Vermiculite, asbestos, indoor air quality, and healthy homes

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Indoor Climate Research & Training
VERMICULITE/ASBESTOS
What are we worried about?

- Asbestos is associated with three major health issues
  - Mesothelioma (a type of cancer)
  - Lung Cancer
  - Asbestosis (scarring of the lung, causes respiratory issues)
Where do we find asbestos in homes?

- Shingles
- Floor tiles
- Thermal system insulation
- Vermiculite attic insulation
Friable asbestos

- Asbestos containing material that crumbles easily with normal force
- This can release asbestos fibers
Vermiculite

- Does **NOT** inherently contain asbestos

- **Problem #1:** Vermiculite mine in Libby, Montana also had veins of asbestos running through it

- **Problem #2:** 70-80% of the vermiculite in U.S. attics came from the Libby, Montana mine
Brief history

- 1919: Vermiculite discovered near Libby
- 1963: Mine purchased by W.R. Grace
- 1990: Mine closed
- 1999: EPA started cleanup
Brief history

- 2009: W.R. Grace entered bankruptcy
- 2014: W.R. Grace emerged from bankruptcy
  - Zonolite Attic Insulation Trust established
  - Covers up to 55% of mitigation costs, up to about $4,200
Brief asbestos pop science

- There are multiple types of asbestos
- Main type of asbestos in pipe insulation is chrysotile
- Main type of asbestos in vermiculite is amphibole
- Some health professionals believe that amphibole is the more dangerous of the two
Vermiculite

- Number of studies showing that blower door tests cause increases in asbestos in homes with vermiculite: 0

- Number of studies showing that blower door tests DO NOT cause increases in asbestos in homes with vermiculite: 0
Montana Asbestos-Safe Weatherization Demonstration Project
Draft Final Report - June 30, 2010

Funded By:
Residential Energy Assistance Challenge Program (REACH)
Low Income Home Energy Assistance Program
U.S. Department of Health and Human Services

Grant Recipient:
Montana Department of Public Health and Human Services
Intergovernmental Human Services Bureau
Contact: Kane Quinemoore, HRDC Services Section Chief

Prime Grant Administrator:
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Contact: Dale Horton, Sustainable Energy Program Manager

Asbestos Testing and Monitoring Contractor:
Montana Tech of the University of Montana Safety Health & Industrial Hygiene Dept.
Contact: Dr. Terry Spear, Department Head

Evaluation Contractor:
Montana State University Housing and Environmental Health Program
Contact: Barb Allen, Program Manager

INDOOR CLIMATE RESEARCH AND TRAINING
Montana Wx Study

- Evaluated impact of different activities on indoor asbestos levels
- Measured both chrysotile and amphibole before and after weatherization
- Report states that evaluation of the impact of blower door testing was a goal; no results provided
  - Blower door tests were done in pressurization mode
Montana Wx Study – results

- Most asbestos in post-Wx air samples was chrysotile

- Weatherization activities most associated with increasing indoor airborne concentrations included:
  - Attic blow-in
  - Sealing penetrations from the attic
  - Drilling holes in interior walls
  - Interior wall blow-in
  - Basement batting insulation
Montana Wx Study – Blower door test recommendations

- Seal penetrations and hatches, from the house side, before conducting test
- Perform test under pressurization only
What other states do

- Mix of decisions
- Some do pressurization blower door testing, avoid going into attic or blowing insulation
- Some defer the home
- Some have worked with developed approach to fund dealing with vermiculite
Thoughts

- Depressurization testing?
  - Why bother, there are other options

- Pressurization testing?
  - Compare to other natural effects on attics...
  - Seems like a reasonable approach given available info
INDOOR AIR QUALITY
Contaminants of Concern

- What most residents are aware of:
  - Moisture
  - Odor

- What some residents are aware of:
  - Carbon Monoxide
  - Carbon Dioxide
  - Radon
  - Asbestos

- What a few residents are aware of:
  - Particles (PM2.5)
  - Nitrogen Dioxide
  - Formaldehyde
  - Ozone
  - VOCs
Associated with respiratory issues?

- What most residents are aware of:
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Impacts from contaminants

- Respiratory ailments
  - Asthma
  - Allergies
  - Lower and upper respiratory tract infections
  - COPD

Credit: AFP, https://www.flickr.com/photos/gasierraclub/5595644959/
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Impacts from Contaminants

- Other ailments
  - Heart disease
  - Headaches
  - Eye, nose, throat irritation
  - Damage to organs
  - Cancer
Asthma

- 1 in 12 children in the U.S. has asthma
- 1 in 8 children in poverty has asthma
- 1 in 4 households below the poverty line has a child with asthma
In the U.S. we spend over $1 BILLION per year on asthma
Particles

- Respirable: < 2.5 μm (PM2.5)
- Get into the lung
- Can cause many respiratory ailments
  - Heart and lung disease
  - Asthma
  - Coughing
  - Difficulty breathing
Image courtesy of US EPA.
Particles

Sources
- Combustion
- Cooking process
- Outdoors
- Cleaning agents
- Chemical reactions
Particles and Mortality

Excerpt from Fig. 3 of Dockery et al. (1993): “An Association Between Air Pollution and Mortality in Six Cities.” New England Journal of Medicine.
LBNL Study: Conducted many replicates to overcome variability in emissions (log scale)

![Graph](image)

- Burger added
- Gas off
- Covered and removed

CPC Cn (#/cm³)

Time from Pan on burner (s)

- No Hood
- Hood E2 Low

Courtesy: Brett Singer
Nitrogen Dioxide – sources

- Nitrogen dioxide is a byproduct of the combustion process
Nitrogen Dioxide and asthma

- Belanger et al. (2013)
  - Focused on school-aged children with asthma
  - Defined asthma severity scores
    - 0 = no symptoms
    - 1 = mild asthma, only a very few symptoms over study period
    - 4 = severe asthma, symptoms most days (at least 20 per month)

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Nitrogen Dioxide and asthma

Belanger et al. (2013)
- Starting at 6 ppb NO2, for every 5-fold increase the odds of being at a severity level higher by 1 increased by 37%
- Odds of increase in wheeze of 49%
- Odds of increase of night symptoms of 52%
- Odds of increase of rescue medication use of 78%
Nitrogen Dioxide in homes

Data from California IAQ Study 2011-2013.
2011-12 data described in Mullen et al. 2013
Nitrogen Dioxide in homes

NO2 CONCENTRATIONS in residences, Lee ET AL. 1998
Nitrogen Dioxide

UMEx 200

Ogawa
Formaldehyde

- Can be an irritant at lower levels
  - Eyes, nose, throat
  - Respiratory
- Carcinogen at higher levels
- Many different standards
  - Range from about 9 ppb to 100 ppb
Formaldehyde

- Sources
  - Pressed/composite wood products
  - Carpet
  - Furnishings
Formaldehyde

- Krzyzanowski et al. (1990)
  - Found increased prevalence of chronic bronchitis or asthma in children exposed to over 60 ppb formaldehyde
    - This level corresponded to a 22% decrease in Peak Expiratory Flow Rate
Formaldehyde measurement

- Mostly passive badges to send in to lab
- Real-time monitor available

Passive UMEx 100 badge, ~$80-100

Datalogger, 30-minute readings, ~$1500
Volatile Organic Compounds (VOCs)

- There are hundreds of these
- Some more harmful than others
  - Acetaldehyde
  - Styrene
  - Toluene
  - Ethylbenzene
  - Xylenes
- Respiratory irritants
- Some have chemical reaction with other gases (e.g. ozone) to create particles
VOCs

Styrene

Acetaldehyde

Toluene
VOCs

Ethylbenzene, Xylene
Those “Clean” Scents

Terpenes (a class of VOCs)

Examples:

- Pinene (pine scent)
- Limonene (lemony-fresh scent)
Contaminants – VOCs

- **Sources**
  - Cleaning products
  - Air “fresheners”
  - Other household products
VOC measurement

- Mainly Passive badges to send in to lab

- Primary result is TVOCs (Total VOCs)
  - Can sometimes select up to three to get specific readings
HEALTHY HOME EVALUATOR
Healthy Home Evaluator – Rationale

- Most home health visits are done by people without knowledge of buildings; they focus on what they observe in the living space.

- Energy auditors know
  - How to measure
  - How to find hidden problems
  - How buildings work

- Let’s put that knowledge to use for health.
There are 436 BPI HHE Certified Professionals in 43 States Plus DC
New Focus – Vision Test
**Toxic Free Tips**
for your home, school, work place, and community

**Recipes For Safer Household Cleaners**

### Multi-purpose greener Cleaner
(A multi-purpose cleaner that cleans and disinfects)

- 1 tablespoon soap (flakes, powder, or liquid) – not detergent
- ½ cup of white distilled vinegar
- 12 ounces (1 ½ cups) water

Add the ingredients to a clean 16-ounce spray bottle. Put the cap on and shake well.

**Cost per ounce:**
- This recipe: $0.01
- Commercial: $0.12

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### Tub & Sink greener Cleaner

- Baking soda
- Liquid soap (not detergent). Castile or Murphy’s Oil Soap are good options.

Use baking soda in place of scouring powder. Sprinkle it liberally on porcelain fixtures and rub with a wet rag. Add a little soap to the rag for more cleaning power. Rinse will to avoid leaving a hazy film. (Baking soda won’t scratch the porcelain.)

**Cost per ounce:**
- This recipe: $0.06
- Commercial: $0.82

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### Window & Mirror greener Cleaner

- ¾ cup white distilled vinegar
- 16 ounces of water

Pour ingredients into a clean spray bottle. Spray on surface. Rub with a lint-free rag, such as a diaper or sheets of newspaper.

**Cost per ounce:**
- This recipe: $0.08
- Commercial: $0.12

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**Toxic Free Tips**

[www.ecy.wa.gov/toxicfreetips](http://www.ecy.wa.gov/toxicfreetips)

**Ecology Publication No. 09-04-017, rev. August 2012**

For more information, contact ECOLOGY, 600 Washington St., P.O. Box 47, Olympia, WA 98507, 360-407-6085.

**www.ecy.wa.gov/toxicfreetips**

**ECOLOGY**

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Moisture mapping

Determine – it’s dry and no significant damage to drywall or floor
Key Steps

1. Start with the resident
2. Visual (qualitative) identification of hazards
3. Support visual identification with quantitative measurement
4. Justify and prioritize hazards
5. Identify interventions to address hazards
6. Communicate with the resident
Special focus on pests

- This is one area that most BA/EAs do NOT look at much
  - Identification
  - Measurement (dust samples)
  - Treatment
    - Integrated Pest Management (IPM)
Dust Sampling – dust mites, other allergens

Vacuum sample

Pump sample

INDOOR CLIMATE RESEARCH AND TRAINING

60
The concept Behind IPM

- Water
- Conducive Conditions
- Nest/Hide
- Food
Liability

- Health is a more litigious topic than energy efficiency
- Health is also covered by HIPAA
- Discussion of liability is included in training
- Make sure that you have processes and protocols in place to cover your team
## Review of steps

<table>
<thead>
<tr>
<th>EA/BA/MFBA/QCI</th>
<th>HHE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Talk to the resident</td>
<td>Talk to the resident</td>
</tr>
<tr>
<td>Visual observations</td>
<td>Visual observations</td>
</tr>
<tr>
<td>Measure</td>
<td>Measure</td>
</tr>
<tr>
<td>Justify and prioritize</td>
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</tr>
<tr>
<td>Identify Interventions</td>
<td>Identify Interventions</td>
</tr>
<tr>
<td>Circle back to the resident</td>
<td>Circle back to the resident</td>
</tr>
</tbody>
</table>
Does it really matter?

- Can provide a more complete look at the homes you assess

- Build models for partnerships with health providers
  - Pilot about to start in Champaign with Carle Hospital
  - Local utilities are also interested in exploring similar programs

- Can expand/diversify your agencies’ offerings, and increase your impact in your communities
Questions?