

# MN Hard to fix houses

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## Minnesota Department of Health

Division of Environmental Health

Indoor Air Unit

651-201-4601

# MDH Problem

- ★ Contractors are not receiving enough training before starting to work on houses.
- ★ MDH has a list of contractors that we “refer”
- ★ More and more contractors are starting businesses



Environmental Health Division  
Indoor Air Unit

## Radon Mitigation Service Providers

### What to Look for in a Radon Mitigation Contractor

Minnesota does not require radon mitigation contractors to be licensed, nor is there any oversight of mitigation work performed. Some things you should consider when looking for a contractor to mitigate your home are listed below:

- Will the contractor guarantee that radon levels will be brought to below the Environmental Protection Agency's (EPA) recommended action level of 4.0 picoCuries per liter?
- How will the system be evaluated?
- Will the contractor perform diagnostics to determine suction point location and pipe and fan size?
- What will the contractor do if post mitigation radon levels are not below the EPA's recommended action level?
- Can the contractor provide a list of references?
- Is the quoted price guaranteed?
- Is a contract provided?
- Will the contractor offer the homeowner training in radon mitigation system operation/troubleshooting?
- Is there a warranty on materials/workmanship?
- Who is responsible for obtaining permits, if required?
- Who will do the licensed electrical work?

### What to Look for in a Quality Radon Mitigation System

Even though all Minnesota listed contractors have gone through the appropriate training, are a member of a national certification program, and also report their work to the state, not all systems are created equal. Here are some key features to look for:

- The fan **SHALL** be located outside of the living space. This means in the attic of the house or garage, or outside on the side of the house; never in the living area itself.
- If the exhaust point is through the roof, with the fan located in the attic, the exhaust needs to end a minimum of 12 inches above the roof.
- If the exhaust point is on the side of the house, it needs to meet the following criteria:
  - be above the eave of the roof,
  - be 10 feet or more above ground level,
  - be 10 feet or more from any window, door, or other opening into conditioned spaces of the structure that is less than two feet below the exhaust point,
  - be 10 feet or more from any opening into an adjacent building.
- Any pipe runs through unconditioned spaces (attics or garages for example) should be insulated to minimize condensation.
- The vent pipe shall be supported every 6 feet on horizontal runs and every 8 feet vertically.
- The vent pipe shall be supported or secured permanently to avoid falling into the suction pit.
- Any horizontal runs of pipe shall be sloped slightly back to the suction pit to ensure rain and condensation can flow back to the pit.
- Any visible cracks or holes in the foundation should be permanently sealed. This will allow the system to be more effective and efficient.
- The system shall have a performance indicator that is visible and easy to read.
- The system shall be labeled with the date of installation, contractors name, and initial pressure reading in the pipe.

# How we deal with these problems

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- ★ Originally we used to take these houses and turn them into research projects and MDH would ensure that they are mitigated
- ★ Now we are getting about one house a month, and we are turning these houses into advanced diagnostics courses...

# Southern MN – Limestone Formations

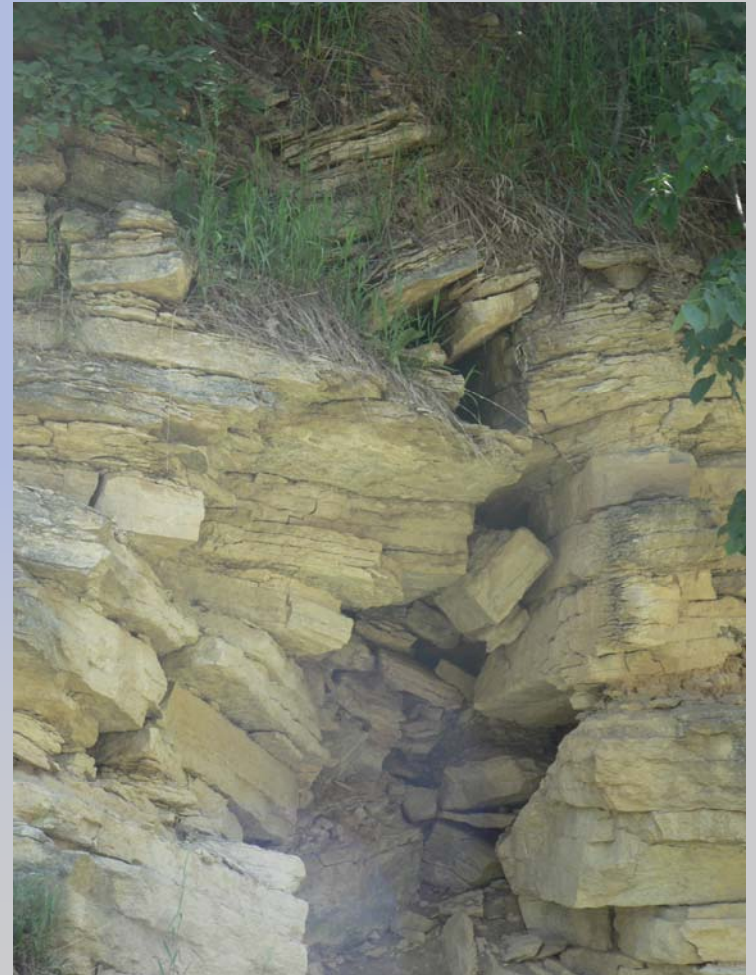
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- ★ Multiple Issues with Southern MN
  - Higher Radon Soil Concentrations
  - Limestone Caves, Sink Holes and Fissures
  - Large Areas of Open Land

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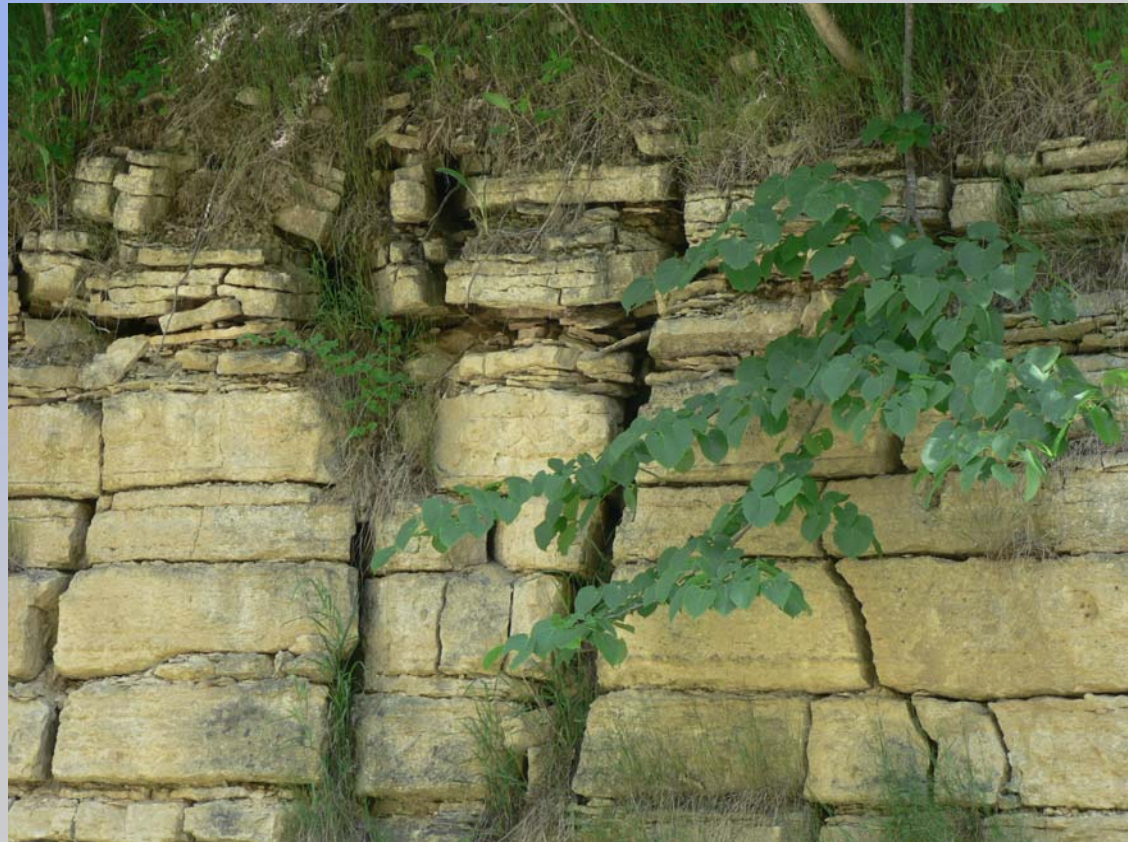
## ★ Limestone Geology



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★ Great  
radon  
pathways



# Dodge County House

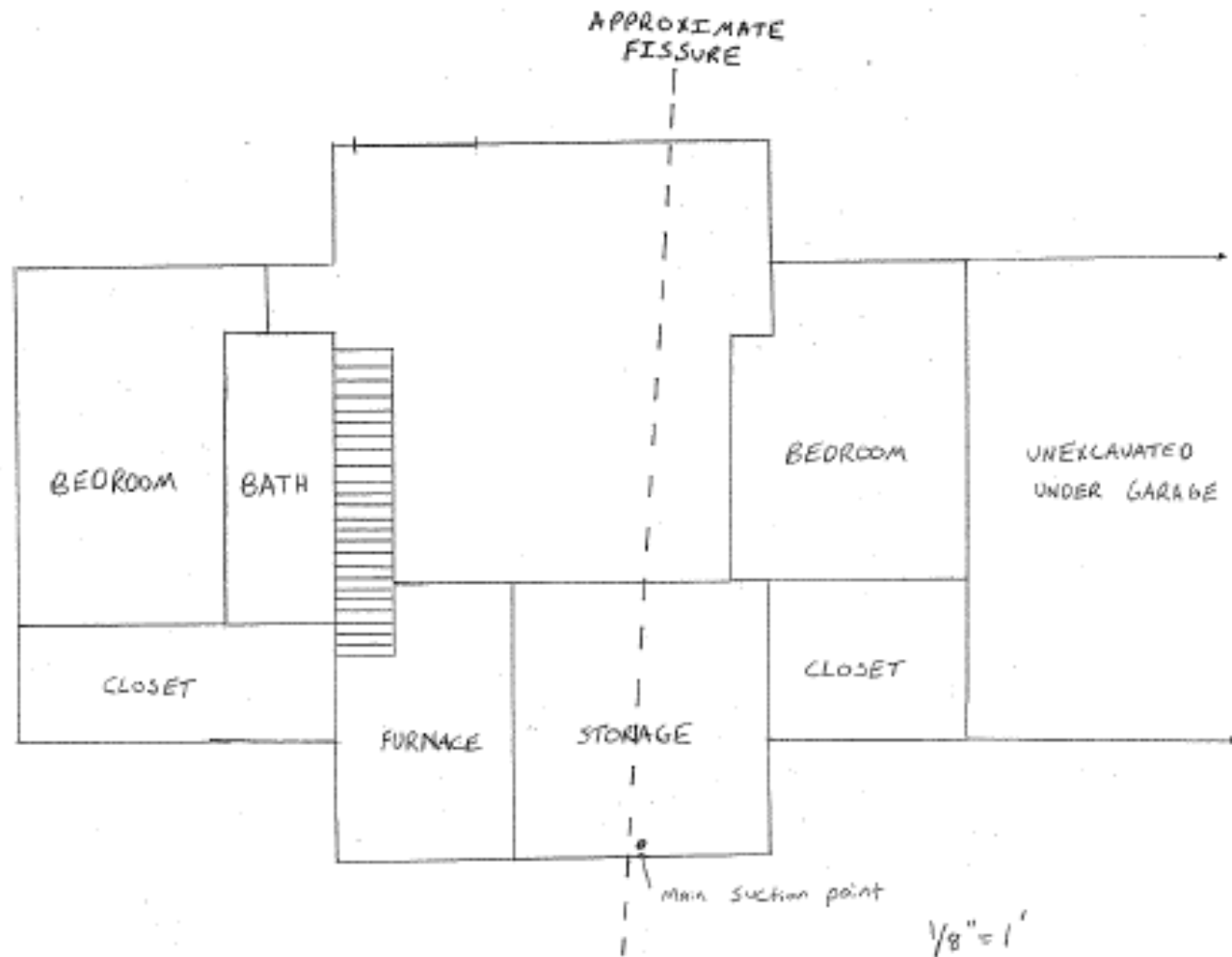
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- ✓ *Contractor tried and failed...*
- ✓ *MDH decided to use house as a research project*
  
- ✓ *System Installed*
  - ✓ *First try, one suction pit and a RP145 (3" pipe)*
  - ✓ *Second try, another suction pit (3" pipe)*
  - ✓ *Third try, RP 265*

# Front of house



# Floor Plan



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## ✓ *House Problems*

✓ *Log home*

✓ *Wood Foundation*

✓ *Day-lighted exterior draintile*

✓ *In-floor heat*

✓ *Limestone Cave below house*

✓ *House on top of hill, surrounded by sink holes and open land*

✓ *Homeowner was the builder of the house*

✓ *Radon levels 130 pCi/L to 160 pCi/L*

# Initial Diagnostic Testing

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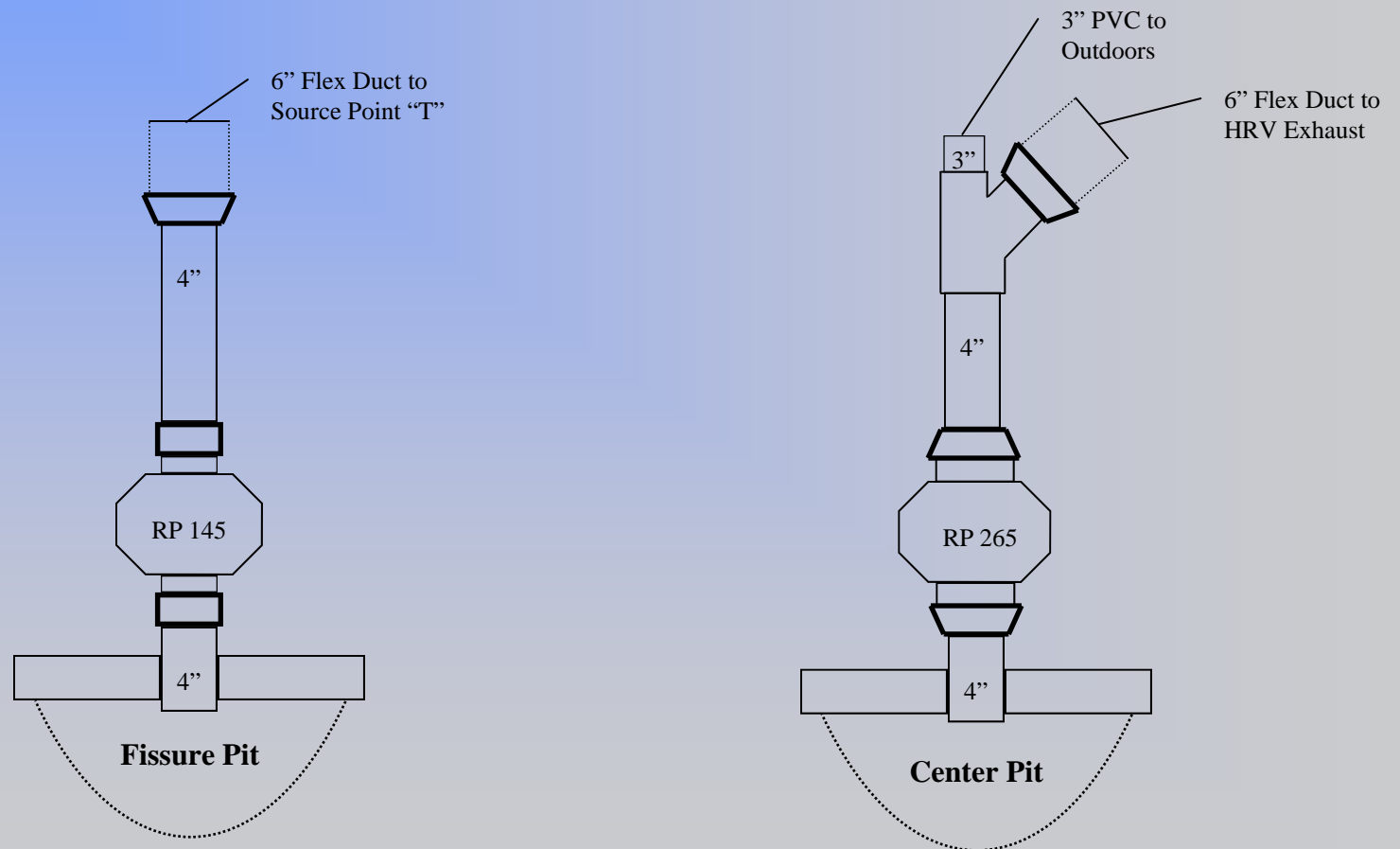
- ★ Pressure Extension did not extend beyond 2' from each suction point.
- ★ Stack Pressure causes house to be -10 pa!
- ★ Blower door testing = 2541 cfm @ 50pa
  - Leakage Area 276" – most leaks above the neutral pressure plane – (12" x 23")
  - Neutral pressure plane  $\frac{3}{4}$  up the house

# Pressurization Mode

- ★ Added roof vent and flipped RP265



# Pressurization



# Partial Victory

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Pressurizing below the slab reduced summer levels but could not reduce winter levels below 17 pCi/L

# Winter Problem

- ★ Ground Capping and the floor is turned on



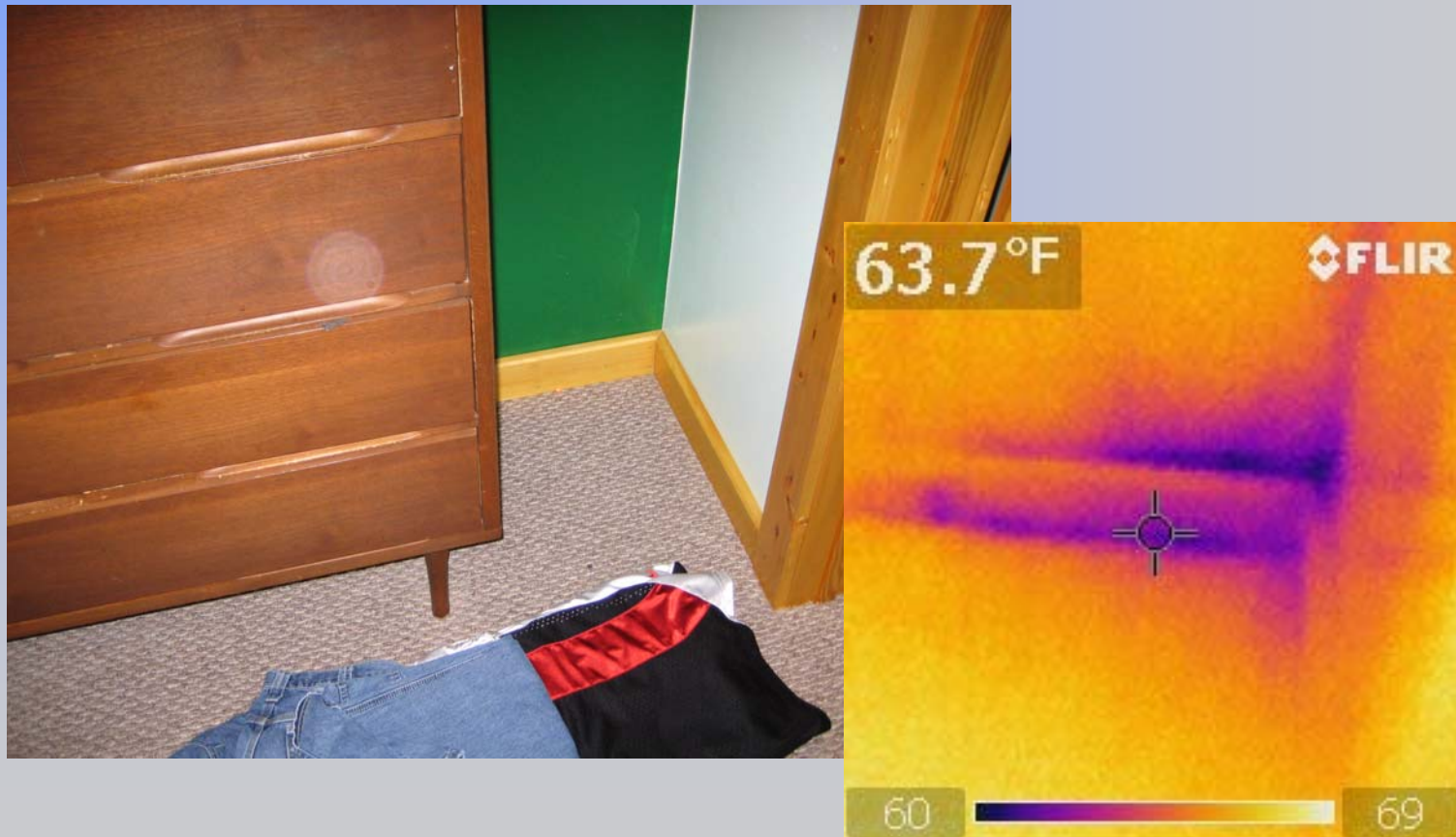
# Further Diagnostics Testing

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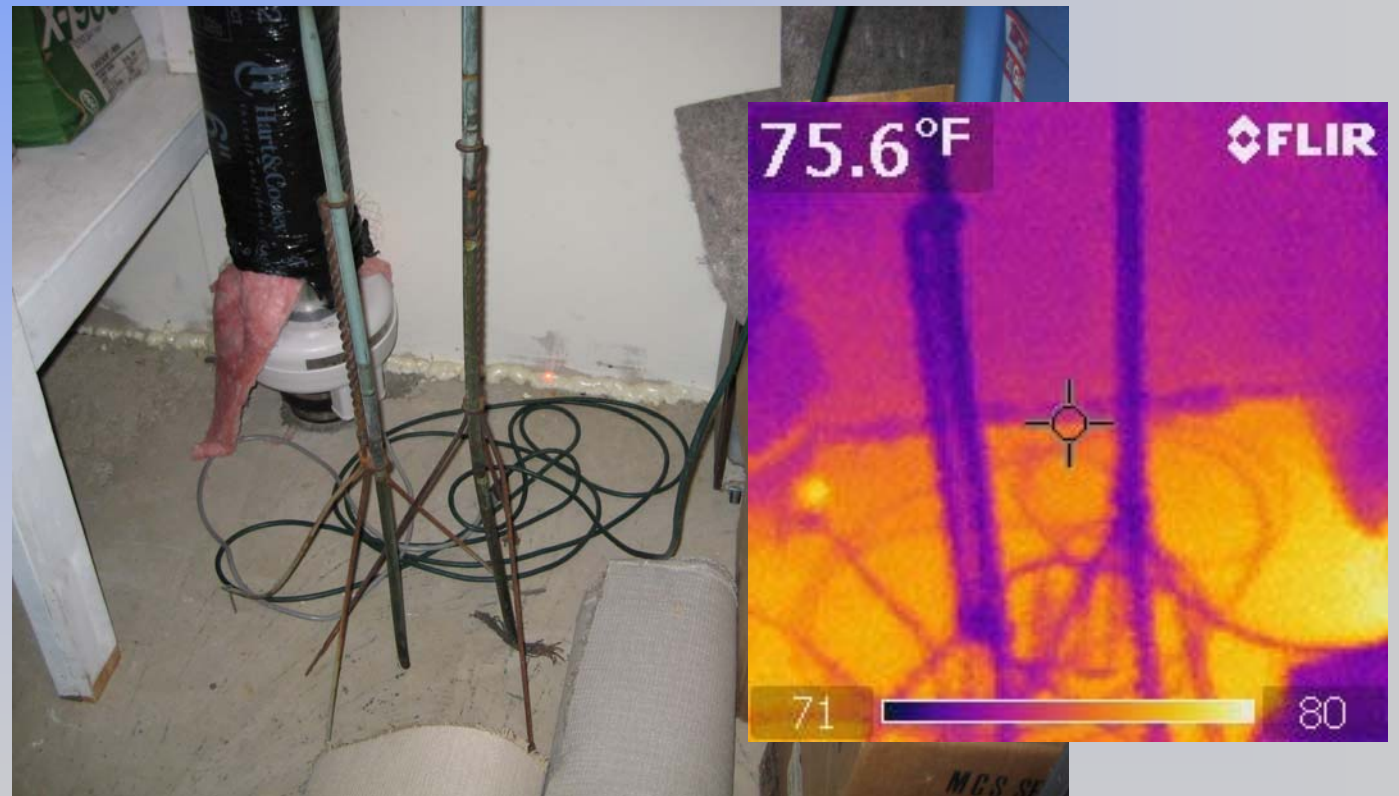
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- ★ Homeowner was not proactive...
- ★ Further diagnostics testing motivated homeowner, A infrared camera and blower door were needed to show the leakage from the soil.

# Infrared Diagnostics



# Infrared Diagnostics



# Infrared Diagnostics



Approximately  
12" x 12"  
hole sealed

# Diagnosics Testing After Sealing

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- ★ Pressure Extension throughout footprint when moving 300cfm+ of air
- ★ Minimal difference on house depressurization!
- ★ Major air sealing in top of house was also done but another blower door number has not be done... The house now operates around -1pa in the same conditions

# Current Dodge Co System

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★ Currently, there is a 6" system in place, with two suction pits, one new and one existing, a FR250, 10" flex duct above the fan to a roof vent...



★ Summer numbers are below 1 pCi/L....

★ Winter numbers have not been gathered for this configuration

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# Advanced Diagnostics Option

# Metro Area Rambler

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# On-Site Advanced Diagnostics Course

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- ★ Metro Area House, Contractor installed a temp system and never returned homeowner phone calls...
- ★ Then, 5 contractors came to look at the house and would not give the homeowner a bid because they did not think they could mitigate.

# Temp System

- ★ The temp system that was installed with a Radon Away XP 201 sucking on the sump basket and was vented through a basement window that was removed...
- ★ The beaver board was caulked closed



# Temp System



# Golden Valley House Problems

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- ★ Fairly large footprint rambler around 2000SF
- ★ Hard pipe routing
- ★ Transite (under floor ductwork)
- ★ Span-crete storage area
- ★ Beaver Board drain board partially buried in concrete
- ★ Partial Draintile

# What we did in class...

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- ★ The contractors walked the whole house and talked about the major issues that they see...
- ★ We did pressure diagnostics on the current system to see how it was affecting the house
- ★ The contractors decided where they would like to put a suction pit...
- ★ Suction pit was dug
- ★ Pressure extension diagnostics were preformed again
- ★ Final pipe routing was decided and further diagnostics were required to ensure effective mitigation

# Planning the Walkthrough

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- ★ Each contractor was given a blueprint of the house
- ★ The proposed points of pressure extension measurements
- ★ Radon measurements that were preformed

# Planning Table



# Walkthrough

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- ★ Although the beaver board was caulked well the sump basket was only taped closed and none of the 1/8"-1/4" cracks within a 5' radius of the sump were not sealed

# The walkthrough

- ★ The 1 ½" PVC pipe that connects the furnace plenum and the sump basket was missed by all...



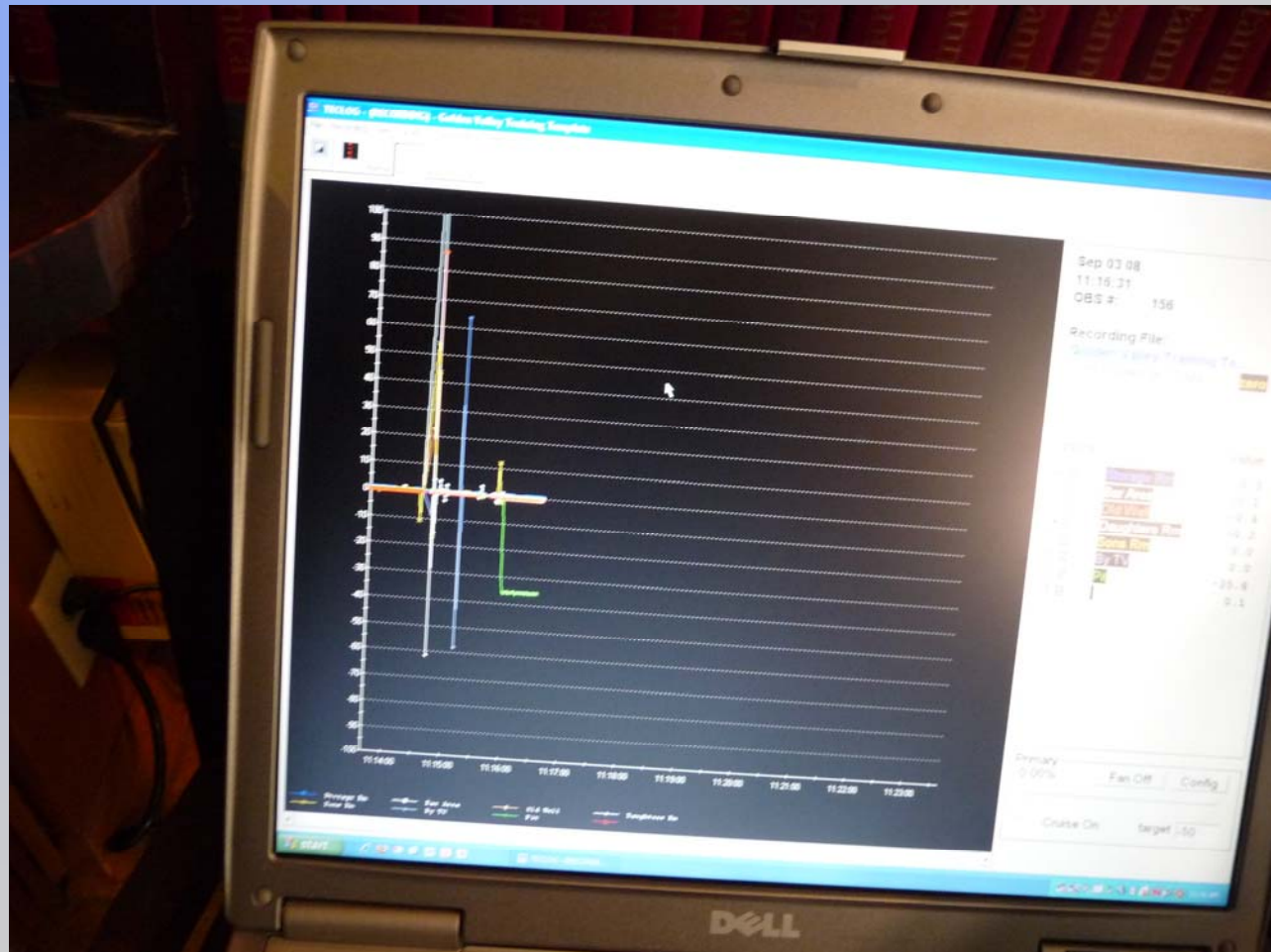
# Pressure Extension Measurements

- ★ To make the pressure extension visual we used a computer, and APT 8...



# Pressure Diagnostics

★ Teclog



# Attempted Pressure Extension Improvement

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- ★ The large cracks around the sump basket were sealed, the sump basket caulked closed...



# Data Collection

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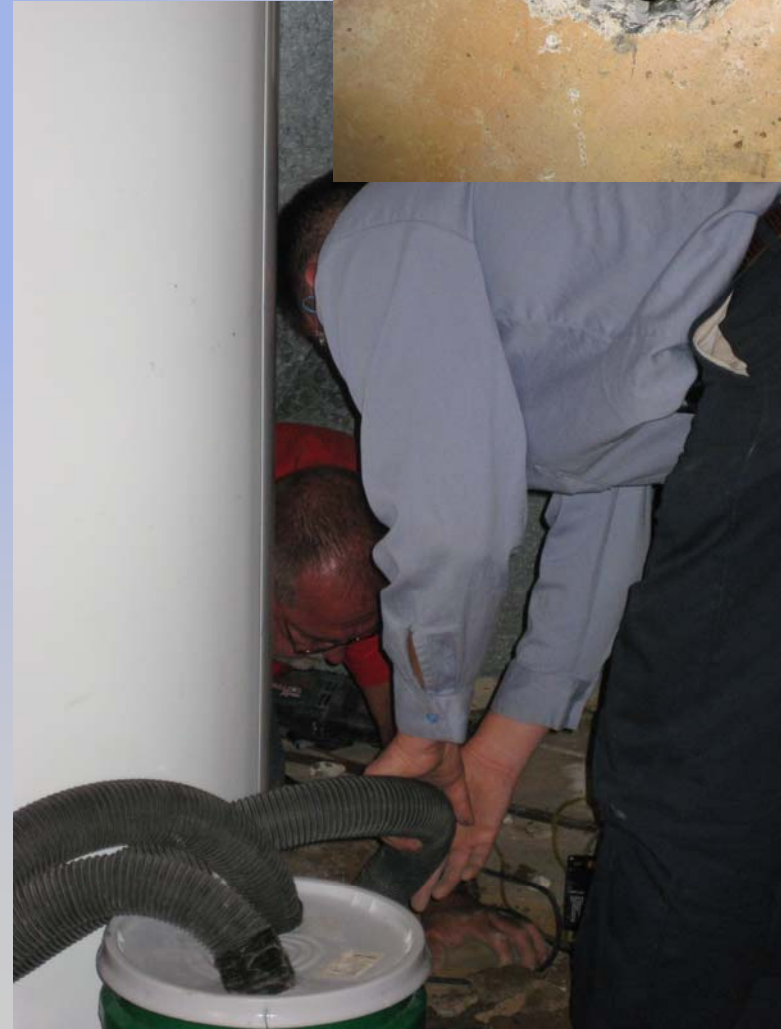
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- ★ We used large pos-it notes to keep track of all the data...



# Suction Pit

- ★ The suction pit was decided to be placed near the furnace plenum and the sump basket



# New Pit Pressure Extension

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- ★ The new pit had better pressure extension than the sump basket but it was not giving strong pressures on the ends of the house



# Final Pressure Diagnostics

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- ★ I returned the following day, I filled in the pit that was near the furnace and sump basket, a new pit was dug.
- ★ I placed the new suction pit in the draintile field, towards the area we were not able to get strong extension and over the main sewer line.

# New Pit, Pictures



# New Temp System

- ★ 6" taped metal flex duct



# New Temp System

- ★ Exterior mounted fan



# New Temp System

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- ★ Flex duct running down the hill to the woods away from the house to exhaust



# Final System

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- ★ 4" PVC pipe with a HP220 due the major leakage into the block cavities due to the basement water proofing system

# Final Slide

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Our solution to our two major problems with contractors is to hold training courses on houses that contractors try and fail or just don't try