IAQ RADIO+

Show Number: 728 Blog

Bradley Prezant
Russ Crutcher
Assessing Wildfire and Other Indoor Particle Contamination

Good day and welcome to the IAQ Radio+ episode 728 blog. This week we welcomed Brad Prezant and Russ Crutcher to discuss assessing wildfire and other indoor particles.

Brad Prezant, MBA, MSPH, CIH, COH, CAQP is an evidence-based public health scientist with a background in epidemiology, occupational health & hygiene, and ergonomics. He provides expert witness support for litigation involving indoor air quality including mold, wildfire, and other issues impacting the built environment. Until the company was sold in 2007, he operated Prezant Associates, Inc. in Seattle, providing consulting, training, and laboratory services for 20+ years. He is currently Principal Consultant at PREZANT Environmental in Melbourne, Australia.

Russ Crutcher is the Owner and Principal Analyst for Microlab Northwest since 1978. Mr. Crutcher Graduated from the University of Washington and also attended graduate school in Civil Engineering. He has taught classes in environmental microscopy since 1976. He has vast experience in microscopy and identifying contaminants and their sources including on the surfaces of satellites returned from orbit. Mr. Crutcher has published over 100 papers on the Analysis of Environmental Particles using light microscopy.

Nuggets mined from this week's episode:

Russ Crutcher began his microscopy particle research in 1974. His microscopy work with particles is recognized internationally. Russ worked for Boeing who loaned him out to NASA. The particles Russ studies come from wide ranging sources: from equipment and process failures, from decommissioned satellites, structure fires, wildfires, from people in offices and homes who wonder if its dust, etc. Russ works at the intersection of the physics of light and matter. Russ manipulates magnification and different light sources light to obtain hints about the condition of a material before it was reduced to a particle, how it became a particle, it's history as a particle, how it was transported, the amount of time spent in a location, etc. Asbestos fibers take years to result in a health problem. Other particles cause health complaints quickly. Particle study identifies causes of discomfort. House pets are sensitive to particles that don't irritate humans. Light microscopy works for Russ, because most particles that cause short term irritation are relatively large, 1 micron or larger.

Brad Prezant and Russ have been working together since the early 1970s. Brad quickly realized that Russ's knowledge and skills were a great resource. Brad told the tale of a small home, the residents of which heavy cigarette smokers, who recently had a new furnace installed and soon after complained of brown residue on the walls. Brad took tape lift samples and sent them to Russ for analysis. Russ found that the residue was caused by a "glob" of grease in the furnace and not occupant smoking.
Brad told the tale of a high rise building in Seattle that stood 150 feet higher than the closest building, where occupants were complaining of mesquite odor. This taller building had a restaurant which featured food cooked on mesquite wood. The building's restaurant had a well-designed exhaust ventilation system on the roof, Russ found mesquite wood cells in the sample's Brad had taken, proving the unlikely pathway between the two buildings.

Brad calls Russ "the not-so-secret weapon for solving IAQ problems".

Another of Brad's cases involved a business interruption claim. The policyholder was smoking foods in a shipping container on the loading dock of their facility, which was using special wood chips imported from Germany's Black Forest. The facility had an intense structural fire. The policyholder was concerned that residue from the structure fire may have contaminated their smoker. Brad took samples from inside the structure fire location, and from the walls of the smoker and sent them to Russ,

who found that no structure fire residue had contaminated the smoker. Russ's findings avoided a costly 6-week shutdown for cleaning the smoker.
According to Brad, the power of light microscopy is greatly mis-understood and underestimated. Light microscopy is effective on both solid particles and condensed particles.

How much does light microscopy sampling cost? According to Russ, analysis of 10 samples costs $400. Some types of analysis are more involved and cost more.

There are many different types of structural fibers, attic fires, kitchen fires, plastic fires, etc. Douglas Fir lumber is commonly used in construction and Douglas Fir particles are commonly found in fires where Douglas Fir burned. Particles deposited by a wood burning fireplace are different than wildfire particles from burning plants.

The common denominator among wildfires is the presence of ash particles which result from burning plants.

Russ recommends the use of 3M Magic Tape for tape lift sampling. In lab preparation for microscopic examination, the tape is dissolved leaving the adhesive which holds the sample to a glass slide. This results in a permanent mount.
According to Russ, clear tape may have defects and traps bubbles. Russ traces the origin of this method back to the 1930s and he found it in a 1960s research paper.
To Russ' dismay this technique is not widely used.
Russ opined that European microscopists are often more skilled and that American microscopists favor use of expensive equipment.
Russ finds that by using different techniques and manipulating different light sources he is able to obtain information that would be damaged or destroyed by other microscopy equipment.

Russ opines that a shortage exists of qualified microscopists to do the microscopy work. He will be teaching particle ID courses for McCrone.

As wood is not a major fuel in most wildfires, it's not necessary to be able to ID the species of trees; however, being able to differentiate between grasses is important. No one burns grass in their fireplace. The Lahaina Wildfire in Hawaii spread rapidly because of Bull Grass, rapidly moving downwind.

For wildfire analysis it is important to be able to characterize the type of grass (e.g. Fountain Grass, Savannah Grass, etc.). Russ stressed the importance of knowing proper set up the microscope to do analysis work.

While investigating cement construction in Colorado, where many residents burn fireplaces, residue from wood burning fireplaces was found on the cement.

AIHA website statement

"After the fire is over, deadly hazards remain.
The lasting threats to communities occur during the cleanup and recovery phase when cleanup, demolition, and construction workers take on hazardous tasks, and families begin returning to their homes. If they are lucky enough to have their home intact, hidden hazards may exist within their homes' walls from the impact of the toxic smoke.
Thousands of people in multiple states are impacted directly and indirectly by wildfires, forest fires, brush fires, and now unprecedented urban wildfires that engulf entire neighborhoods. Even those hundreds of miles away from a burn zone may be at risk as equipment and materials in these environments are transported to other areas for service, repair, and decontamination.
Residents returning home to pick up their lives must have their property tested and evaluated by a certified professional to ensure it is completely safe, through sampling and data interpretation, to begin recovery efforts."

According to Brad, the AIHA statement was not well considered because there are a wide range of wildfire impacts: some impacts tell the assessor all we need to know while others are ambiguous. We don't need a massive examination to prove the obvious. Common sense is often sufficient. While sampling may be required in certain cases, it is not always necessary or desirable to sample, thus the use of the word "must" in a blanket sense to apply to all situations is not defensible, either on the basis of property damage or potential health concerns.

Professional judgement begins with a sampling hypothesis.
When sampling is appropriate, its purpose is to answer a posed hypothesis, such as "there is microscopic settled dust evidence of particulate deposition in this residence that is consistent with wildfire emission and not consistent with other sources of indoor combustion particulate.". The hypothesis is either confirmed or refuted based on the sampling results.

One should *a priori* have a different conclusion or action plan based on the possible results of the sampling. If you sample, and cannot interpret the results, for example, you test for SVOCs in a building potentially impacted by a structure or wildfire, but have no health benchmarks with which to compare the results, or no definition of

background levels in residences absent any fire impact, you cannot meaningfully interpret the results. The sampling may have been a waste of time and money.

When a wildfire occurs, there is massive impact on air quality and public health, particularly with respect to fine particulate, PM2.5. Over time and distance, levels typically decrease and exposures are reduced. Days, weeks, and months after a fire, these exposures may no longer be present.

Some residual exposures may remain. Following the Ft McMurray Wildfire in Canada, where a significant number of homes in the city were burned to the ground, wood ash was found to contain high levels of arsenic and chromium attributed to wood treatment. There were exposure concerns for persons walking and agitating the ash. The potential for indoor accumulation of arsenic-containing ash over the following years was raised. Studies by Arthur Chan and colleagues at the University of Toronto disproved this hypothesis; higher levels of arsenic and chromium were found in control homes in areas unaffected by wildfires. This Ft McMurray study came out after the AIHA Redbook on wildfire was published in 2018. There is currently no published evidence to support concern over microscopically-identified deposited particulate indoors following wildfires.

The physics of structure fires and wildfires are different. Energy from structure fires can push smoke into ceiling and wall cavities. The resulting condensed gases within wall cavities can emit odorous compounds, which if not cleaned from the cavity, can migrate outward to the occupied portion of the residence and cause undesirable odors.

Wildfire particles have less energy and pressure pushing them. The rate of infiltration into wall cavities is orders of magnitude below what might occur in a structural fire inside a residence.

It can be kept in mind that within wall cavities, long-term accumulation of exterior and interior-generated particulate can overwhelm the brief exposures to wildfire emissions.

Russ' other comments:
Testing following remediation needs to be performed shortly after remediation.
Log scale of exposure.
The source of the residue in your home may come from your neighbor's fireplace.
There are times when analysis tells us something important.

Data from poor analysis- Has seen wildfire lab reports that ID char and found no ASH and claim that is wildfire impact.

https://www.researchgate.net/publication/343295316_Thermally_Modified_Calcium_Oxalate_Phytoliths_as_Markers_for_Biomass_Fire_Sources

https://www.researchgate.net/publication/259594793_PDC_10_Particles_and_Health_Environmental_Forensic_Analysis_Particles_and_Health_Environmental_Forensic_Analysis

https://www.researchgate.net/publication/265510347_THE_CHARACTERIZATION_OF_PARTICLES_ON_SPACECRAFT_RETURNED_FROM_ORBIT

https://www.researchgate.net/publication/265510294_Light_Microscopy_as_an_Analytical_Approach_to_Receptor_Modeling

Z-Man signing off

TRIVIA

Name the term defined as the: "The line, area or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels?

Answer;
Wildland Urban Interface

Answered by: Ralph Froehlich
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