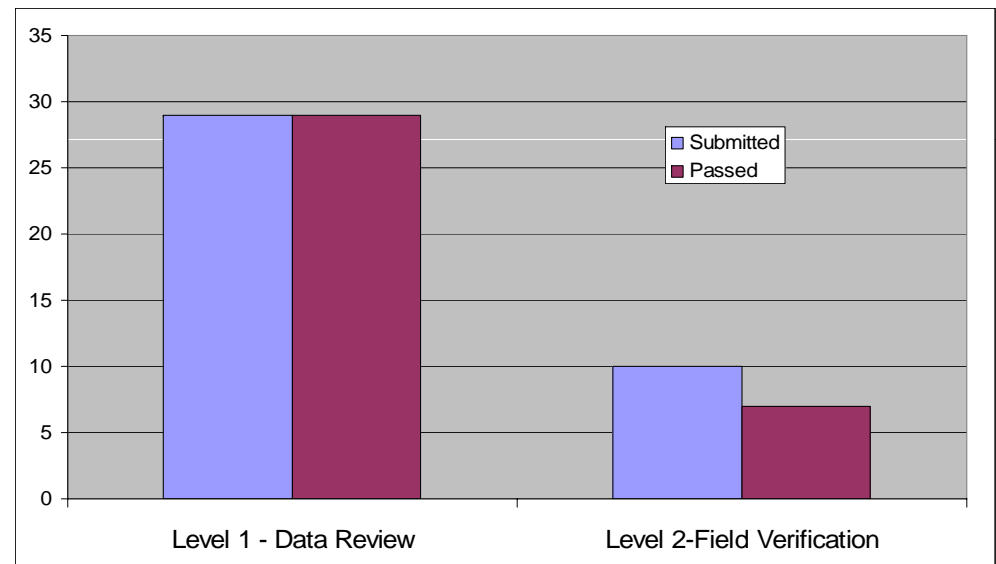
- 70% of verified sites passed in-field verification

➤ Issues

- Timeliness of verification (leaks)
- Gauge calibration

➤ Strategy

- Educate participants on the importance of calibration and make it part of the entry training



Pilot Results – Air Flow



➤ Results

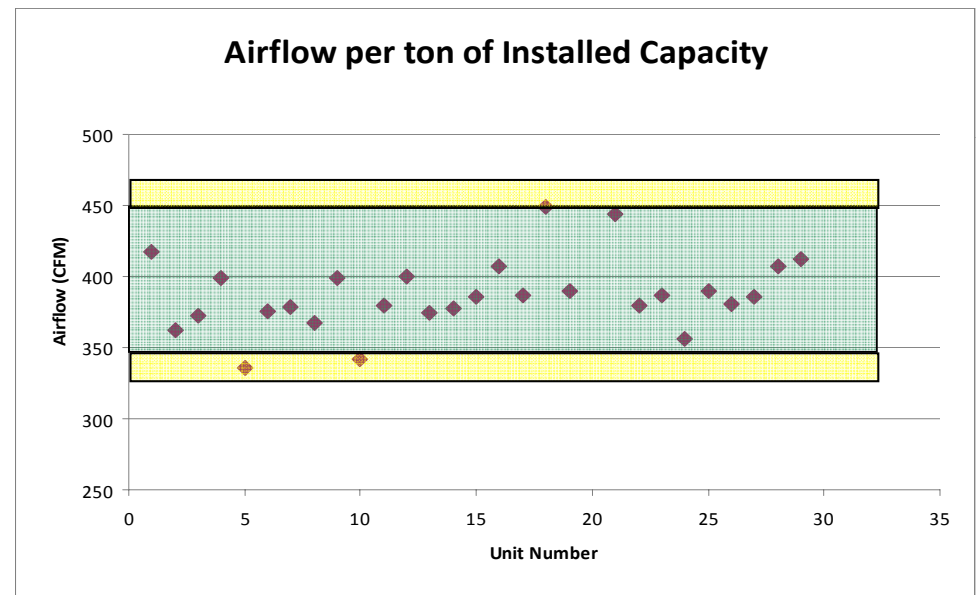
- 90% of verified sites passed the in-field verification

➤ Issues

- Guidelines are not standard practice
- Lack of proper equipment

➤ Strategy

- Approved air flow technique training is an entry requirement
- Verifier should use same method to ensure consistency



Pilot Results – Duct Leakage

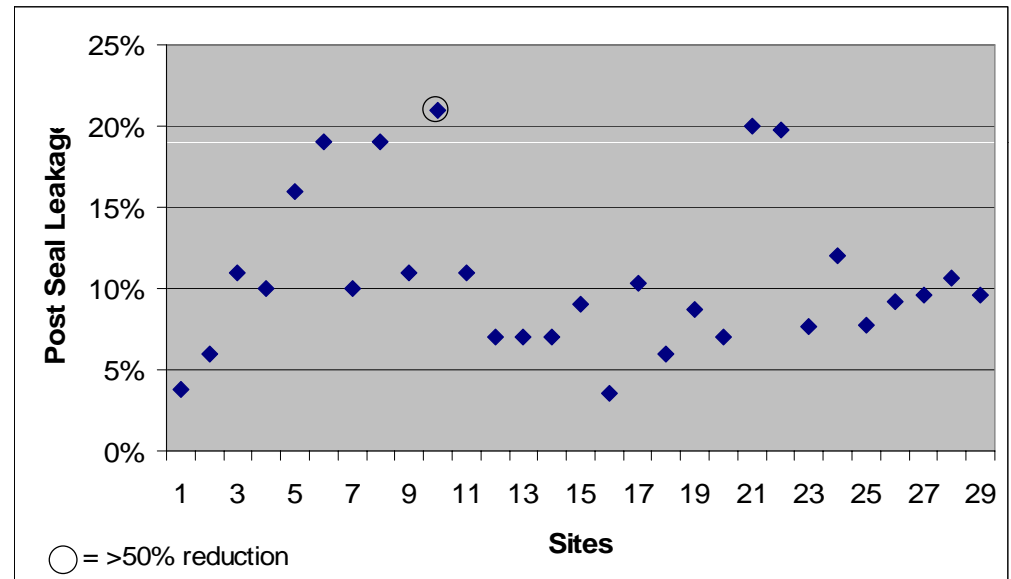


➤ Results

- 100% of verified sites passed in-field verification

➤ Issues

- Standard practice in parts of TX and CA but not elsewhere
- Duct system may need major repair which is expensive



Sampling Rates



Program requirements:

- **All sites receive a Level 1 verification**

- **Level 2 verification sampling protocols:**
 - Phase 1 - Level 2 verification protocols will be conducted on 3 of the first 5 installations submitted by a new contractor participant.

 - Phase 2 – Level 2 verification protocols will be conducted on 20% of the next 25 installation submittals.

 - Phase 3 – After successful completion of Phase 1 and 2 the partner may use Level 2 verification protocols at a rate of 5%.