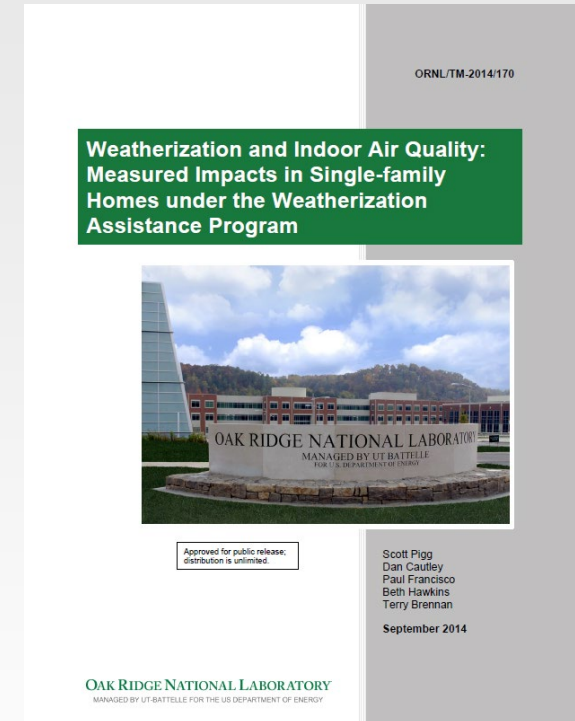


BEX (radon) Study Results

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Context

- ▶ WAP IAQ study found statistically significant increases in radon in 314 WAP homes in 35 states
 - 0.4 ± 0.2 pCi/l in lowest living level
 - Used “difference-of-differences”
- ▶ Follow-up study suggested exhaust ventilation may help
- ▶ HUD-funded study suggested that package of precautionary measures may be beneficial



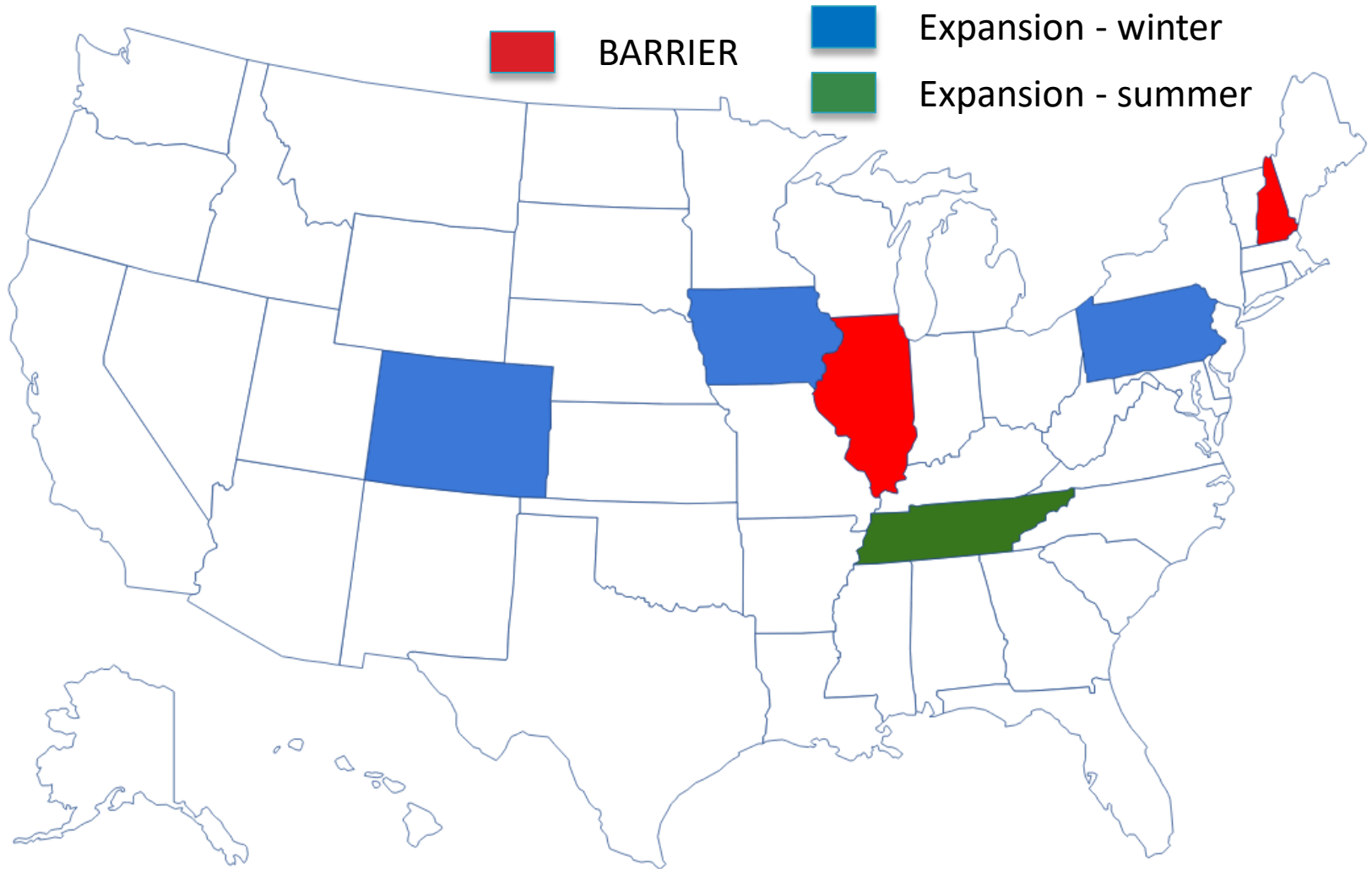
ORNL/TM-2014/170

BEX study

- ▶ Evaluate radon impacts in WAP homes given current H&S practices
 - Ground covers over bare dirt
 - Sealed sump pump covers
 - Ventilation



BEX states



276 treatment homes from 19 agencies

Analysis Approach

- ▶ “Ratio-of-ratios”
 - Similar to “difference-of-differences” but tracks the changes in airtightness of the home (the primary weatherization measure of concern)
- ▶ Also did difference-of-differences in order to compare directly with WAP IAQ study

Primary Results

	WAP IAQ study	BEX, Differences		BEX, Ratios	
	<i>Differences, no outliers</i>	<i>All data</i>	<i>No outliers</i>	<i>All data</i>	<i>No outliers</i>
Pre-Wx radon, pCi/l, LLL*	2.0	6.9	6.5	6.9	6.5
Change in radon level, LLL	<i>0.4 ± 0.2</i>	0.3 ± 0.5	0.3 ± 0.4	1.05 ± 0.07	<i>1.00 ± 0.06</i>
% change in radon level, LLL	<i>22% ± 11%</i>	5% ± 7%	5% ± 6%	5% ± 7%	<i>0% ± 6%</i>

* Lowest Living Level

Bold italics indicate significance at 90% confidence

Summary of primary results

- ▶ No statistically significant increases in lowest living levels
- ▶ Using difference-of-differences with no outliers results in $5.0\% \pm 6.5\%$ increase (0.3 ± 0.4 pCi/l)
- ▶ Using same approach except with ratios results in 0% increase ($\pm 6\%$)

Takeaways from primary results

- ▶ Current WAP H&S practices largely address increases observed in previous studies in radon on the lowest living level
 - Any remaining changes are not statistically significant
- ▶ Should continue these practices
- ▶ Likely need to emphasize sealing of sump pumps (and provide technical guidance as to how)
 - 22.5% of sample had unsealed sump pumps pre-Wx

Looking a little deeper...

- ▶ Basement radon level increases were statistically significant in most analyses
 - 10-12% using differences
 - 7% using ratios (not statistically significant when all data used)
- ▶ May consider recommending non-exhaust (e.g. supply or balanced), or exhaust in basement, if basement includes sleeping accommodations

Persistence?

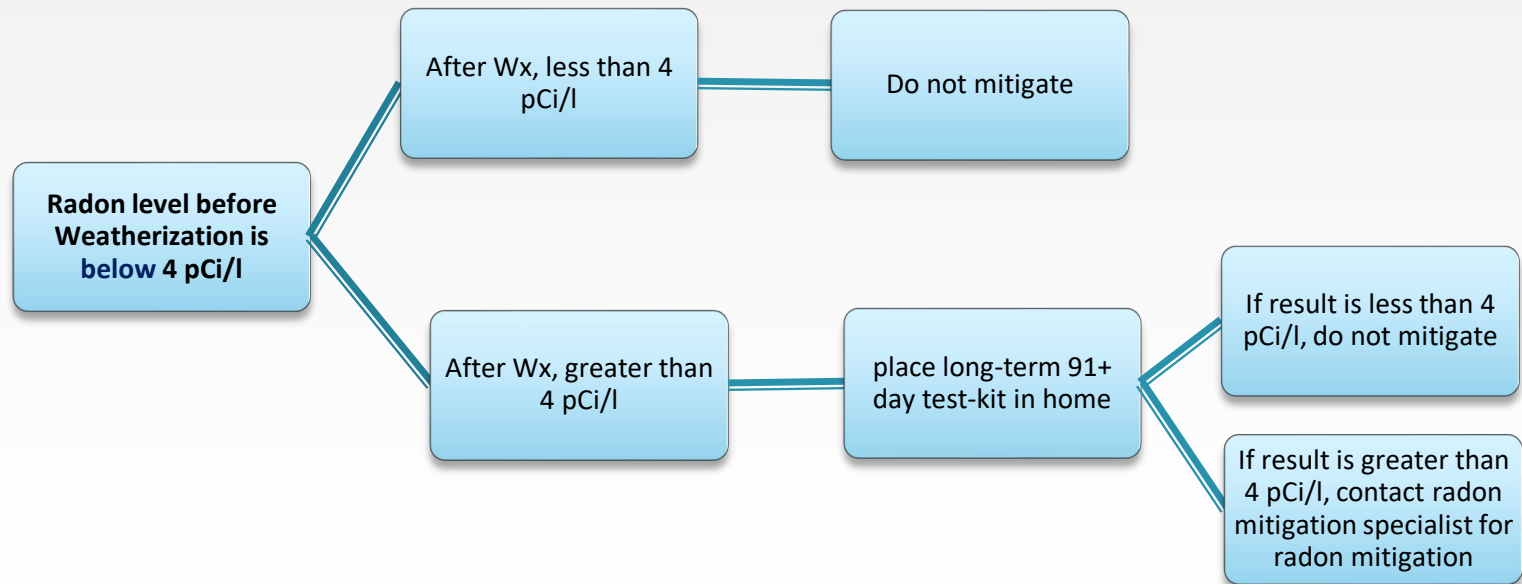
- ▶ Did 1-year follow-up testing in as many homes as possible (122 homes)
 - Analyzed as differences, not ratios – no further WAP retrofits
- ▶ Relative to post-weatherization readings, lowest living levels decreased by $10\% \pm 8\%$ with outliers removed ($10\% \pm 9\%$ using all data) (statistically significant)

Other interesting nuggets...

- ▶ States with higher fraction of homes with crawls appear to have better results
 - Tennessee is the only state that had statistically-significant changes by itself, with a 30% decrease
 - Colorado had the next most number of crawl spaces and also had a decrease, but not statistically significant
- ▶ May indicate the importance of ground covers when there are large areas of bare dirt

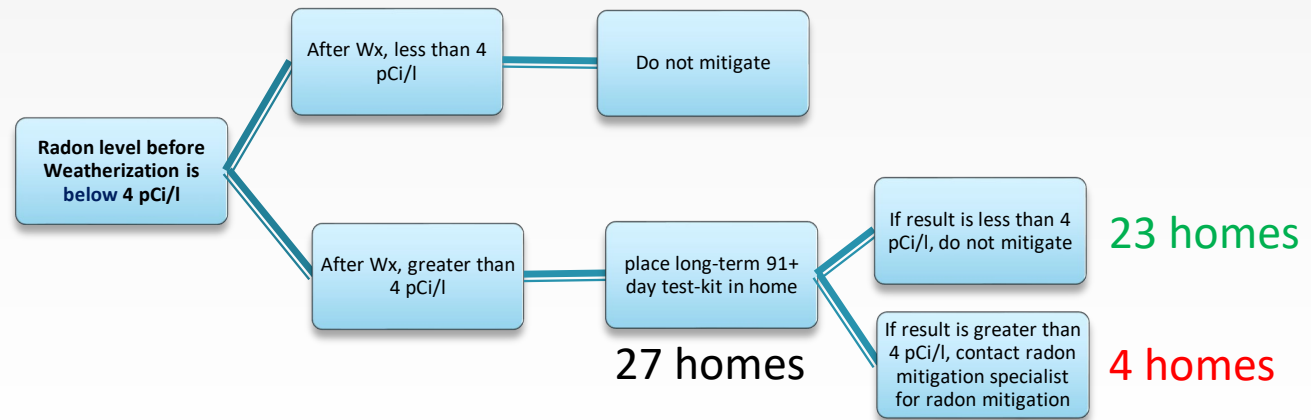
Other interesting nuggets...

- ▶ Per study rules, if a home had a pre-Wx radon level of <4 pCi/l in the lowest living level, and the post-Wx level was >4 pCi/l, we would pay for mitigation if a long-term test also came back >4 pCi/l



Other interesting nuggets...

- ▶ Twenty-seven homes received long-term testing per these rules
- ▶ Only four of these homes had long-term radon levels greater than 4 pCi/l



Overall summary

- ▶ Generally positive for WAP
- ▶ No statistically significant increases in lowest living level with current H&S practices
- ▶ Apparent further reductions after one year, especially in basements

Questions?