

Knowing the Limitations of the Tools in Your Toolbox



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Understanding Your Instruments

Many practitioners sell services based on the capabilities of their gizmos and gadgetry. Most practitioners are keen to tout what their tools can do. Do you remember “It slices, dices and juliennes fries?” However, as a professional, it is equally or perhaps even more important to

understand what your tools cannot do. Here’s a relatable example:



What’s Wet in This Bathroom?

Exhibit 1 is a photo and coinciding infrared image depicting wallpapered drywall in a bathroom shower enclosure. The infrared (IR) image shows an area of cooler wall surface temperatures, which is represented by the blue color. The cool or blue area is bordered by warmer wall surfaces as indicated in green. The blue areas present an anomaly possibly indicating wet building

Ever see someone try to drive a nail with a screwdriver? If you haven’t seen it, I’ll save you some trouble. It just doesn’t work. Either the nail is the wrong tool for the job, the screwdriver is the wrong tool for the job, or the combination of nail and screwdriver are completely wrong. You may ask, why would anyone try to drive a nail with a screwdriver? I propose the practitioner doesn’t understand the limitations of the tools in their toolbox.

I loosely define the environmental practitioner’s toolbox as containing not only the devices of the trade, but also their skills, means, and methods. Your toolbox literally contains microscopes, dehumidifiers, boroscopes and even hammers. But, your toolbox also contains your abilities to:

- Visually assess what you see
- Recognize what might exist that cannot be seen
- Hear what’s being described
- “Hear between the lines” and recognize what’s not being said
- Draw on your experience to recognize patterns
- Draw on your education/training

Practitioners with limited experience or inadequate training often make errors by:

- Not possessing the right tools
- Using the wrong tools
- Using the right tools in the wrong way
- Misinterpreting data generated by the tools

Rarely do I find these errors to be malicious; generally they occur out of ignorance. Usually, the practitioner just didn’t know better. It’s often said; ignorance is bliss. But, bliss quickly gives way to embarrassment and liability the moment someone points out you are ignorant.

I’ve made certain assumptions in writing this article. First, I presumed, you are professionals in the related fields of remediation, restoration, industrial hygiene, environmental consulting and/or laboratory analysis. Second, I presumed each of you cares . . . I am not speaking of warm fuzzy holding hands caring. I mean you care about your customer, your business, your employees and your reputation. Finally, I presumed you are striving to master your craft to become or remain a reputable and effective expert.

Below are a few illustrations of the countless examples of tools with limitations. I hope one catches your eye and makes you ponder the limitations of your own toolbox.



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materials. So, the blue area is wet, right? Before you reply, let's dig a little deeper.

Your non-penetrating (nondestructive) moisture meter beeps or pegs the display when applied to walls throughout the bathroom. To double-check yourself, you reach for your penetrating (destructive) moisture meter. It too, beeps or pegs the display on every bathroom wall. Both meters showed the bathroom floor, ceiling, and wooden baseboards to be dry <15% and/or below the established dry standard.

Surely you're ready to call the walls wet now. All your state-of-the-art, expensive, and impressive tools proved that all walls were wet? So, given this scenario, what is wet? The answer is NOTHING. Everything is dry.

How Can the Walls be Dry?

False Positive #1. The cool blue wall section results from HVAC supply air cooling the surrounding materials. It's not typical to see HVAC registers in a shower enclosure, but they exist. Duct leaks in wall/ceiling cavities or outdoor air infiltration can produce similar anomalous cold spots. The take home lesson: cool surfaces do not always equal wet building materials.

False Positive #2. The non-penetrating moisture meter beeps on all walls throughout the bathroom because the wallpaper has a metallic decorative additive. It is not typical to see metal-infused wallpaper, but it exists. Other metal building components such as metal studs, metal corner bead, reflective foil-backed drywall, case window counterweights, etc. can produce similar results. The take home lesson: a beeping meter does not a wet building material make.

False Positive #3. So too, the penetrating moisture meter alarms on all walls throughout the bathroom because the wallpaper has a metallic decorative additive.

Remember, a monkey can be trained to put a moisture meter on a wall, collect a spore trap sample, or turn on an IR camera. Certainly in trained hands instruments can make your job easier, faster, more complete, but no tool can replace the experienced trained professional. As an expert, you must know the limitations of your tools, understand building materials, and have a working knowledge of applicable rules and regulations.

"But Derrick," you say, "these are the state-of-the-art tools, and anyone could make this mistake." Well I reply, not you. You, the expert, are curious, vigilant, and knowledgeable. You always question your results. You question results not only when they challenge your hypotheses, but also when they support your hypothesis.

Understanding the Limitations of Document Templates

Computers have dramatically changed our industry. I am not that old (unless you ask my daughter), but I remember reports being typed on a device called a typewriter. Actually, at that time a secretary (known now as an administrative assistant or document engineer) would transcribe gibberish notes from a technical professional into a report from scratch. The draft would be reviewed by the technical professional and retyped by the secretary. This practice has gone the way of the dinosaur, as have sec-

retaries for technical professionals. Now, we all have computers and generate our own reports.

This gave way to the use and abuse of the document template. Generally, document templates are stored electronically in order to save the author time and effort by preventing repetitive data entry of common phrases, calculations, etc. Templates provide a consistent document appearance and they speed the output of common documents such as proposals or reports. They prevent technical experts from having to reinvent the proverbial wheel for each project.

Abuse of templates is a rampant limitation to this otherwise helpful tool. Experienced professionals write reports, which get converted into templates. The available templates tempt junior staffers into plagiarizing reports that truly require expertise above their pay grade. I can hear the junior staffer's inner dialogue "Why not? The original report was defensible, so my cut-and-paste version will be defensible too." Invariably, every project has differences; some are subtle and some are of freight train proportions. If the junior staffer cannot recognize the need to modify, remove, and/or add sections, they are doing their client a disservice, extending liability, and blackening the eyes of the industry.

You, the author must decide what's essential to your report. Don't force your report to "fit" the template. If particular sections are not needed, cut them out. If you need an additional section not included in your template, insert them. Each report must be accurate, complete, and defensible. The information regarding the service order, proposal, meetings minutes, and your observations must be reflected accurately. This is especially important since the reviewer (presuming you have your reports reviewed) cannot verify this information since they do not have first hand knowledge of the project details.

Copy-and-paste errors and phantom template verbiage reveal a lack of both attention to detail and professionalism. Templates are useful, but mustn't be abused.

When the day is done, the fieldwork is forgotten, the phone conversations are lost, and the collected samples are discarded, only your report remains. It must stand alone, it must be correct, and it must be clear.

Understanding the Limitations of Our Skill Set

It amazes me when practitioners sell services simply because they can. Perhaps they are proverbial one-trick-ponies yearning to perform their one trick. Just because you can perform a service doesn't mean you should. Be a responsible citizen of the IEQ community; and only provide value added services. Here's an example that can be modified to apply to all trades across the environmental industry.

A customer calls a mold consulting and testing firm describing asick building syndrome scenario. According to the client, office employees perceive they experience headaches on Wednesdays at noon. Immediately the testing firm proposes a thorough mold inspection. Little regard is given to asking "is there a history of water incursion"? In fact, the question "what happens at your facility on Wednesdays never even comes up. And \$2,000 later the customer ends up with a lovely report stating, "It appears mold is not an issue at your facility."

The report may be pretty, the service may be cheap, the turn-around-time may exceed the customer's expectations but the mold testing firm wronged the client. The report is worthless for determining why the perceived headaches occur. The client expended valuable resources, critical days have passed, the tenants have paired up with an attorney, and now the entire environmental consulting industry gets a black eye.

A vast array of causative agents and combinations of causative agents potentially cause headaches. People get headaches from writing articles, too much sun, not enough fluids, poor lighting, incorrect contact prescriptions, VOC overexposure, pollen allergies, low blood sugar, etc. More questions should be asked and more options presented. Being a one-trick-pony is fine, but you must understand and express the limitations of your service.

Understanding Lab Results & Instrument Measurements

The best laid sampling strategy can yield false positives, false negatives, anomalies,

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 <p>Indoor Air Quality Monitor 2211 Measures multiple parameters CO, CO2, Temperature, R/H</p>	 <p>Digital Aerosol Monitor 3431 Compact Aerosol / Dust monitor</p>	 <p>Anemomaster A004 Air Velocity and Temperature Meter Compact & Handy</p>
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mismarked samples, media failures, shipping damages, lab failures, data entry errors, etc. You need to have an anticipated result in your mind before you collect a single sample. You need to know what the results mean before you collect a single sample. There is nothing worse than getting sample results without value.

You must select sampling and analytical methods with appropriate lower limits of detection (LOD). The lower LOD is the concentration below which the results cannot accurately be reported.

Let's imagine you're performing exposure monitoring on your employees to determine the 8-hour time weighted average (TWA) exposure to the dreaded Deathaline (not a real substance, but it sounds scary). Let's say the LOD for Deathaline given your chosen sample method, run time, and flow rate is 10 parts per million (10ppm). The lab reports a result below the detection limit (BDL). This DOES NOT mean Deathaline is absent in the sample. Simply the sample results are less than 10ppm (<10 ppm) or below the lower limit of detection. It means your result falls within the range of 0ppm to 9.9999ppm.

What if the permissible exposure limit (PEL) for Deathaline is 7 ppm? Your results are inadequate to weigh against the PEL. You have done a disservice to your employees and extended your liability. You cannot prove to OSHA the PEL was not exceeded. You look like a fool, and the lab still charges you for the analysis.

Analytical Upper Limit of Detection

While performing dry ice blasting, you try to record worker exposure to carbon dioxide (CO₂). You buy some CO₂ meters, and you slap them on your crew. Let's say your new meters read up to 4,000ppm. Your crew begins blasting away, and you get data that pegs the meter at 4,000ppm for the whole day. Does this mean you were 1,000ppm below the PEL the entire shift? No, it means your meter didn't have an adequate upper limit of detection. You cannot tell if your crew was exposed to an environment with 4,000ppm, 4,001ppm or 1,000,000ppm. That is what I like to call "bad", since the exposure limits for CO₂ are 5,000ppm PEL, 30,000ppm short term exposure limit (STEL), and 40,000ppm immediate danger to life and health (IDLH).

The cafeteria manager calls reporting headaches and nausea. So you check the air in the cafeteria manager's office at 6:00am with a real-time measuring device for carbon monoxide (CO). The display says 0ppm, so you go back to the office and write a report stating carbon monoxide is not an issue at the facility visited. NO, NO, NO, NO, NO!

You drew an inappropriate conclusion based on a single point-in-time measurement. At 6:15am the cooks turned on the exhaust hoods, dramatically shifting building pressure relationships. If you would have stuck around until 6:25am you wouldn't have missed CO backdrafting into the manager's office from both the parking garage and the boiler room. Use caution when drawing conclusions based on limited data.

Know the Limitations of Standards and Guidelines

We've heard the adage: rules are made to be broken. Our industry rules include:

- Manufacturers specifications
- Industry guidelines
- Federal regulations

- State regulations
- Local regulations

Breaking the rules in the environmental health and safety industry carries liability and may carry dangers to life and health. But, what if you have a really good reason for not following the rules? Never deviate from the standard ... unless of course you want to.

Most reputable regulations and guidelines have disclaimers stating something like ... "this document does not cover every encounterable scenario and it is up to the professional to judge each situation on its own merit using experience, education, and common sense." As a professional you should use

guidelines as needed and exercise judgment where appropriate.

If you choose to depart from the norm (manufacturer's recommendations, guidelines, standards etc.) simply indicate you are aware of the correct or the recommended way, and you are consciously choosing to digress for reasons X,Y,Z.

In order to deviate from the standard, demonstrate you:

- Understand the standard and are aware of "the box"
- Considered and accepted potential consequences to both you and your client for stepping outside said box

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Throughout his 15-year career, Mr. Denis has been involved in over 10,000 IEQ projects. Examples of his industry-relevant certifications include: CIEC, CIAQP, CAC, WRT.

Presently Mr. Denis is the IAQA Phoenix Chapter Director and is a Member of the IAQA Board of Directors. He previously sat on the National Advisory Board of the American Indoor Air Quality Council.

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