Advanced Diagnostics: Hard Won Lessons from the Field

Chris Dorsi • Energy Outwest Phoenix • Monday, May 21, 2018 • 8:00 am – 12:00 pm

Brain Training for Building Scientists

The tests you perform may not return the results you expect. In this session we'll fact-check one another as we analyze case studies and choose among possible scenarios. And we'll address common pitfalls in analysis and planning that can happen even when you're working with good data.

We'll also take a fresh look at the classic struggle of man versus machine -- or "auditor versus diagnostic tool". Our goal is to help improve your diagnostic audits by balancing the use of tools with an informed process you apply differently to each job.

--- Chris Dorsi cdorsi@habitatx.com (*thanks to J West for many of the perspectives included here*).

Why We Test

Every diagnostic test requires a different approach depending on what you'll do with the information.

- **Perform a Diagnosis**. Identify components, confirm condition, and make broad recommendations to improve building performance and occupant safety. Analyze known problems.
- **Develop a Scope**. Test and analyze the home with sufficient detail to create a scope of work. Identify relationships among the home's components, and anticipate the effect of proposed work. Create a line of communication with crews.
- **Perform Quality Control**. Perform test-in procedure to set a baseline for the home or system. Determine if work performed is complete and effective. Perform test-out procedure or end-of-job analysis. Perform programmatic oversight.

Take an Intelligent Approach

We've observed a mindset common to experienced practitioners. It's a combination of education, experience, and situational awareness.

- **Use Basic Science *and* Applied Science.** Learn about the principles of science, but don't ever forget about the limitations of your tools, or the variability of the work environment.
- **Remember That the House is a System.** Analyze each separate part of the home as needed, but keep a broad view of the home, considering how the home's components are linked to one another.
- **Synthesize the Information.** Keep all your observations in play until the very end of the process. Don't discard data just because you cannot find an immediate need for it.

Watch out for Common Pitfalls

We've seen that when the process of analysis goes wrong, it can often be attributed to the same old. Learn to recognize these, and improve your situational awareness.

Errors of Planning

- **Perceiving the House Incorrectly.** *Example:* You did not fully understand the impact of intermediate zones such as porches.
- **Not Accounting for Interference.** *Example*: You did not expect that kids would play with windows, or that pets would come and go through pet doors.
- **Making Assumptions about Hidden Components.** *Example*: You tested airflow at a grille that's not connected to the duct system. Or you checked the draft of a chimney that vents into the plumbing system.
- **Performing Tests under Different Conditions.** *Example*: You included a semi-conditioned porch in the test-in process, but not in the test-out.

Errors of Testing

- **Choosing the Wrong Test.** *Example*: You spend time testing ducts which are completely indoors, and which you cannot get access to for sealing anyway.
- **Choosing the Wrong Setting or Set-Up**. *Example*: You don't configure the manometer to match the blower door set-up. Or you zero your CO monitor in a garage that's full of CO.
- **Doing Tests Out of Order.** *Example*: You do a winter blower door test that causes chimney backdrafting, thus cooling the chimney so it fails a draft test. Or you IR-scan a wall in the morning shade, then scan it in the afternoon sun, and get surprised by the results.
- **Doing Things the Hard Way**. *Example*: You make a cardboard adapter for an arched door, when you could have installed the blower door in a big nearby window.

Errors of Analysis

- **Taking Too Much Data.** *Example*: You waste time or get confused by doing a complete audit on each and every unit in a row house. Or you perform extensive combustion analysis on a water heater you plan to replace.
- **Taking Too Little Data.** *Example*: You go back to the office to discuss a moisture problem in the crawl space before you look for any plumbing leaks. Or you report a combustion appliance that fails under worst-case depressurization, without testing it under natural conditions.
- **Relying Only on Data.** *Example*: You install a large exhaust fan, according to usual protocols, in an apartment with shared walls. But you don't consider whether the negative pressure sucks smoke and odors through the common wall. Or you call for attic insulation without inspecting the ceiling for structural integrity.

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