INTERESTING EXPERIMENTAL APPROACHES: ORNL WINTER CASE STUDY

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- And, many schedulers, technicians, and sample pick-up staff

Outline

- Project Objectives
- Project Plan
- Indoor Air Pollutants
- Preliminary Results
- Next Steps
- Q&A

WAP Evaluation IAQ Study

Objective:

Determine the impact of weatherization on a number of indoor air quality parameters in homes.

For Example --

- Tightening a home could increase concentrations of indoor air pollutants (e.g., formaldehyde); or
- Air sealing between main living areas and basements and crawlspaces could reduce concentrations of indoor air pollutants (i.e., radon) in the main living areas
- Furnace repair/replacement could reduce indoor air emissions of carbon monoxide (CO)
- Tightening of home could increase comfort, etc.

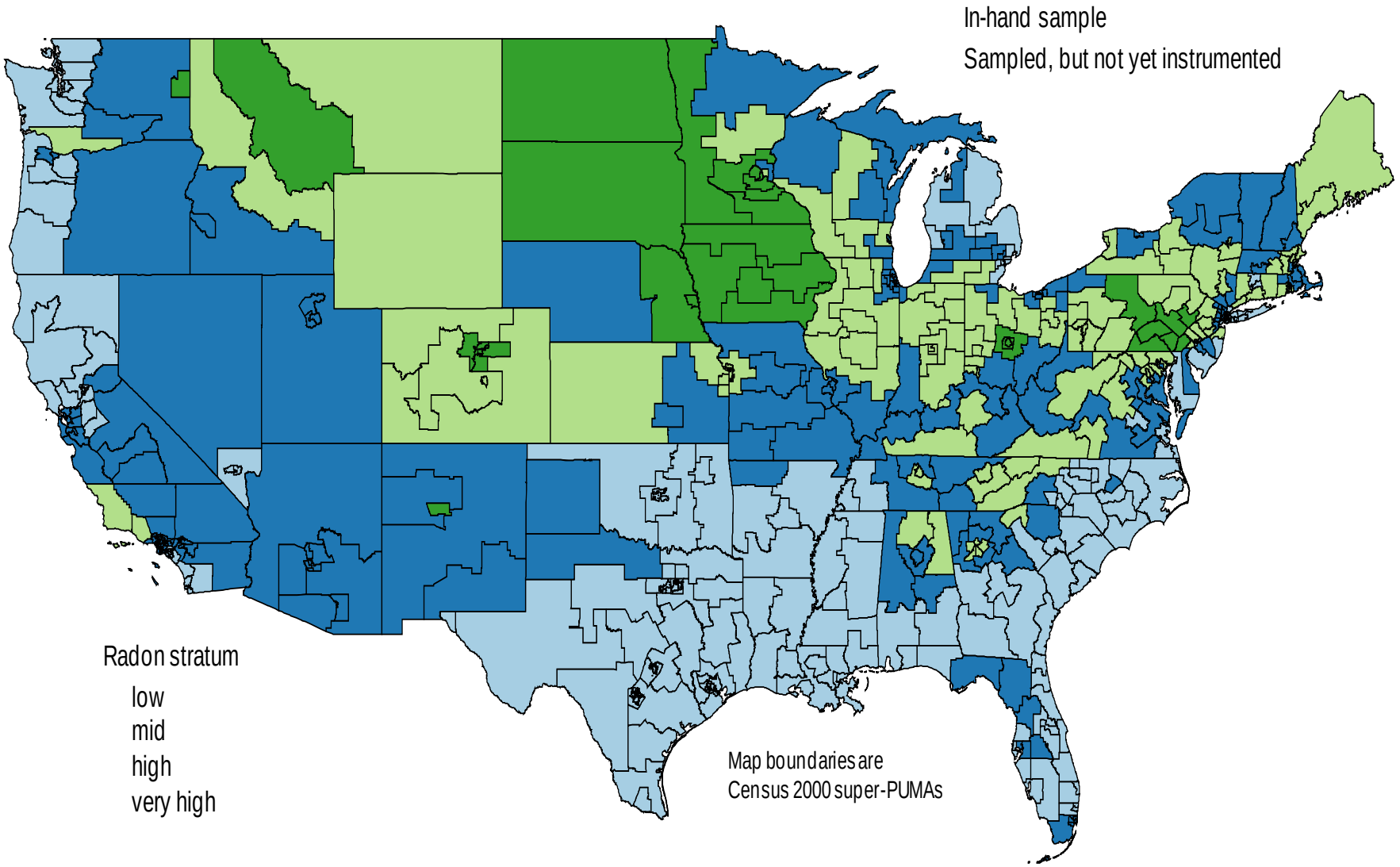
Field Study Plan

- Randomly sampled 80 Super – Public Use Micro Data Areas, with an oversample in high radon areas
- Include approximately 550 single family homes in the treatment/control group study (~ 5/8 treatment)
- Most homes monitored during winter with balance monitored in summer in hot climates(closed home conditions)
- Comparative pre- and post-weatherization sampling periods

Pre- and Post-Weatherization Occupant Survey

- Three groups of respondents
  - Nationally representative sample, IAQ study sample, Field Process Study Sample
- Non-energy benefit topics include
  - Change in comfort (winter, summer)
  - Incidence of illness, need for medical attention
  - Change in indoor safety
  - Change in energy, food, medicinal security
  - Change in family functionality
  - Change in employment, school attendance

Map of 80 Study Areas by Radon Levels



Implementation Approach

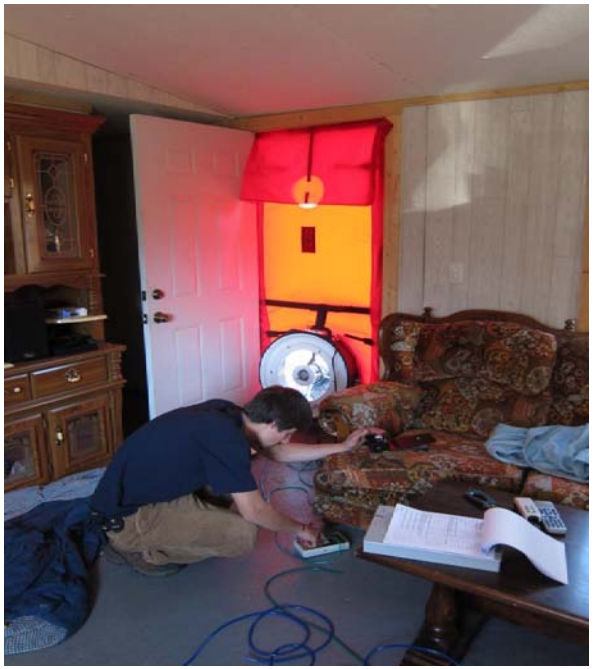
- Contact agencies in sampled areas
- Receive lists of homes to be weatherized
- Contact homes and schedule technician visits
- Schedule sample pick-up staff
- Re-schedule technicians and sample pick-up staff
- All samples are sent by FedEx to appropriate testing organizations

IAQ Parameters Measured

- Carbon monoxide
- Radon
- Formaldehyde
- Temperature & RH
- General moisture/mold inspection

On-site Testing Protocol

- CO production of combustion appliances
- Combustion products spillage
- Brief inspection for moisture accumulation or mold growth
- Blower door air leakage test results
- Zonal pressure diagnostics
- Pressure pan measurements of duct leakage



Carbon Monoxide Monitoring

- Monitored at 1 location
- Main Living Level
- Recorded at 5-min intervals
- Alarm set to 100 ppm

Formaldehyde Monitoring

- Standard commercial sampling badges
- 1 location on main living level
- Seven day monitoring period
- Done in 2/8 homes

Radon Monitoring

- In basement/crawlspace (if present) and main living level
- Charcoal canisters
- Includes 6% duplicates and blanks
- Seven day monitoring period
- Materials and analysis provided by EPA Las Vegas Lab

Response to Possible Hazards

- CO hazard identified on site
  - Discuss with occupants present; written warning to occupants ; notify weatherization agency
- CO hazard identified in logged data
  - Written notification to occupants; notify weatherization agency
- Formaldehyde hazard identified in logged data
  - Re-sample; written notification to occupants
- Radon hazard identified in logged data in living space
  - Re-sample; if threshold exceeded, remediate for radon, trying low cost measures first

Preliminary Results

- 288 Homes: 74% single family detached, 21% mobile home, 5% single family attached
- Majority in cold climates to ensure closed home conditions
- Only pre-weatherization
- Only for CO, radon and formaldehyde

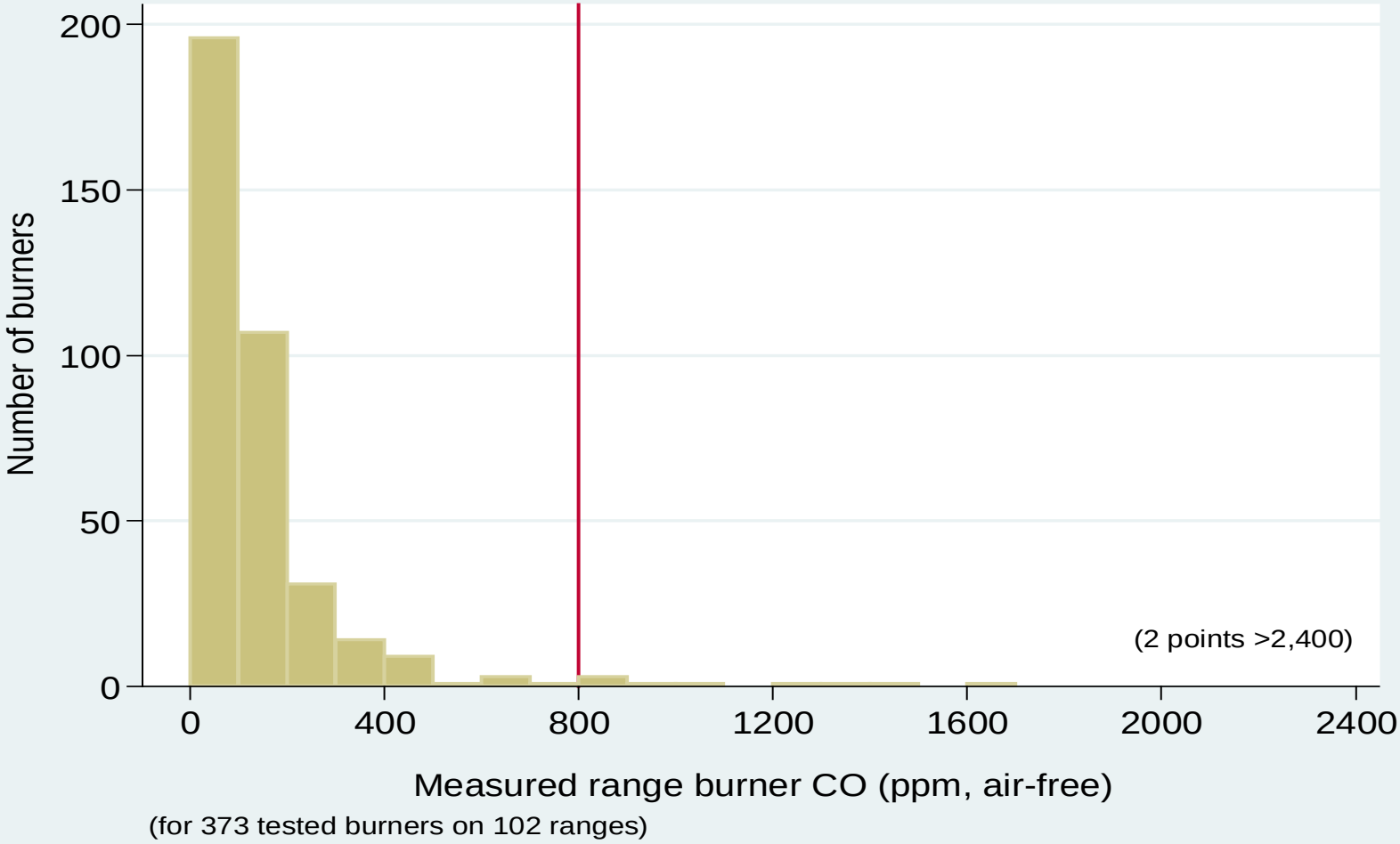
CO Results: Heating Systems

- 70 ppm is considered dangerous; >150-200 ppm very serious
- Eighty Percent had functional fuel-fired heating systems at time of first visit
- Flue CO measurements made in 107 units with atmospheric or induced draft venting systems
  - 13% produced 50 ppm or more of CO
  - 4% produced 500 ppm or more of CO

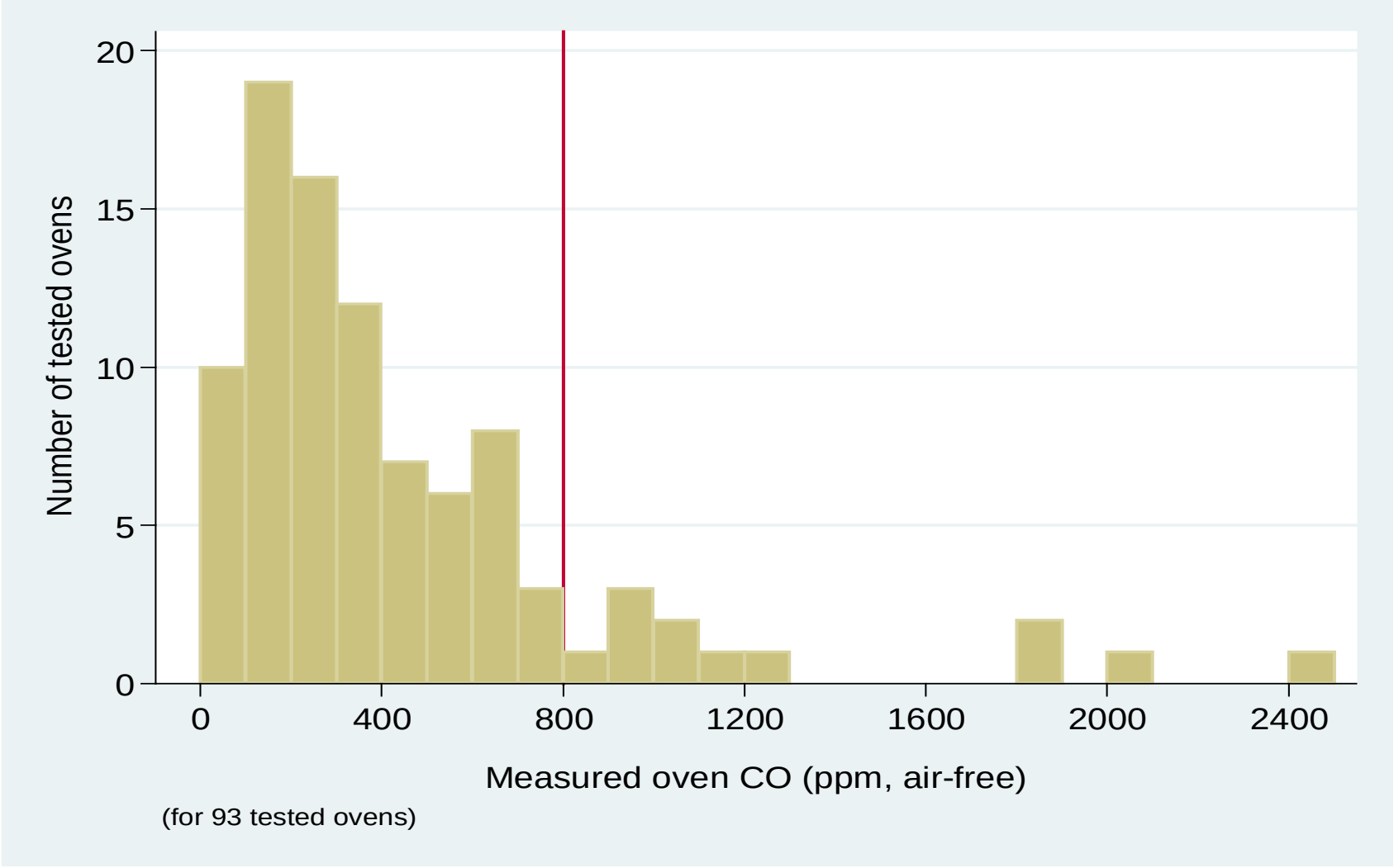
CO Results: Water Heaters

- 55% of homes had fuel-fired water heaters
- CO production measurements made in 122 homes
  - 98% CO production less than 50 ppm
  - 1 unit CO production was 60 ppm
  - 1 unit CO production was 1,650 ppm

CO Results: Range Burners



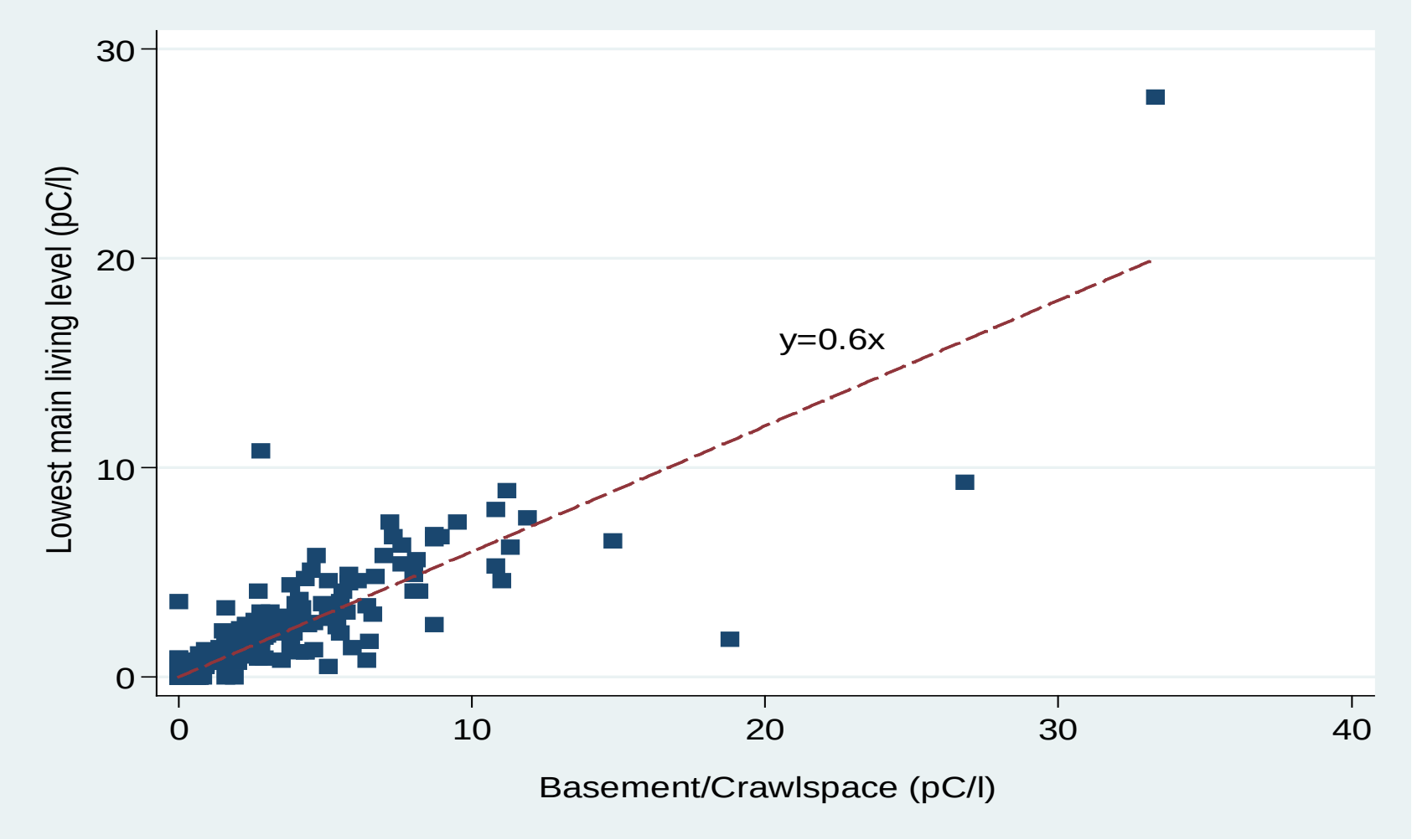
CO Results: Ovens



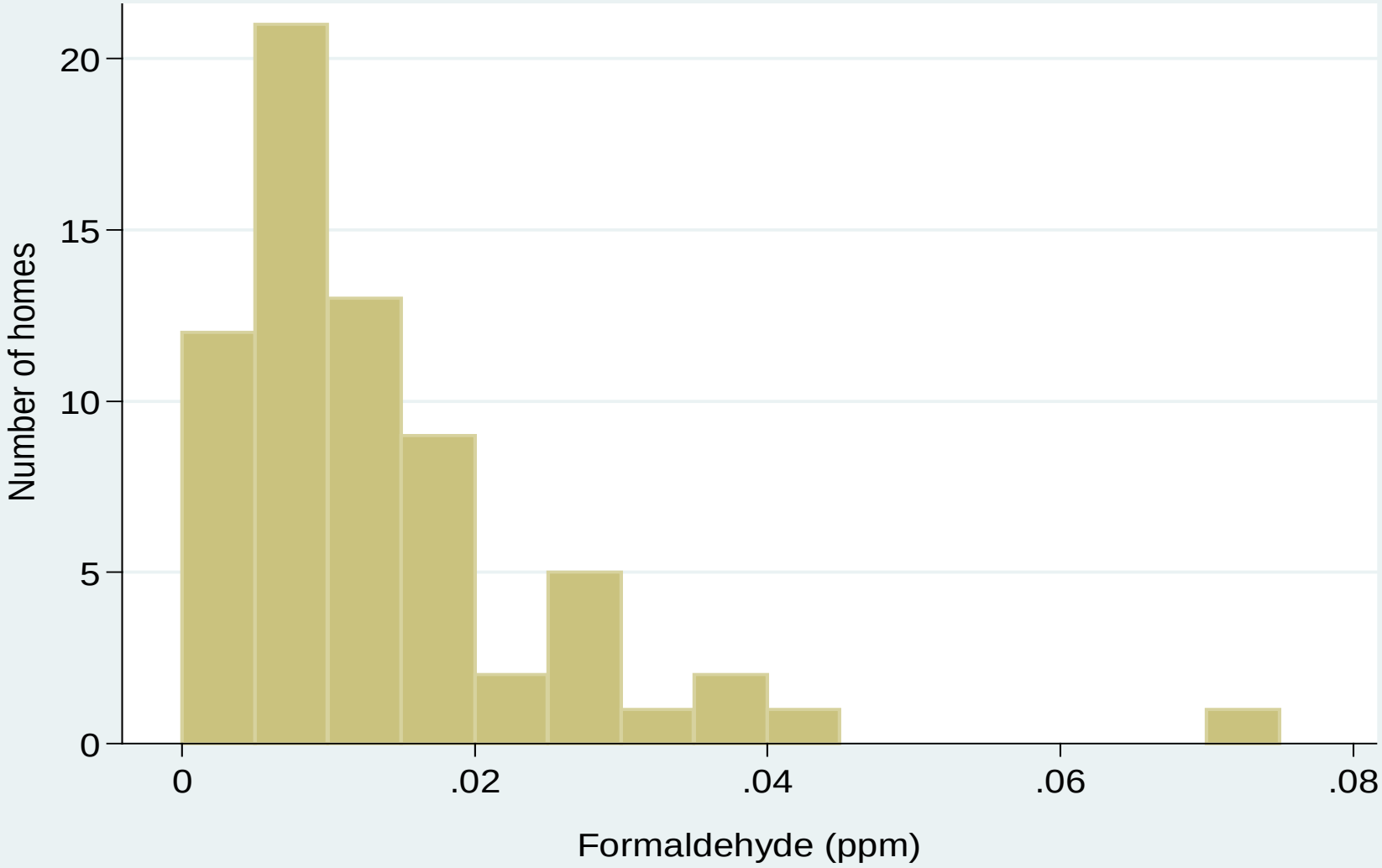
Radon Results: EPA Threshold is 4.0 pC/l

Radon Stratum	Basement/Crawlspace n	mean (pC/l)	s.e.	% > 4 pC/l	Lowest Main Living Level n	mean (pC/l)	s.e.	% > 4 pC/l
1 (low)	13	0.5	0.2	0%	22	0.3	0.1	0%
2 (mid)	60	2.7	0.5	20%	99	1.5	0.2	8%
3 (high, per EPA or LBL)	70	4.1	0.5	37%	100	2.3	0.3	18%
4 (high, per EPA and LBL)	46	4.5	0.6	39%	59	2.9	0.3	22%

Radon Measurement Correlations



Formaldehyde Results: Suggest exposure Limit is .10 ppm



Early in the Study But ....

- Project activities lead to replacement of damaged hot water heater in a mobile home
- Several CO problems have been remediated
- Treatment and control households have received monetary incentives to participate

Conclusions

- Few homes in sample suffer from serious indoor air quality problems pre-weatherization
- Study does not include hot climate homes
- Study only includes small set of indoor air pollutants
- Occupant survey will be re-administered approximately one-year post-weatherization