



This Thousand Home Challenge webinar series is brought to you by the Pacific Gas & Electric Company's Energy Training Center & Affordable Comfort, Inc. (ACI).



Dense Pack for Insulation & Air Sealing of California Homes

Nov. 14, 2011 11 a.m.-12:30 p.m. Pacific Time

Part 2 - Nov. 17, 2011 11 a.m.-12:30 p.m. Pacific Time

Presented by:

Jim Fitzgerald, Center for Energy and the Environment, MN

Facilitated by: Linda Wigington, Affordable Comfort, Inc.

www.1000HomeChallenge.org

www.affordablecomfort.org



Recordings & Presentations

Parts 1 & 2 Dense Pack

<http://thousandhomechallenge.com/news-and-events>

All Participants Are Muted

Send questions using “Question” feature

Slides out of Synch Today?
Or Slow Internet Connection???

ecoffman@affordablecomfort.org



ACI Resources



Past Handouts & Upcoming ACI Events

www.affordablecomfort.org

Colorado ENERGY STAR Summit 2011 Denver, CO Dec. 6-7, 2011

ACI National Home Performance Conference 2012 Baltimore, MD Mar. 26-30, 2012

Information about the Thousand Home Challenge

www.ThousandHomeChallenge.org

- Introduction to the Thousand Home Challenge Webinar
- Thursday, Dec. 8, 2011: 10-11:30 a.m. Pacific Time

Contact: Linda Wigington lwigington@affordablecomfort.org



THC/ETC Webinar Archives



High Performance Hot Water: On the Path to Deep Energy Reductions (2-part) - *Gary Klein*

Analyzing Electricity Usage: A Critical Step Toward Deep Energy Reductions - *Chris Hunt*

Ductless Heat Pumps: Recent Research & Applications for Low Energy Homes (2-part) - *Mark Jerome, Bob Davis, & Marc Rosenbaum*

Ducted & Ductless Mini-splits for Cooling Existing Homes - *Danny Parker & Dave Robinson*

Dense Pack for Insulation & Air Sealing of California Homes (Part 1) - *Jim Fitzgerald*

<http://thousandhomechallenge.com/resources>

PG&E's 2011 Classes – Free!

Related to Deep Energy Reductions in Existing Homes

For a fall class schedule, visit -- www.pge.com/energyclasses

Deep Energy Reductions – The Thousand Home Challenge - *Linda Wigington*

Energy-Wise Renovation of Foreclosed Homes - *Dave Robinson*

Go Ductless California, Try Mini-Splits! - *Dick Rome*

Planning a Zero Energy New or Existing Home in CA - *Danny Parker*

Air Sealing & Insulating Existing Homes - *Gavin Healy*

Balanced Ventilation for High Performance Homes - *Dan Perunko & Gavin Healy*

Auditing Electricity Use in Existing Homes - *Chris Hunt*

Retrofitting California Crawlspace - *Rick Cowperthwaite*





Disclaimer



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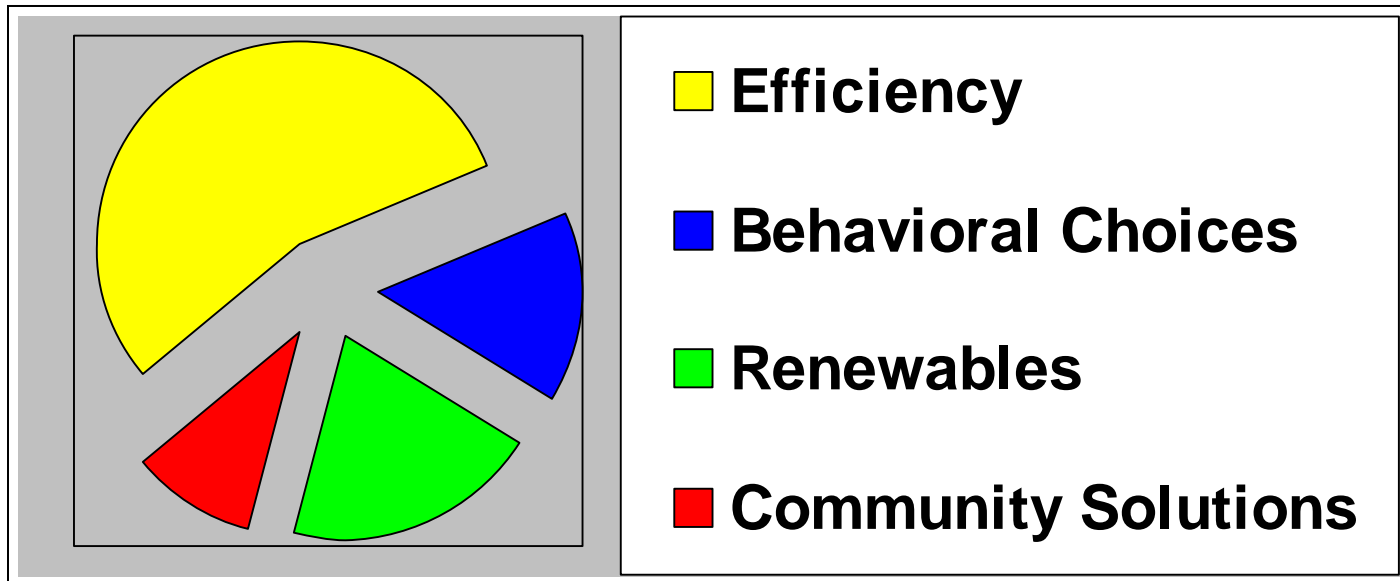
www.pge.com/stockton



70%+ Deep Energy Reductions

The Thousand Home Challenge

Access & Integrate





Key Metric

*Transparent & Direct
Include Occupants*

Net Annual Household Site Energy
Credits/offsets: Solar & onsite renewables
Wood counts!

Each household has its unique threshold of performance to meet or exceed.



Thousand Home Challenge Threshold Determination

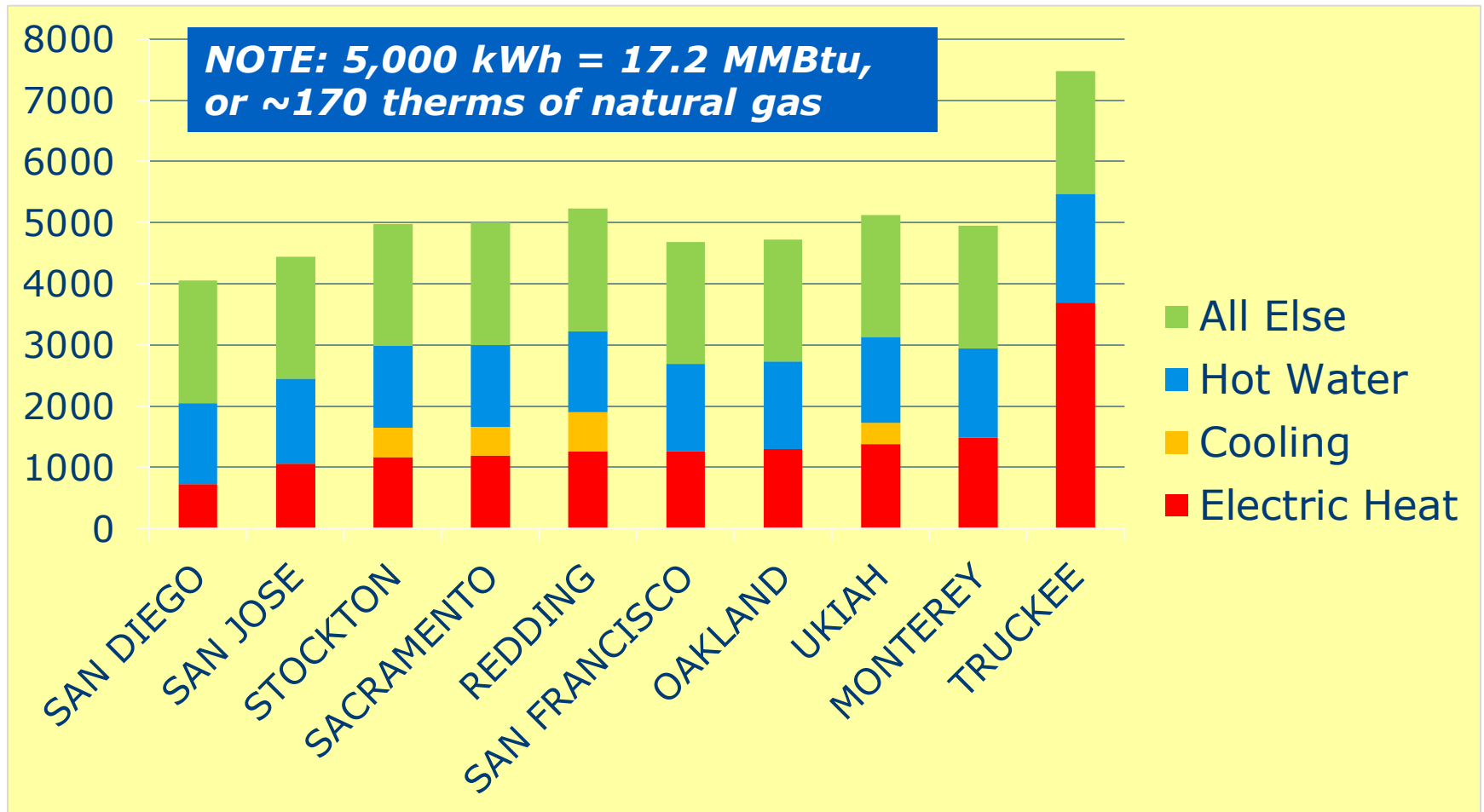
OPTION A

- 75% reduction in actual annual site energy use

OPTION B

- Climate (ZIP Code or best match weather station)
- House size (FFA), converted to surface area (5 sides)
- Detached or attached
- Electric heat allowance = $\frac{1}{2}$ fossil fuel or wood heat allowance
- Number of occupants (including partial occupancy)

THC Option B Household Threshold (kWh/yr. by end-use)



OPTION B Inputs: Detached; 3 in household; 2,000 ft² finished floor area (FFA); electric heat

No Right Answer (Usually)

(depends on context)

- Who is paying?
- Who is assuming/sharing risk?
- What are project objectives?
- What is the value proposition for those who are paying & absorbing risk?

THC – High value on pushing boundaries & expanding our knowledge/experience

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Learning Objectives Today

By attending this two-part webinar, participants will be able to:

- ✓ See that many houses have accessible **areas to seal** & (less accessible) **closed cavities to dense pack**; in combination, these complete a reduced air leakage enclosure;
- ✓ Recognize that each **house type** has a few specific **framing openings** & **typical large gaps** to complete before primary **air leakage reductions** are realized;
- ✓ Be able to point out features that require additional access, and choose **where** to apply **sealed barrier materials** & where to **dense pack cavities**;
- ✓ Describe considerations for **selecting points of access** to close floor/wall joints, & interior wall joints with outside walls;
- ✓ Better **differentiate** between a job **well done** & **partially complete work**.

Webinar Outline Today

Linda Wigington

- Intro & Thousand Home Challenge

Jim Fitzgerald

- Complete the low leakage envelope
- If you can't get to the bypass...
- Framing edges (critical junctures)
- Targeted densepack, re-insulate cavities w/batts, etc.
- Insulation requirements in taller & thicker cavities
- Moisture examples: daily cycling, storage, 10 years

Discussion/Questions

- Post comments & questions under “Questions”

Reminder -

This Webinar Does Not Address

- ✓ Combustion safety (including unvented appliances, venting system performance, potential for pressure-induced back drafting)
- ✓ Source control of pollutants & adequate house ventilation
- ✓ Adequacy of electric wiring, e.g., knob & tube wiring
- ✓ Flashing/rain & surface water management
- ✓ Disturbance of materials containing asbestos or lead
- ✓ Potential fire hazards (gas leaks, chimneys, recessed light fixtures)
- ✓ Any other stop work conditions that require repair prior to proceeding

Check It Out - Great Resource!

“DENSE-PACK SIDEWALL INSULATION VIDEO”

developed by WECC & the Energy Center of Wisconsin, funded by a US DOE weatherization grant:

<http://www.ecw.org/wxdensepackinsulation>

Jim Fitzgerald



Jim Fitzgerald is widely known throughout North America for training weatherization contractors & crews. He started his career as an insulation contractor in Minneapolis, where he developed techniques for dense pack cavity fill insulation of existing homes. With the help of Gary Nelson (The Energy Conservatory) & the use of infrared & blower door diagnostics, Jim developed a comprehensive approach to dense packing that consistently yields insulation continuity & significant air leakage reductions. Jim recently helped develop BPI's criteria for Air Leakage Control Installer certifications, & is now a member of BPI's working group to draft standards for thermal insulation used as an air retarder. He also provides field audits for ABAA (Air Barrier Association of America) in new commercial work. In the past, he has conducted hundreds of stucco moisture investigations.

Dense Pack in California, Part 2*

Completing the Envelope

* And elsewhere! 😊

Dense Pack in the BPI 104 Envelope Standard

*“For **leakage paths** through **enclosed cavities** which **cannot** be accessed or reasonably sealed with **conventional air sealing techniques**”*

<http://www.bpi.org/>

Envelope 104 (cont'd)

BPI requires installation of:

- High density blown insulation, or
- Air impermeable foam insulation in cavities

...to reduce airflow through the building shell

Quick Recap of Part 1

- Blocking airflow through side walls also blocks leakage connected to the walls (from interior)
- Insulation void only affects actual area; Air sealing miss hurts whole job
- Critical components of wall insulation
 - Set up machine for target density of product: cell: 3.5 lb/ft³; fg 2.2 lb/ft³
 - Open every cavity: check side-to-side, find all stud cavities
 - Fill 100%, top to bottom w/tube
 - 2-hole: drill within 1' of top & close to bottom, use plumb line
 - Fill every cavity, no voids (continuous), installed uniformly
 - Check: no smoke @50pa & confirm bag count
 - IR check after every job until you learn to beat it (best teacher)

In summary, a well done job = plan for, verify as you go, & check to make sure you achieved it

What Is Connected to the Sidewalls?

- Interior wall edges, offset walls, common walls
- Floor framing, drop soffits, stairways
- Porch roofs, cantilevered floors, bay windows
- Chimney/plumbing/duct chases
- Plumbing/electrical systems
- Attics, crawl spaces, porch attics, decks
- Lower roof at dormer wall, split levels

Example 1: Where Are the Edges?



Bed & Breakfast: Conference training site 1989
Good shape 22 years later
(Indiana WX)

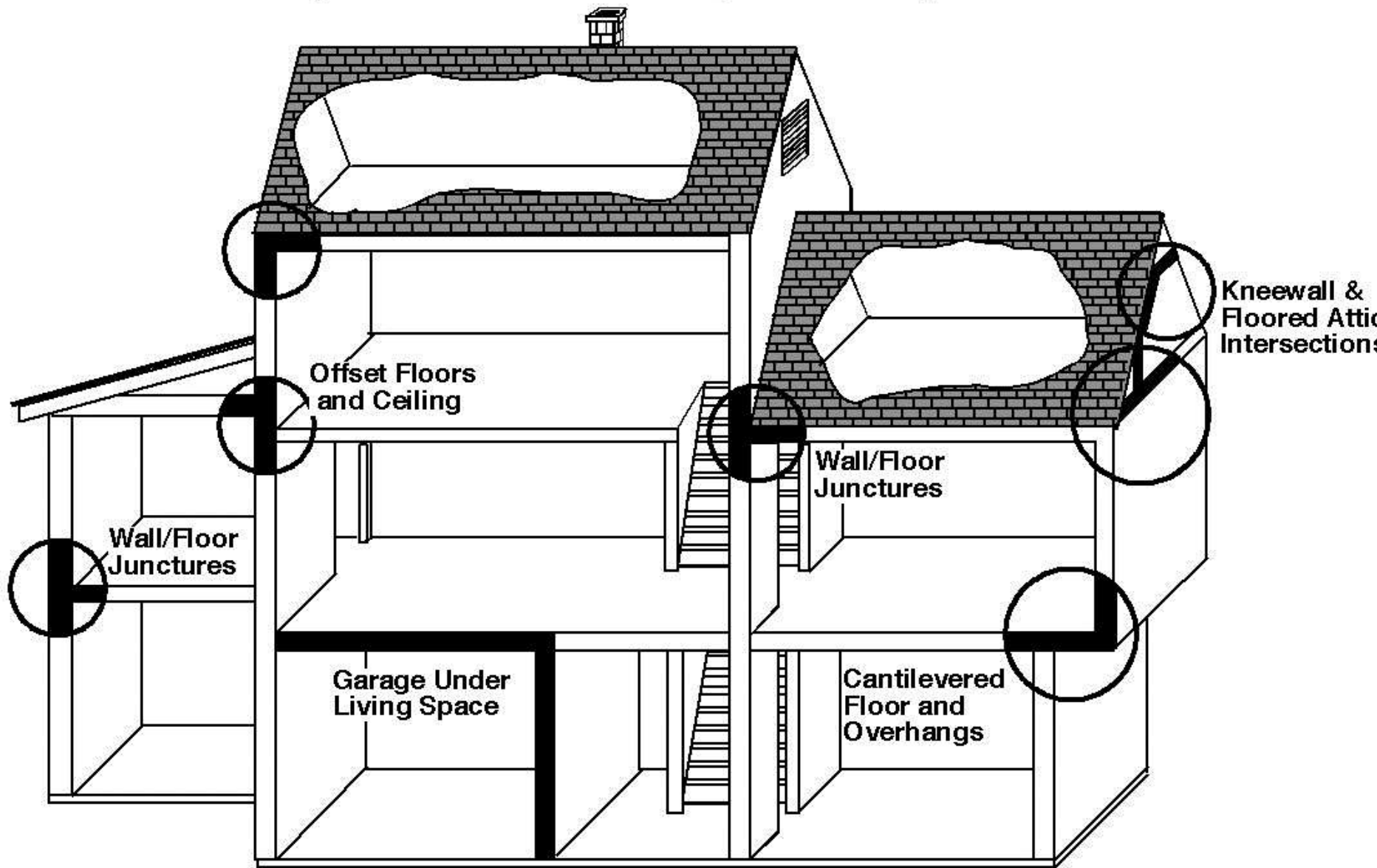
Example 1



5,000 ft² walls plus:
porch roof, offset floor, attic
stairway, pocket door, crawl
space

Bed & Breakfast: Conference training site 1989
Good shape 22 years later
(Indiana WX)

Key Junctures in High Density Insulation



Start Walls: Drill & Tube

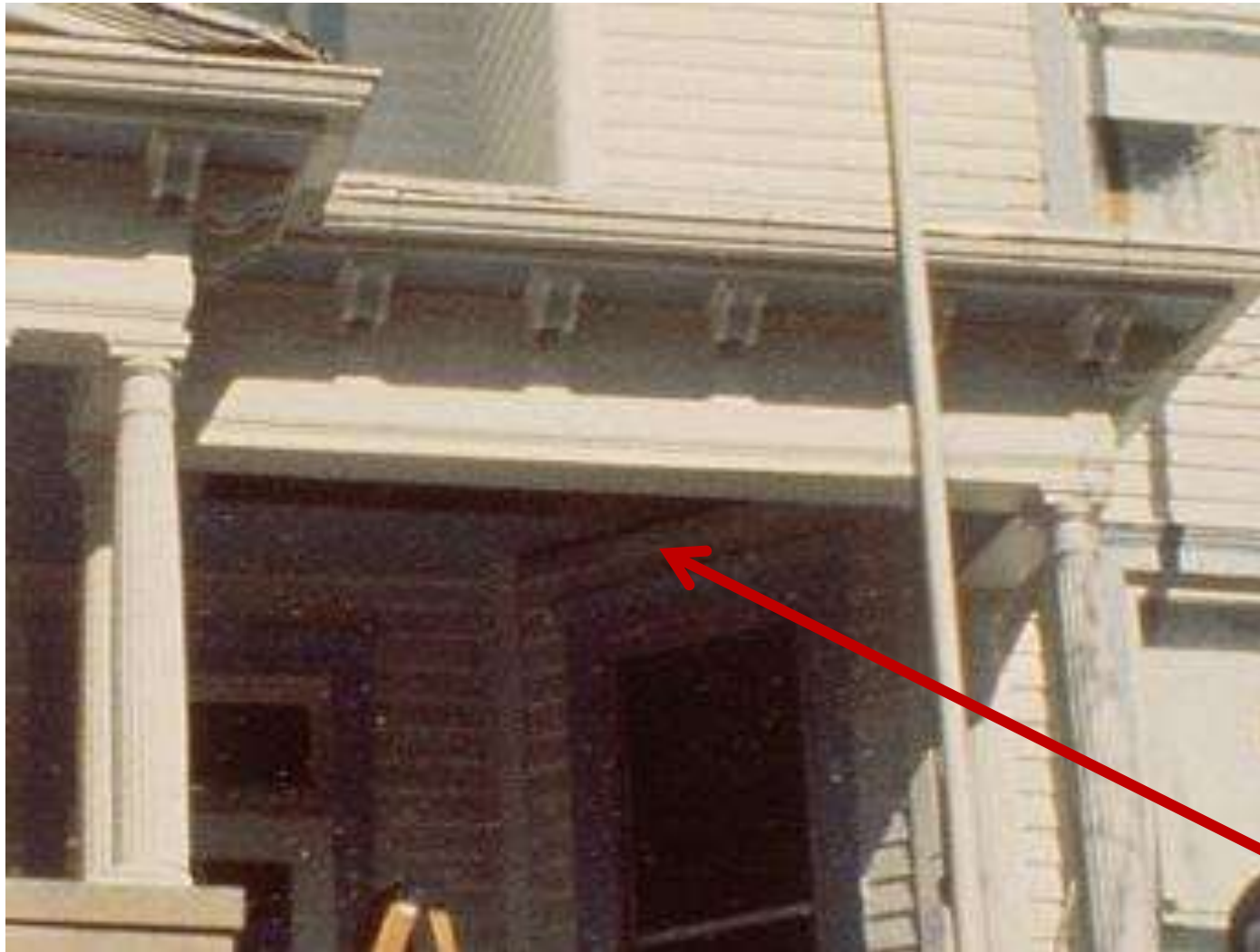


Finger Tight, Now Test with Smoke



Upper Corner over 1st Floor Angle

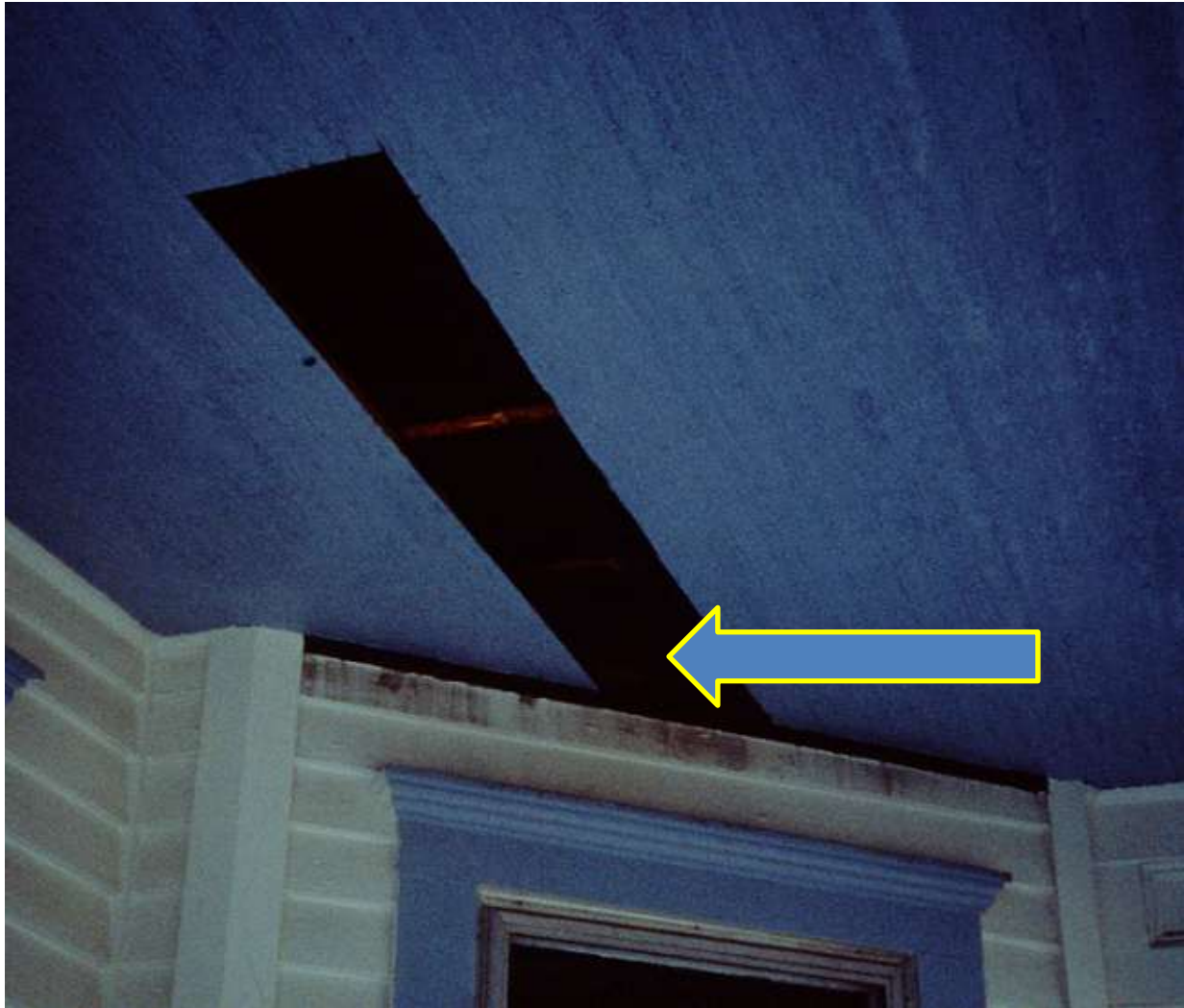
=> create access to see



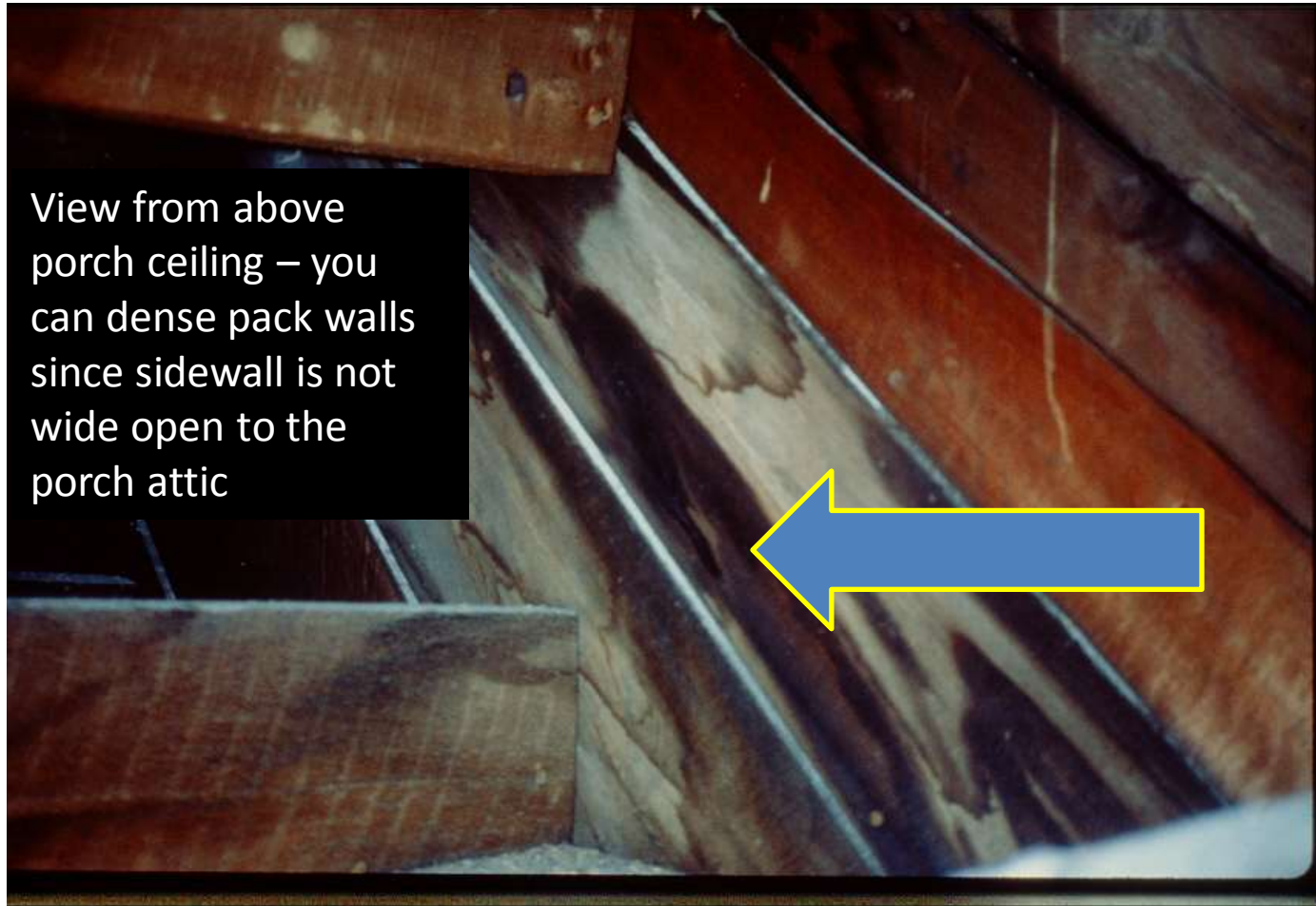
Open
beaded
ceiling

Ceiling Boards Open: View Joist Edge

(choose one: barrier or dense pack)



½" Diagonal Gaps 6" OC = Dense Pack Opportunity



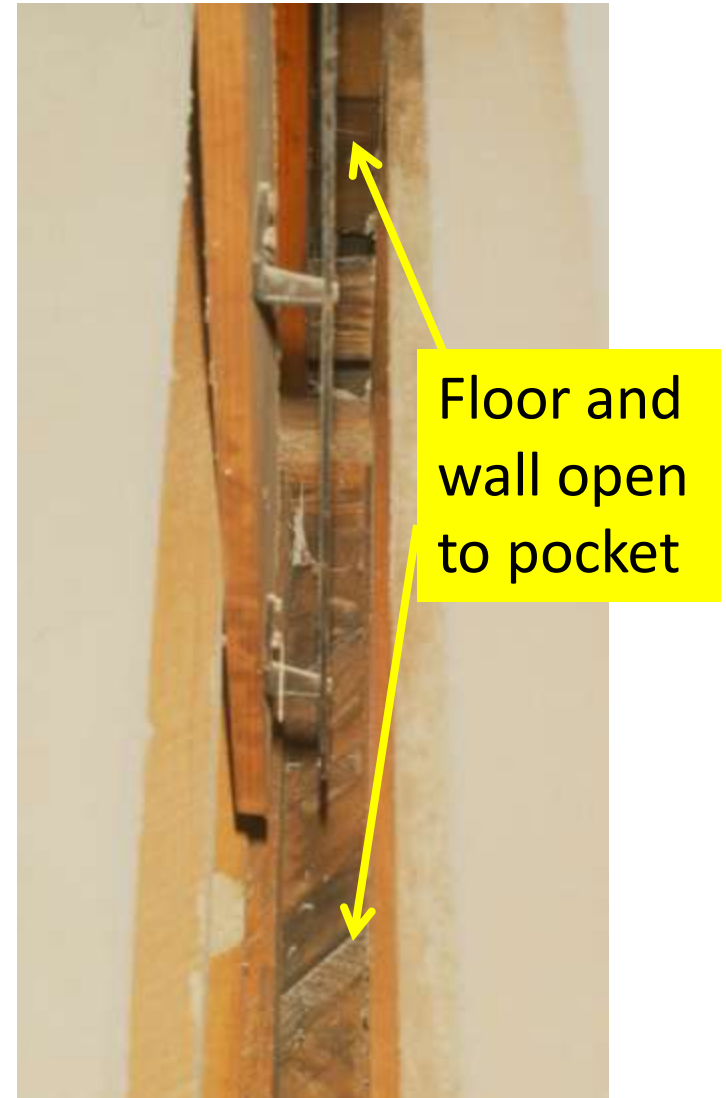
View from above porch ceiling – you can dense pack walls since sidewall is not wide open to the porch attic

Cell in Pocket Door from Walls Nearby

How to clean & protect
operation?



Push in Batt to Hold Dust, Pack Tight



Pack Stairs to Attic, Upper & Lower, Then Pack Walls from Inside



Block Opening to Unheated Crawl Space



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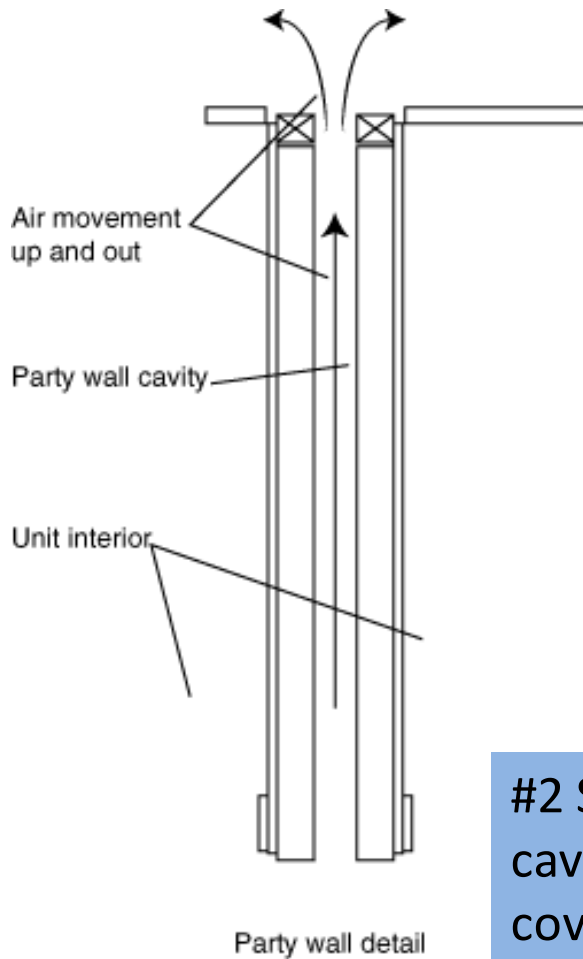
Pack Perimeter Floor End Joist



Using 20', 1.5" tube to reach to far side of floor joist cavity

#1 Access Edge of Party Wall from Inside Corner of Web Truss

(up + down 10')



Access through 2" Hole Bag Method for Rim Joists



Sack filled with insulation creates enough of a block so that additional insulation can be dense packed against it without wasting lots of material in the floor cavity

Gaining Access

Bottom line:

Gain access however you can – hose gives you 10 to 15 feet of reach

Gain Access

(bedroom floor from under porch roof)



Edge of Plumbing Wall at Exterior (tube between pipes & exterior wall)



Gain Access

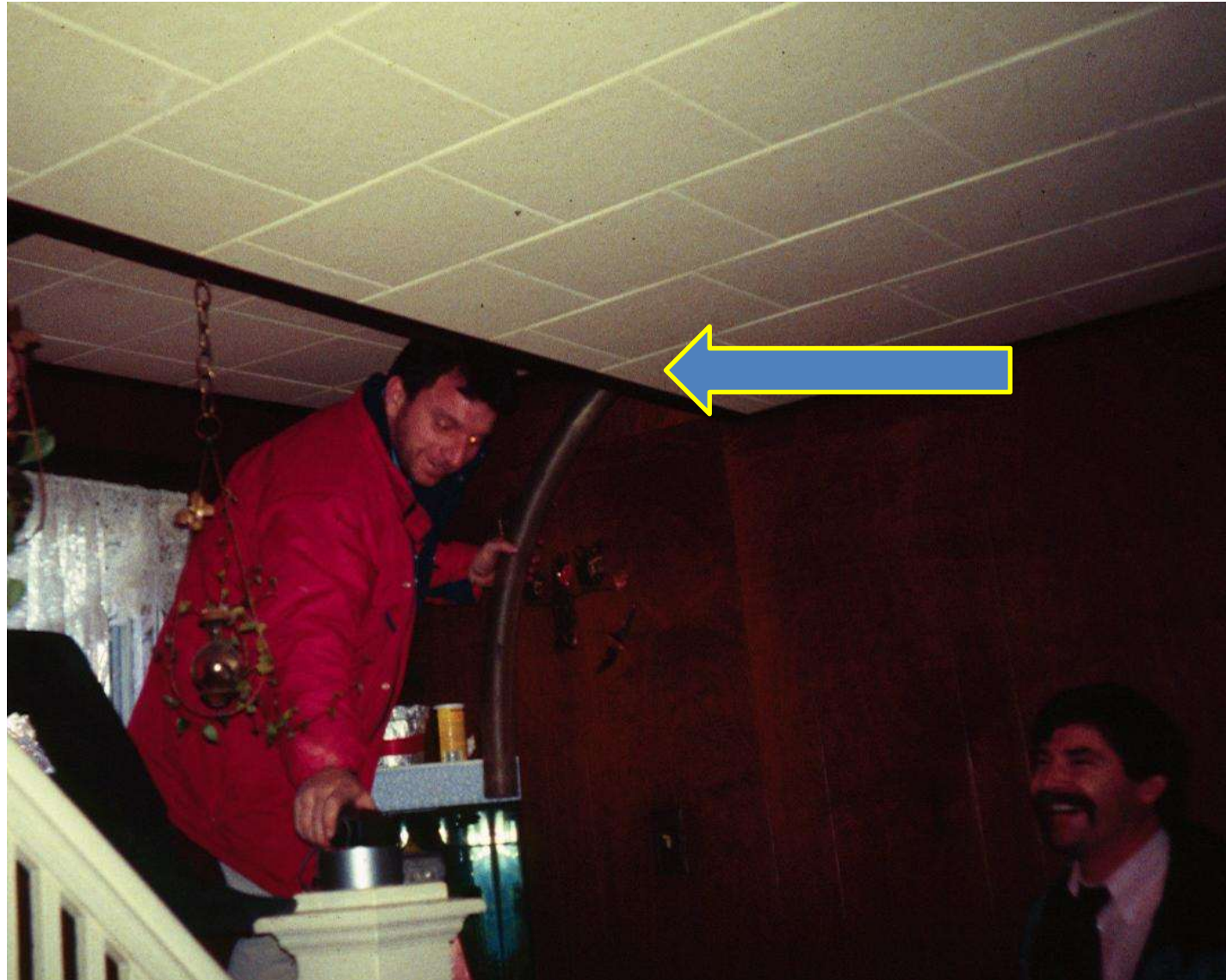
(mobile home belly from below)



Gain Access through the Floor



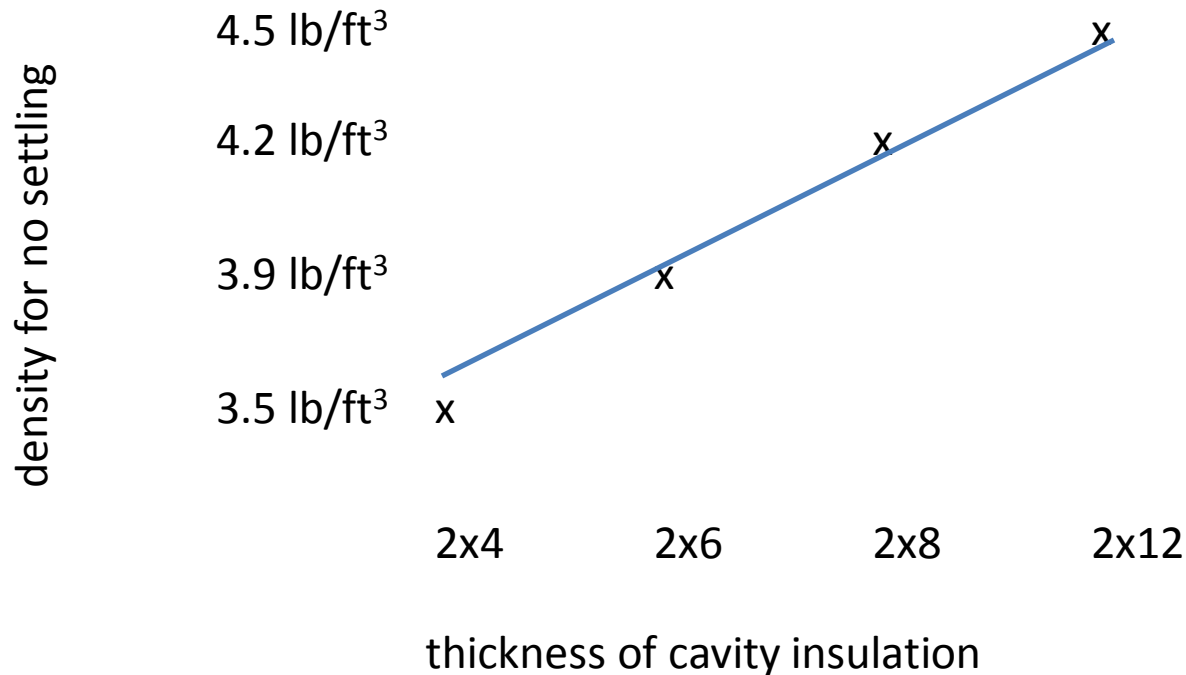
Gain Access from Edge of Drop Ceiling



Larger Cavities Need Higher Density Cellulose to Prevent Settling

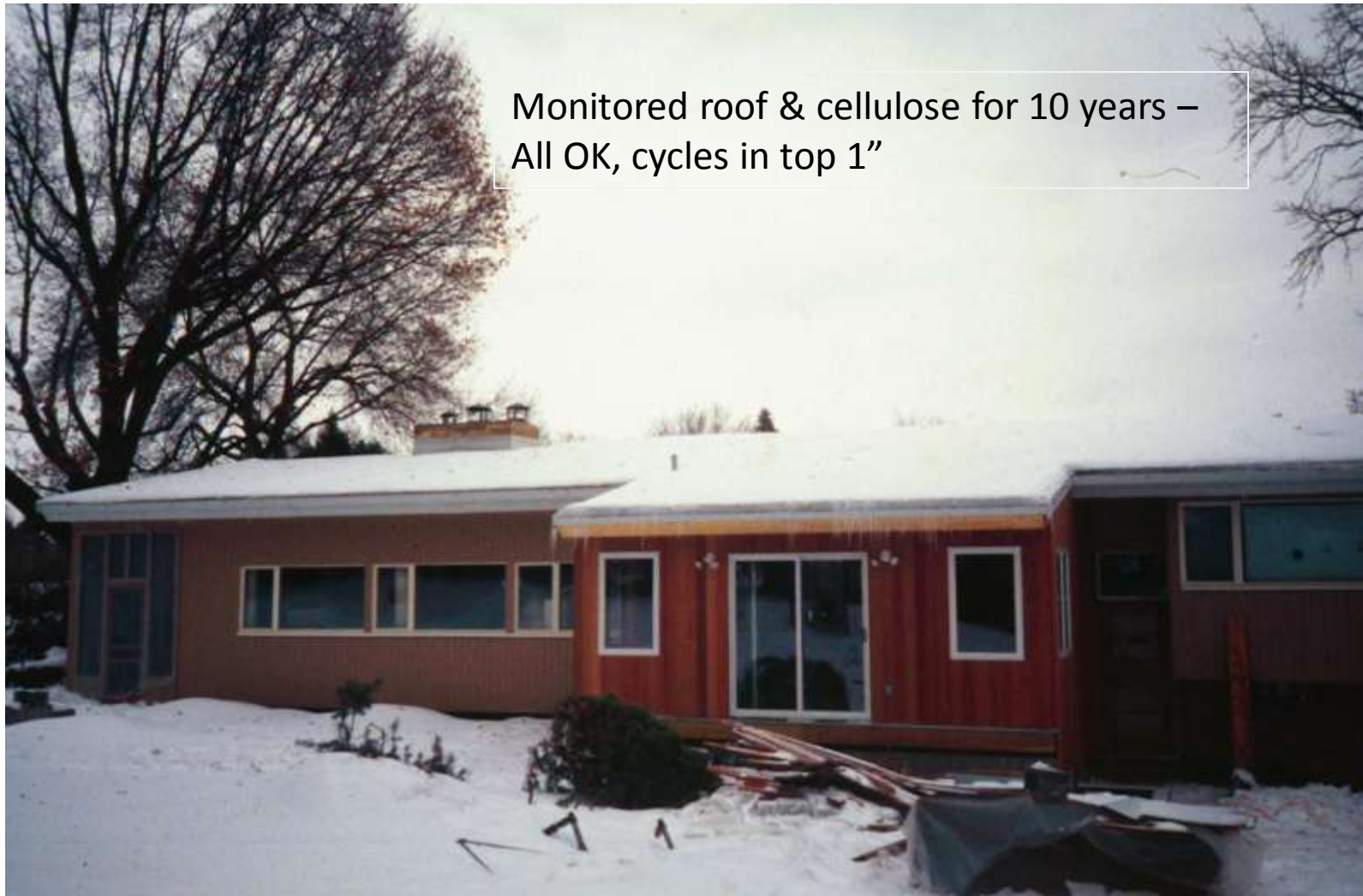
JM lab doing test with 16' column of Spider

Danish Research Verifies 3.5-4.5 lb/ft³ Cellulose Density Needed to Prevent Settling

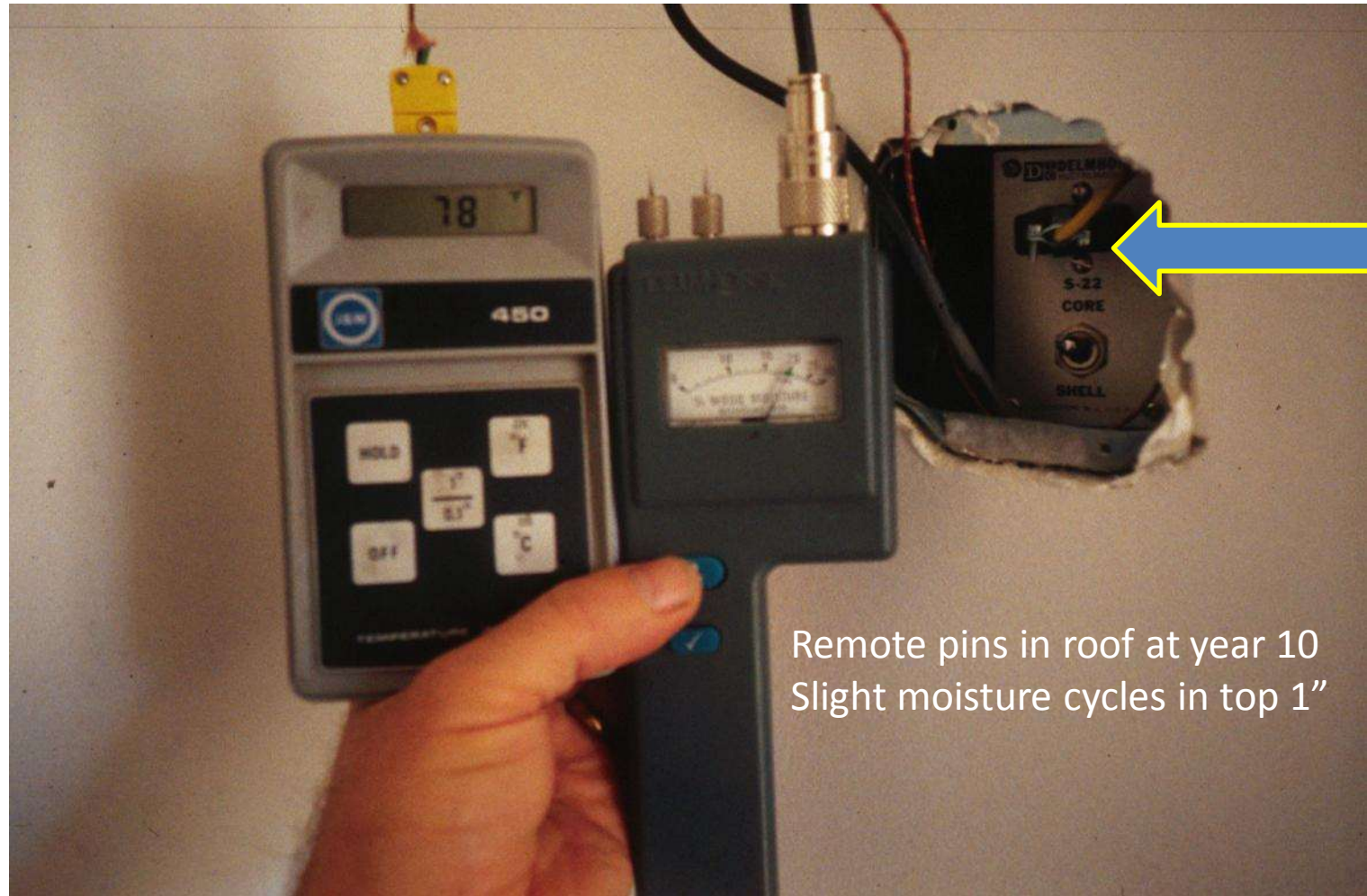


- 8' tall cavity with wood studs & gypsum board, moisture cycles 50%-80%, 200 days (Rasmussen, Denmark 2003)
- 5% lower density needed if RH kept constant at 50%, horizontal crack 10mm (0.4") noted through 8" wide cellulose block at end of test

10" Cellulose in Vaulted Ceiling



Monitoring Moisture



2 lbs/ft² Packed over Full Batt



Wet for Years - No Mold



Lake Cabin Kitchen Wall - Flashing Leak



High RH Homeowner, Small Leakage



4'x5' Damage -- No Margin



Time for Questions & Comments

Use “Question” option to submit questions

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