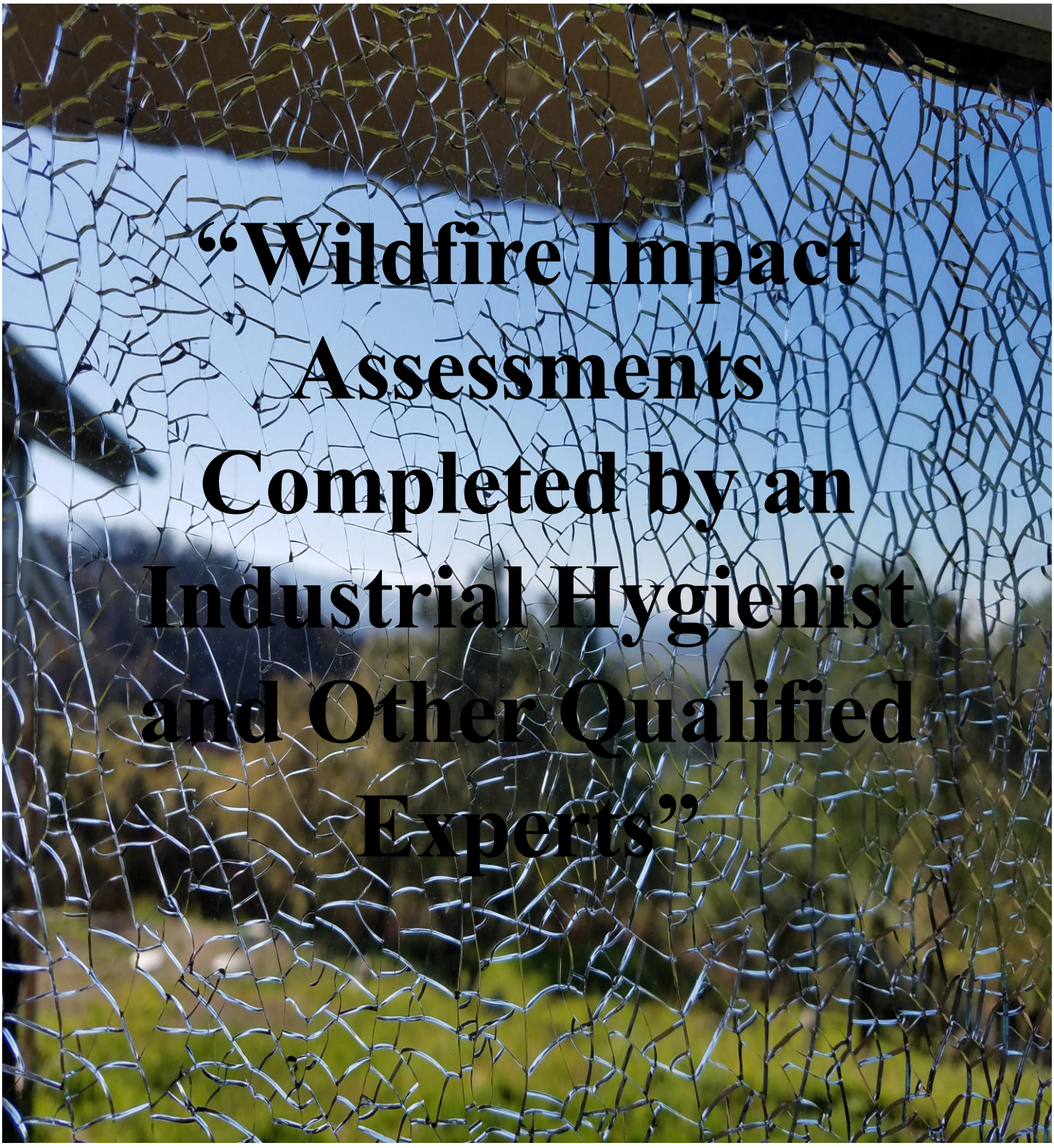
Blue Sky Environmental Consulting, Inc.®



Bulletin 201, Updated 2020

"Wildfire Impact Assessments Completed by an Industrial Hygienist and Other Qualified Experts"

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➢ After a Wildfire, Do I need to hire an industrial hygienist and other qualified experts? "It Depends" is the answer, which sounds vague, but it is not.

Summary:

- After a wildfire, communities will have various degrees of damaged and smoke impacted structures and it may be necessary to have them inspected or tested by experts before occupancy.
- It is it necessary to have non-fire damaged buildings inspected and tested? Generally, no. In a light wildfire impaction situation, the building owners may feel comfortable doing their own work.
- In more severe situations, building owners or their representative may need to hire experts. Initially, a visual property inspection, assessment, photo documentation, and report written by qualified experts should be sufficient to document property and content damage and identify the means and methods of cleanup and repair.
- A few situations may require inspection by experts. These include, but are not limited to:
  - When property around buildings or the building itself is charred or experienced high heat damage it should be inspected by licensed contractors.
  - Buildings having their power interrupted because of a power outage or burnt wiring, should be inspected by utilities, an electrician or both.
  - When neighboring buildings burnt, where there could be a release of toxic materials, they should be inspected by environmental experts.
  - When you or other individuals in your family or business experience health effects when entering the building, surface and air quality should be sampled and analyzed.
  - When there is moderate to high levels of smoke and/or particulate impaction in the building, attic insulation and HVAC system, an industrial hygienist and other qualified experts should inspect the property and determine if sampling is necessary.
  - When there is an increase in risk or liability, materially interested parties (e.g., mortgage, insurer, CPA) may require independent verification of the extent of heat damage or smoke and particulate impaction, where their documents support the cost of cleanup and repair.
- The focus of this bulletin examines qualifications of experts, investigation processes, the types of sampling and analysis methods, and interpretation of lab data that drives cleanup and restoration reports.

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1.0 Discussion:

1. **When your home or business was near or next to a wildfire**, likely, your community was impacted with smoke, soot, char, and ash. If you had to evacuate, your first thought on returning may be something like, 1) do I have a home or business to return to, then, 2) how much damage do I have, and then, 3) is it healthy for me, my family, or workers to occupy the building?
2. **Wildfire wind-driven storms impacting communities,** create heat and forced pressures equal to a hurricane. Besides damaging the roof and exterior, even when the building is tightly sealed, a form of back drafting (a rapid force of heated air pressure entering the building) can occur, entering roof and attic vents, HVAC systems, fireplace chimneys, bathroom and kitchen vents, and crawlspaces, leaving behind smoke, soot, char, ash, organic and inorganic matter. Non-hurricane force winds can also penetrate door and window seals, leaving in its path smoke and wildfire particulate.
3. **There are numerous articles available by government and the insurance and restoration industry,** that provide guidance to building owners. Subjects cover topics about your health and safety to cleaning the exterior and interior and contents. Complete an internet search, or contact our company for a list, which is several pages long.
4. **If you "are not" filing an insurance claim,** this likely means you are completing light debris removal and cleanup on your own or having someone that you know who is qualified to complete work.
5. **If there are moderate to heavy amounts of smoke and debris,** which requires the removal of smoke, soot, ash, the cleanup of the exterior and interior, or the structure is heat damaged, it is important to hire qualified independent experts and contractors, as well as file an insurance claim.
6. **Documentation is everything in today's world of wildfire damage assessments.** After the wildfire, collect news articles about the wildfire damage that impacts your community, including reports by government leaders who promise assistance. As soon as possible, take photos and videos of burnt neighboring buildings, even if they are blocks away, including charred acreage, hills, and valleys. Take distant and closeup photos and videos of your property. Closeup photos and videos are those that show wind-driven damage, such as roofing shingles and tiles laying on the ground; heat damage to the property including char, melting, scorching, blistering, and peeling; the build-up of ash in the yard, pool, and against the building; and particulate matter brought into the building by strong winds impacting the interior and personal possessions.
7. **Some of the best experts do not take enough photos to describe everything that occurred at your property.** Numerous times over my career, the photo I should have taken is missing. A year ago, our company invested extensively in specialized 2-D and 3-D camera equipment, training, and certification, where we no longer miss documenting a wildfire loss correctly, including, when required, laser measuring the interior square feet, windows and cabinets. The 2-D and 3-D scanning process also documents the location of furniture, appliances, antiques, musical instruments, collections, and fine art.

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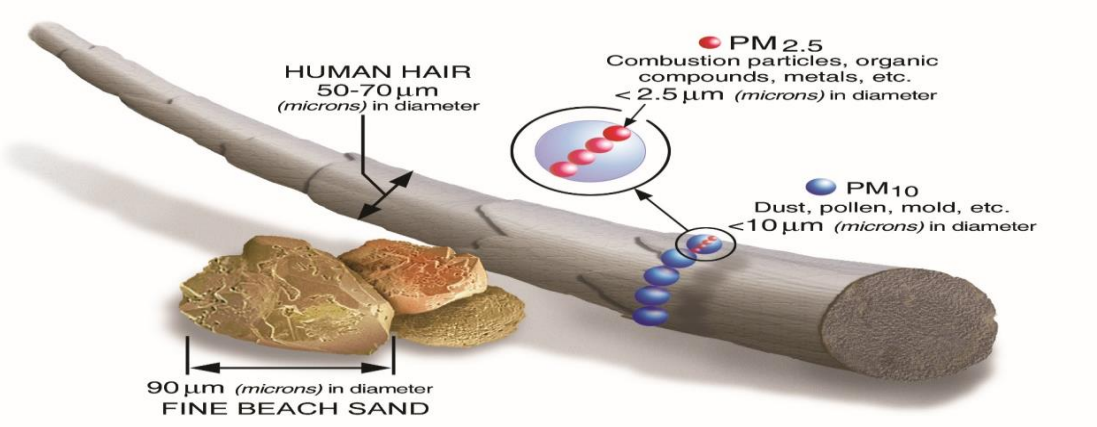
2.0 About Wildfire Smoke and Particulate:

1. What is Wildfire Smoke?
    a. Smoke composition is dependent upon several variables, including fuel type, moisture content of the fuel, fire temperature, and weather-related influences.
    b. Combustion during a wildfire produces smoke, which is a mixture of carbon dioxide, water vapor, carbon monoxide, hydrocarbons, other organic chemicals, nitrogen oxides, trace minerals and particulate matter.
    c. The components of wildfire residue (e.g., particulate matter) can deposit on surfaces.
    d. From a public health perspective, airborne particulate matter is the primary pollutant of concern over a short-term exposure period (e.g., days to weeks).
2. Smoke as an Odor:
    a. Smoke in the form of a vapor or gas includes submicron particles and cannot be seen by the naked eye. Smoke is a combination of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs).
    b. An accumulation of smoke as a smoke film on surfaces and smoke absorbed onto particles, can be detected through the sense of smell. The removal of smoke requires detergent cleaning of surfaces having smoke film and absorbed particulate matter.
3. Particulate Matter:
    a. In wildfire smoke, there is particulate matter, including the small size component of particulate matter referred to as $PM_{2.5}$, which is the principal air pollutant of concern for public health.
    b. Particulate matter is a generic term for particles suspended in the air, typically as a mixture of both solid particles and liquid droplets.



c. Due to weight and size of solid particulate matter, larger particles tend to settle out of air onto horizontal building and content surfaces fairly rapidly.
d. For wildfire particulate matter to become visible, solid particles have to be around 50 microns in size or larger.
e. In our company studies, large wildfire particles tend to be settled near exterior facing doors and windows; and smaller size solid wildfire particles tend to distribute in air and settle on interior surfaces.
f. On occasion, wildfire particles can be found sticking to vertical surfaces. This phenomenon generally occurs when smoke was indoors, where the composition of smoke remains, allowing particulate matter to electric charge and cling onto surfaces. (Coulomb's law)

3.0 What is an Industrial Hygienist and Their Role in The Workplace and Community?

1. **Hygiene comes from the area of practice relating to cleanliness, sanitation, and health.** An Industrial Hygienist (IH) is a professional who is dedicated to the health and well-being of workers. IH training is both science and art, devoted to the anticipation, recognition, evaluation, prevention, and control of environmental factors which may cause sickness, impaired health or significant discomfort among workers and the community.
2. **Besides assessing the occasional wildfire and occupant health concerns,** an IH's daily focus is on health and safety challenges facing workers at their workplace including, indoor air quality (IAQ) issues such as noise, sick building syndrome, second-hand tobacco smoke, building air circulation, pollens, mold and bacteria; evaluating and controlling exposures to pesticides, asbestos, lead, and chemicals; cumulative trauma disorders, such as repetitive stress injuries, and carpal tunnel syndrome; ergonomics including lifting, sitting, and standing; and the detection and control of potential occupational hazards, such as noise, radiation, and illumination.
3. **In other words, the goal of the IH is to keep workers healthy and safe,** and they play a vital role in ensuring that federal, state, and local laws and regulations are followed in the work environment.

4.0 Other Qualified Experts:

1. **Another name for an IH is an IEP (Indoor Environmental Professional),** which was coined by the restoration industry. Like the IH, the IEP has specific training, experience, and certification to identify and correct worker and occupant safety issues, assess building damage and contamination, and the knowledge of the means and methods to contain, control, and remove them safely.

2. **Based on qualifications, other names are given to qualified field technicians,** such as a certified asbestos consultant (CAC), which requires a state license to sample for asbestos. Another professional is an environmental professional (EP), who possesses specific education, training, and experience to exercise professional judgment, and to develop opinions and conclusions regarding conditions to indicate the release or threatened releases of hazardous substances on, at, in, or to a property (EPA).
3. **Licensed General Contractors (GC), having "industry certifications in fire damage restoration,"** are expected to be qualified to assess fire and wildfire impacted structures, and provide expert opinions on: roof and structural heat damage, structural stabilization, removing electrical safety hazards, when and how to bring power back to the building, tree and debris removal and cleanup, inspection of ventilation systems, ducting and insulation, and the requirements for completing structure smoke cleaning and odor neutralization.
4. **Hiring a "Packout" and a "Moving Company,"** will not be necessary in many instances, unless the structure is heat damaged, heavily impacted by smoke and particulate, or the composition of wildfire impaction brought in hazardous or toxic materials. In California, as of 2018, a pack out contractor, restorers who remove contents, and anyone else boxing and removing personal possessions from a building must be licensed by the Bureau of Household Goods (BHGS).
   - **Based on jobsite complications, different investigators may be required** to assess property damage, and document the extent buildings and contents are wildfire impacted.

5.0 AIHA's Wildfire Technical Guide:

1. **IHs and Other Qualified Experts (Inspectors) that inspect and assess Wildfire Impaction,** complete sampling, analyze lab data, and write reports based on AIHA's Technical Guide.
2. **The most current technical guide for IH's and other experts is by the American Industrial Hygiene Association (AIHA)** called the "*Technical Guide for Wildfire Impact Assessments for the OEHS Professional*," 2018 (Technical Guide}To purchase a copy at $49.00, go to: https://online-ams.aiha.org/amsssa/ecssashop.show_product_detail?p_mode=detail&p_product_serno=1558&p_cust_id=&p_order_serno=&p_promo_cd=&p_price_cd=&p_category_id=&p_session_serno=7051107&p_trans_ty=
3. **Wildfire impact assessments are complex by nature; besides the investigator, they can involve** the property owner, laboratory, restoration contractor, and the insurance company adjuster, who should collaborate and make decisions involving the grounds, landscape, building, personal possessions, and the indoor environment, and how to bring them back to pre-loss condition.
4. **The OEHS (Occupational and Environmental Health Service) professional,** the IH and other qualified experts conduct a wildfire impact investigation by first defining its purpose and objectives, and

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second, develop a working hypothesis to drive all phases of the assessment from initial inspection, to sampling, lab analysis, and laboratory data interpretation.

5. **From a thorough inspection and documentation of the extent the wildfire impacted grounds, building, and contents,** a range of options can be considered, such as; based on current evidence, can we start with the cleanup and deodorization process, recognizing the building owner is paying all costs; or because the building owner may ask their accountant to use the wildfire loss and costs associated with cleanup and repair, these costs may be a tax deduction for the year; or the building owner may file a claim and have their insurance company reimburse them for costs. Important documents, we believe, include the building owner's forwarded invoices onto others, including the IH's report, and all the reports of other experts including the cleanup and repair contractor.
6. **Environmental sampling and lab analysis may be required** as a form of documenting heat damage and smoke impaction and answering customer questions about the type and level (amount) of particulate matter in the building, and indoor air quality concerns. When potentially hazardous conditions are likely, including poor indoor air quality--inspection, sampling, and testing should be completed as quickly as possible, before occupants reenter the building, and before workers start cleanup and restoration.
7. **The AIHA technical guide assists IH professionals and other experts** in conducting defensible wildfire impact assessments, including sampling and analysis, which leads to evaluating restoration options for returning the building and its environment back to a safe and healthy indoor environment.

6.0 What Situations May Be Present That Could Require Hiring an IH, and Other Qualified Experts?

1. **Following the AIHA Technical Guide and Other Industry Guidelines (e.g., AIHA; IICRC), Examples Include but Are Not Limited to:**
    a. **There is heat damage to the building or grounds**, where damage to structural components and systems (e.g., electrical, gas, plumbing) are not working, or they could be a safety hazard.
    b. **After ventilating a building and changing HVAC filters,** you, your family, or coworkers continue to experience respiratory discomfort and breathing problems.
    c. **Smoke odors remain indoors** that become an irritant, and elements in indoor smoke may be hazardous or toxic to breathe.
    d. **When structures burnt near your building,** they may have released asbestos, lead, PCBs, toxins, and hazardous substances.
    e. **When char, soot and ash residue become a human health concern**, the building owner or manager require an investigator to identify potential exposure pathways and evaluate the level of

exposure to a sensitive receptor, which may contain polycyclic aromatic hydrocarbons (PAHs), dioxins and furans; and other compounds which may be carcinogenic, such as benz[a]anthracene, dibenzo[a,h] anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[j]fluoranthene, benzo[k]fluoranthene, chrysene, and naphthalene.

f. **Special concern for susceptible populations**, such as the elderly, small children, individuals having heart problems or COPD, pregnant women, persons having immune system disorders.
g. **Special buildings, such as those where the public enter**, children daycare centers, hospitals, schools, nursing homes, senior citizen daycare and long-term housing, and shelters.
h. **When it is necessary to document the conditions** of the wildfire impacting the landscape and grounds, neighboring properties can affect your property, the exterior structure, and the interior and contents for insurance, real estate, and tax purposes.
i. **When a visual inspection and photographs alone are not sufficient** to document wildfire impaction. The insurer, lienholders, or a third-party assessor (TPA), require further documentation and testing to document the effects the wildfire has on the conditions of the building, its environment, air quality, and personal possessions.
j. **When materially interested parties (MIPs),** such as the building owner, property managers, leasing agent, tenants, insurers, insureds, lienholders, TPAs, and the restorer require independent documentation about the presence and extent of wildfire impaction involving smoke, soot, char, ash and vegetative matter impacting the exterior, interior, ventilation system, insulation and personal property.
k. **When inspection followed by sampling,** and laboratory analysis becomes necessary to document the extent of impaction and type of impaction, which leads to creating a scope of work to mitigate landscape, building, its environment, HVAC, insulation, and personal contents.
l. **When one or more parties are in dispute** with each other as to the presence and extent of smoke, soot, char, ash, vegetative matter, and potential chemical agents and byproducts.
m. **When a limited set of samples and the laboratory analysis** do not support what the investigator, building owner, tenants, adjuster, and others smell and/or see being fire-smoke related, and where signs of char, ash and vegetative matter are or are not noticeable.
n. **When litigation becomes an issue** to support the findings of a wildfire loss.
o. **When personal possessions require** sampling to support the need for cleaning and deodorization, or possible replacement.

7.0 When is the Best Time to Complete a Wildfire Impact Assessment?

1. **Ideally, investigation, documentation and when necessary, sampling should be completed** as close to the date of the wildfire as possible.
2. **When you, your family, or coworkers have health concerns**, getting proper advice from medical and occupational and environmental health and safety professionals is required as quickly as possible.
3. **When it is important to photo and video document the conditions** and remnants of the wildfire "before" cleanup begins, or shortly thereafter.
4. **When it becomes necessary to preserve and archive** the presence (evidence) of smoke, soot, char, ash, and wildfire particulate matter impacting building materials, components, and personal possessions.
5. **Education Notes:**
    a. Smoke, soot, char, and ash degrades (oxidizes) over time and with changes in temperature, humidity, and sunlight.
    b. The longer an investigator waits to investigate and assess wildfire impaction, there is often a corresponding reduction in visual acuity--seeing the particulate matter in a degraded state.
    c. Therefore, week and months later, the identification of contaminates becomes less obvious, and using the human eye to complete an impact investigation and to determine where to collect surface samples can limit the sampling process, potentially providing the customer with biased or false analysis results.

8.0 Hiring a Qualified Investigator:

1. Get to Know Your Inspector:

a. **Before hiring an environmental impact assessment company,** it may be important to Google and research their qualifications and credentials.
b. **Environmental companies carry general liability insurance,** but they may not carry pollution and errors and omissions (E&O) insurance.
    i. Ask for a copy of their current general liability, and errors and omissions coverage.
    ii. When an environmental problem occurs, and the investigator may have made the wrong decision that compromises the building, personal possessions, occupant health, or they wrote a wrong scope of work, a lawsuit may result.

c. **Ask about the investigator's credentials** that will arrive at your home or business.
    i. You may find the inspector is highly qualified or they have minimal training in inspecting and assessing a heat damaged or wildfire impacted structure, including the grounds, the building's exterior and interior, indoor air quality, the ventilation system, insulation, attic, and contents.

d. **During wildfire season, some environmental companies** are exceptionally busy and may not be able to arrive on the date or the week you request.
    i. A reasonable expectation for an appointment during wildfire season is generally within the week you called the environmental company.

e. **During your phone call and while interviewing the environmental company**, they should also be interviewing you.
    - Besides asking for your name, address, and phone, it is good practice for them to ask for your email, and a backup phone number.
    - In addition, they should ask you:
        1. Are roads open and accessible in your area?
        2. Is there a secondary route?
        3. What are security gate passcodes?
        4. Will we be meeting you when we arrive or someone else?
        5. What condition is the building in, meaning, is it fire damaged or heavily smoke and debris impacted?
        6. Is the electric power and water operating?
        7. Are there outdoor and/or indoor air quality issues?
        8. Have you hired a cleanup contractor to mitigate exterior damage, such as burnt brush and tree removal, including ash cleanup?
        9. Have you hired cleaning and deodorization company?
        10. Are you able to live or work in the building?
        11. Did you file an insurance claim; if yes, who is your insurance company, claim number, name, and contact information of your adjuster?

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9.0 Environmental Impact Assessment: With and Without Sampling:

1. **Occupant Interview:**
    a. The AIHA Technical Guide for Wildfire Impact Assessments recommends the occupant completes an interview questionnaire. This documents the concerns and should become one of the foundation elements in the inspector's report.
        i. **The occupant interview describes in your words,** the history of the wildfire impacting your home or business; your concerns and those of family and workers' about potential health issues; and among other things, it documents your concerns involving structure (exterior and interior), and personal possessions.
            1. (Note, if your inspector does not have an occupant interview form, email us for a copy of our form.)

2. **Documentation:**
    a. Documentation is the key for all future work.
        i. Documentation starts with your phone call, the occupant interview, visually assessing the conditions surrounding the building and in the building; then, completing a thorough photo documentation of areas impacted by wildfire.

3. **Environmental Impact Investigation "without Sampling":**
    a. Discussion about Wildfire Impact Inspection:
        i. **The visual inspection is the most important part of any investigation**. When there is obvious visible evidence of the wildfire impacting the exterior, interior, and personal possessions, costly and time-consuming sampling may not be necessary to collect.
        ii. **In these situations, extensive photo documentation of heat damage and impaction** of smoke, soot, char, ash, and wildfire particulate should be sufficient, where the inspector is expected to have enough information to justify writing a report of his or her findings, and when required, include a scope of work to bring the building, air quality and personal possessions back to pre-wildfire loss conditions.

4. **Environmental Impact Investigation "with Sampling":**
    a. Discussion about Sampling Strategies:
        i. **When there is obvious visible wildfire evidence,** or when the human eye cannot verify the extent of wildfire impaction, air and surface sampling may be necessary to confirm what the inspector knows or suspects to be wildfire particulate versus household dirt.

ii. **The sampling strategy should be designed to provide sufficient data that enables the trained investigator to test a hypothesis,** intended to confirm the presence of measurable wildfire combustion generated particulate matter. In other situations, the hypothesis can confirm that burnt neighboring buildings are the most probable cause of poor indoor air quality, and/or the presence of asbestos and other toxic materials. When analytical results do not support the hypothesis, further investigation and sampling may be required. In some situations, sampling methods and analytical procedures may change; and/or, based on results, the inspector is required to change his/her opinions.

iii. **A flawed sampling strategy may lead to false positive or negative findings.** When a sampling strategy does not provide for the collection of enough samples to represent the actual site conditions, the associated analytical results may be inadequate; the results may not provide sufficient information to test the hypothesis.

iv. **The value of sample data is entirely dependent on the quality and reliability of the collection method and sampling procedures used.** Recognizing most sampling is directed at collecting surface and airborne particles associated with the wildfire, other forms of sampling and analysis can provide valuable information, such as sampling for volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs).

v. **VOC and SVOC sampling have unique challenges** since smoke and other odors from a wildfire may or may not be measurable through analytical methods. Some SVOCs, such as polycyclic aromatic hydrocarbons (PAHs) absorb into building dust, fabrics, and insulation, which may be present and noticeable months after initial exposure.

vi. **Several reasons why VOCs and SVOCs are difficult to capture and quantify**:

1. The building is not closed for an adequate length of time to flush out outside (outdoor) influences, such as outdoor air that mixes (dilutes) with the VOCs and SVOCs (gases) being emitted from their source.
2. Temperature, humidity and vapor pressure change throughout the day and night, where at night for example, lower temperatures, higher humidity, and with the ventilation system on, changes the chemistry of gases being released by wildfire smoke, where smoke-like odors can become noticeable and irritating.
3. The detectible level of VOCs and SVOCs for humans at day and night change, where this phenomenon in part is related to being in an enclosed space for a period, where there is an increase in chemical odor sensitivity.
4. Sampling indoor air is usually a snap-shot in time, using a five, ten, to a sixty minute sampling (using Summa canisters for example) method that captures indoor air. In these cases, the sampling method may not have been taken at the ideal time or length in sampling time to document any release of gases.

5. There wasn't enough samples collected under ideal conditions, where in some parts of the building, there was a statistical measurable change in the data, where in other parts of the building, changes in types of gases did not shift or occur.
6. The lab's measurement of VOCs and SVOCs are at non-detectible levels, even though humans can detect smoke odors through their olfactory lobe. Olfactory perception, while subjective unless proven otherwise, is an indicator of wildfire residue's impact to an occupiable structure. There are many theories for this phenomena, some being, the sampling time was not under ideal sampling conditions; the sampling method and collection times were not adequate; the requested analysis were not appropriate to identify extremely low-levels of VOCs and SVOCs.

10.0 Types of Environmental Sampling:

1. **Discussion Points:**
    a. **To Sample or Not?**
        i. Once the investigator arrives, and completes an occupant interview, and a thorough wildfire impact inspection and assessment, they should have sufficient information to consult with you on whether collecting environmental samples are reasonable and appropriate option or not.
        ii. The investigator is expected to have with them multiple types of sampling equipment and media, and their sampling strategy should be formulated based on known conditions the community experienced as reported in the news, and the customer's interview.
        iii. The cost in collecting samples is not inexpensive (often, in the thousands of dollars), and it is important to determine whether the goal in sampling and analysis can provide additional information to the already completed inspection.
        iv. Sometimes the building owner and the investigator is obliged to complete sampling, such as when a third-party (e.g., insurer, attorney) requires the data. This means that the inspection and analysis opinions of the expert investigator must be confirmed using appropriate sampling and laboratory analysis methods.
        v. Sampling is also driven by occupant health concerns, including questions about indoor air quality (IAQ), and questions about the impact smoke and particulate has on the building and personal contents.

b. Industry Standards and Guidelines:

i. Currently, there are no industry standards for assessing wildfire damaged and smoke impacted buildings. There are guidelines for collecting wildfire smoke (smoke film, vapors, and gases, and particulate) in AIHA's "Technical Guide," and depending on the expert, and the requirements for completing sampling in the field, they may refer to one or more ASTM Standards, such as:

1. D4840-99(2010) "*Standard Guide for Sampling Chain-of-Custody Procedures.*"
2. D5197-16 "*Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology)*."
3. D5755 -09(2014)e1 "*Standard Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Structure Number Surface Loading"* which can be used to support micro-vacuuming loose soot on surfaces.
4. D6345-10 "*Standard Guide for Selection of Methods for Active, Integrative Sampling of Volatile Organic Compounds in Air*."
5. D6602(2018) "*Standard Practice for Sampling and Testing of Possible Carbon Black Fugitive Emissions or Other Environmental Particulate, or Both.*"
6. D7910-14 "*Standard Practice for Collection of Fungal Material from Surfaces by Tape Lift.*"
7. D8141-17 "*Standard Guide for Selecting Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs) Emission Testing Methods to Determine Emission Parameters for Modeling of Indoor Environments.*"
8. E800-14 "*Standard Guide for Measurement of Gases Present or Generated During Fires*."
9. E1216-11(2016) "*Standard Practice for Sampling for Particulate Contamination by Tape Lift.*"

c. Air and Water Sampling:

i. There are various government agencies that regulate the quality of the air we breathe and the water we drink, which are not included in this bulletin. Wildfires are known to have released chemicals and toxins in air and have fouled drinking water from rivers, streams, city water and wells. If you are concerned about these issues, consult with your environmental company and their industrial hygiene team.

d. Air and Surface Sampling Difficulties:

i. Surface and air sampling of wildfire residue involves collecting foreign matter and gases that were not present before the wildfire. Smoke, for example, is a complex mixture of particulate matter and gases, such as particulate matter brought into a building that includes soot, char, ash, vegetation and organic and inorganic substances; and vapors and gases, such as carbon dioxide, water, carbon monoxide, hydrocarbons and other organic chemicals, nitrogen oxides, and trace minerals. There are thousands of individual compounds present in smoke.

ii. As mentioned above, there are ASTM standard guides for several sampling methods. For a discussion about specific sampling, and the plus and minus of each, refer to AIHA's Technical Guide.

iii. The sampling method(s) and lab data are expected to answer specific questions based on the customer interview and assignment; when the data does not provide or produce the desired results, further sampling using different methods of collection and analysis may be required.

iv. Surface sampling for wildfire combustion byproducts and vegetative matter is both a science and an art. The investigator is expected to understand the complex nature of wildfires and the limitations of sampling and analysis. When sampling and laboratory analysis are not completed correctly, the sample collection and resulting data can be skewed, producing false positive or false negative results.

v. Many wildfires leave behind vapors and gases in buildings which are expected to dissipate fairly rapidly in fresh air, but there are a number of VOCs and SVOCs that cling to building finishes and bind with materials and dust, which can remain for days, weeks and months. These compounds including particulate matter, can be the source of lingering smoke odor and the source of potential health issues.

e. Types of Surface Sampling, Limitations and Documentation:

i. Types of Surface Sampling:

1. Chemical wipes (e.g., Ghost wipes, and specially prepared wipes) for the identification of chemical residues.
2. Dry matter collection methods including micro-vacuum.
3. Bulk materials, such as when there is a large collection of particulate matter, or heat damaged materials.

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4. Tape lifts (tapelifts) are the majority of samples collected at a wildfire impacted building, because they have proven to be an effective sampling method for collecting particles such as ash, soot, char and other signature particles, which are the primary indicators of wildfire affecting a building and personal possessions. Unlike other sampling methods, properly applied, the tapelift technique preserves the relative position, density, size, and shape of particles, as well as the population per unit area.

ii. Notes:

1. Based on the building and materials sampled, there are challenges and limitations to each of the above sampling methods, which should be discussed with the customer and in reports.
2. Each sampling area should have a corresponding photograph or group of photos showing the material to be sampled, sampling method, and the sample with its identification number, which can be found on the chain of custody. It is recommended that the report should have photos showing where each sample was collected either in the body of the report or attached as an appendix.

f. Types of Air Sampling, Limitations and Documentation:

i. Types of Air Sampling:

1. There are two general types of air sampling, one for particulate matter and the other for gases.
2. Particulate and gases require collecting indoor air from a controlled space that was sealed for no less than 8 to 12 hours from surrounding rooms or outside influences, where fans or air conditioning are not operating in the environment to be sampled. Then, when required, fans and air conditioning can be turned on, and the sampling regime is repeated.
    a. Particulate matter is extracted out of the air through a vacuum pump, where a filter media is in a cassette.
    b. Gases in air can be collected on specific carbon adsorption tube media, in a Summa canister, or a Tedlar bag.
3. There are inherent limitations when collecting air samples, such as not having an environment conducive for sampling, not having control samples from unaffected environments, and sampling in a community that remains impacted by airborne particulate and smoke vapors and gases.

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4. Besides photo documentation of the areas sampled, having additional documentation may assist the investigator, such as:
    a. Temperature and humidity readings indoors and outdoors.
    b. Wind speed, pressure and direction of wind impacting a building.
    c. A laser particle counter that measures particulate matter indoors and outside from 10 microns in size down to 0.1 microns.

11.0 Reporting Investigation and Laboratory Findings:

1. **The Results of the Occupant Interview, Investigation and Assessment, Laboratory Analysis and Report:**
    a. The investigator is expected to have specific training in occupant interviewing, construction, investigation, assessment, hypothesis modeling, sampling, laboratory interpretation, and report writing.

2. **Report Writing Basics:**
    a. **The occupant interview** is an integral part of the investigation and assessment process. This information is important to capture in the report and in the investigator's final analysis.
    b. **The investigator should outline their conclusions of the inspection and assessment,** which either found that sampling was not required, or it was important to sample.
    c. **When sampling occurred, the sampling part of the report** should describe what sampling methods were available and which methods were applied. In addition, it should state restrictions in sampling, such as the investigator could not gain access to certain portions of the building, ventilation system, attic, or crawlspace. When sampling is required, the data should be incorporated into the report, or attached as a supplement, including seeing the raw set (not the redacted set) of laboratory data.
    d. **The conclusion section** is based on the findings of the occupant interview, the investigators' inspection, and assessment, and when available, the laboratory analysis. Together, they are expected to provide valuable information to the customer about the wildfire impact affecting their property and when required, the next step in mitigating damage or the impact to bring their environment back to pre-loss conditions.

12.0 The Investigator's Scope of Work Leading to Closure:

1. **Scope of Work Writing and Closure:**
    a. When the investigator is required to establish the direction leading to "cleaning, deodorization, and repair"; or, "it is not necessary to complete some processes of cleaning, deodorization and repair" in their scope of work for others to follow, it is assumed, the inspector is qualified, competent, and credentialed to direct others in performing their work, including, but not limited to:
        i. Exterior:
            1. Exterior debris removal and cleanup.
            2. Building washing, lawn furniture cleaning, deck, and swimming pool cleaning.
            3. Cleanup after Phos-Chek and other fire-retardant impactions.
            4. Recommending or not recommending building repair and painting, such as from heat damage, and thermal pressures affecting windows, doors, decks, siding, and roofing.
        ii. Interior:
            1. Cleaning and deodorization of structure and furniture.
            2. Cleaning and deodorization of soft goods including draperies, carpets, upholstery, linens, and clothing.
            3. Cleaning of mechanical HVAC systems and ducting, bathroom and kitchen fans and ducting.
            4. Removal and replacement of wall, attic, and crawlspace insulation.
            5. Repainting and repair.
            6. Refinishing or replacement.
        iii. Administrative:
            1. The only way the inspector knows the scope of work they directed was completed to their satisfaction, is through one or more verification site assessments and/or through verification clearance sampling.
            2. The inspector is to consult with their customer their findings, based on the occupant interview, their inspection and assessment, and when necessary laboratory findings that the building, its environment, and personal possessions are back to pre-loss condition, or the goals of their assignment have been achieved.

13.0 Filing an Insurance Claim:

1. **Filing an Insurance Claim:**
    a. Discussion:
        i. When an insurance claim is filed in a substantial community-wide wildfire, more than likely, the claim may be not be inspected for days or weeks after the wildfire by a company field adjuster, an independent adjuster (IA) or a catastrophe (CAT) adjuster who may have come from out of state.
        ii. Unlike a company adjuster, the IA or CAT adjuster are often fact-gathers, who may or may not have claims management authority. Meaning, they may not have the authority to direct the insured what to do, other than advise them to protect their property as best as they can; they will not approve work or pay claims.
        iii. Under some state insurance regulations, it is up to the insured to protect their property from experiencing further damage, and not the insurer. Therefore, it becomes the responsibility of the insured to either cleanup wildfire damage, smoke, soot, char and ash impaction as best they can, or hire cleanup companies and restoration contractors skilled in the art of wildfire debris removal, exterior cleaning, interior cleaning and deodorization, including contents (personal possession) cleaning and deodorization.
    b. Documentation:
        i. In all insurance claims and settlements, documentation is everything. Even when an adjuster inspects the building, that inspection may be the beginning process. The insurer may need to hire others, such as contractors and environmental professionals to inspect and assess damage and impaction, and when required, complete sampling.
        ii. In large or complicated wildfire damage assessments, the insured may benefit by getting a second opinion involving damage to their property, including the presence of environmental contamination from burnt neighboring buildings. It is important to document why the indoor air quality is poor to unacceptable, and documenting with distant and closeup photos and videos, including 2-D and 3-D Matterport scanning (a tour) of the interior and exterior, including the placement of furniture, antiques, musical instruments, fine art, etc., can be helpful in substantiating claims.
        iii. To maintain integrity of the insurance claim supported with creditable, verifiable, documentation, a visual inspection and assessment, photos and Matterport should be completed as close to the time of loss as possible.

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14.0 Cleaning Up Exterior Wildfire Debris:

1. **Precautions Before You, Your Family and Friends Begin Wildfire Debris Removal and Cleanup:**
    a. Recognize that your health and the health of your family and coworkers is more important than removing wildfire debris and cleaning up the exterior of your building. When an individual experiences health concerns, have them leave the wildfire impacted area and seek appropriate medical advice.
    b. If you are in good health and can wear a respirator to complete cleanup, it is recommended for you and others to wear a NIOSH approved N-95 respirator.
    c. Follow the advice in your state and county, such as California Air Resources Board (CARB) "*Protecting Yourself from Wildfire Smoke*" https://ww2.arb.ca.gov/protecting-yourself-wildfire-smoke, and federal government, such as "*EPA – Wildfires and Indoor Air Quality*" https://www.epa.gov/indoor-air-quality-iaq/wildfires-and-indoor-air-quality-iaq
    d. When you must cleanup ash, do so safely, and follow safety directions from your state, such as the California Department of Public Health "*Cleaning Up Wildfire Ash Safely*" https://www.cdph.ca.gov/Programs/OPA/Pages/NR18-039.aspx
    e. For additional personal protective equipment (PPE) recommendations, go to 3M Technical Data Bulletin #182 https://multimedia.3m.com/mws/media/882700O/3m-technical-data-bulletin-182-ppe-during-cleanup-of-residential-wildfire-debris.pdf

2. **Precautions Your Contractors Must Take in Protecting Workers During Wildfire Cleanup:**
    a. When you hire workers to complete outdoor cleanup, they must be doing so safely following OSHA and other government regulations, such as:
        i. "*Respiratory Protection During Fire Cleanup*" https://www.dir.ca.gov/dosh/Fire_Resp_Protection.html
        ii. "*Worker Safety in Wildfire Regions*" https://www.dir.ca.gov/dosh/Worker-Health-and-Safety-in-Wildfire-Regions.html
        iii. "*Personal Protective Equipment During Wildfire Cleanup*" https://www.dir.ca.gov/dosh/wildfire/Protective-Equipment-During-Fire-Cleanup.html
        iv. "*Emergency Regulation on Protection from Wildfire Smoke"* https://www.dir.ca.gov/dosh/doshreg/Protection-from-Wildfire-Smoke/Wildfire-smoke-emergency-standard.html

3. **Precautions Before Disturbing or Removing Wildfire Debris that Can Contain Hazardous Chemicals and Hydrocarbons:**
    a. A "*Health and Safety Hazard Assessment*" must be completed before disturbing buildings and vehicles that were partially or completely burnt. Refer to your state and local jurisdiction for additional information, including codes and regulations. Examples of precautions include:
        i. Guidance for the "*Evaluation of Fire Debris Cleanup and Employee's Exposure to Silica, Asbestos, Metals, and Polyaromatic Hydrocarbons*" is found in CDC/NIOSH document "HHE Report No. 2018-0094-3355" https://www.cdc.gov/niosh/hhe/reports/pdfs/2018-0094-3355.pdf?s_cid=102015-HETAB-RSS-001
        ii. EPA's "*Guidance for Conducting Emergency Debris, Waste and Hazardous Material Removal Actions Pursuant to a State or Local Emergency Proclamation*" https://calepa.ca.gov/wp-content/uploads/sites/6/2019/06/Disaster-Documents-2011yr-GuideRemoval.pdf
        iii. In California, also comply with "*Emergency Guidance on Wildfires, Fact Sheet #1 and #2*" https://dtsc.ca.gov/emergency-guidance-on-wildfires-1/ and https://dtsc.ca.gov/emergency-guidance-on-wildfires-2-2/
        iv. California Recycle Program "*Dangerous Debris: Potential Health Risks Associated with Residential Wildfire Debris*" https://www2.calrecycle.ca.gov/Publications/Details/1661
        v. California Hazardous Waste Operations "*Wildfire Debris Cleanup and Recovery*" https://www.calrecycle.ca.gov/disaster/wildfires

4. **Other Precautions That Must Be Considered Include:**
    a. Hazards associated with:
        i. Electrical wiring and gas lines.
        ii. Explosions from transformers, heat damaged propane and gas tanks, and explosions from containers having solvents, paints, fertilizers, and pesticides.
        iii. Falling debris from overhead wiring, communication poles, trees, and roofing.
        iv. Walking on burnt ground where the ground is soft, and it caves in.
        v. Walking through ash that exposes workers and their clothing to hazardous substances.
        vi. Unsafe buildings, including window glass that is tempered or not, which can break or explode inwards and outwards due to heat and vibration stress.
        vii. Recurring fires from smoldering underground tree trunks and burnt buildings.
        viii. Breathing in air that contains chemical fumes, VOCs and SVOCs.
        ix. Contact with rodent feces including breathing in dust that can contain viruses such as Hantavirus.

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x. Contact with dead animals that are diseased.
xi. Workers potentially exposed to the COVID-19 pandemic, which requires all contractors (employers) to have a program in place that protects cleanup workers and the public from exposure.
    1. CDC says "Wildfire smoke is a complex mixture of air pollutants that are harmful to humans. The relationship between wildfire smoke and COVID-19 has not yet been studied, but research suggests that exposure to smoke could increase the risk and severity of respiratory infections similar to COVID-19."
    2. More information on COVID and Worker Safety at Wildfire Impacted Areas, include but are not limited to:
        a. Fire Management Board:
            i. Wildland and Fire Medical and Public Health Advisory Team: https://gacc.nifc.gov/nrcc/dispatch/equipment_supplies/agree-contract/contractor_updates/FMB_Memorandum_20-008a_Interim_Guidance_for_Prevention_of_Coronavirus_Disease_COVID-19_During_Wildland_Fire_Operations.pdf
            ii. "Interim Standard Operating Procedures" https://www.nwcg.gov/sites/default/files/docs/fmb-m-20-006a.pdf
        b. U.S. Department of Labor:
            i. "Wildfires & COVID-19" https://www.doi.gov/wildlandfire/wildfires-covid-19
        c. AirNow.gov
            i. "*Wildfire Smoke: A Guide for Public Health Officials*" supplement contain information on COVID-19. https://www.airnow.gov/publications/wildfire-smoke-guide/wildfire-smoke-a-guide-for-public-health-officials/

15.0 Cleaning Up the Interior having Wildfire Debris:

1. **Indoor Hazard Analysis and Risk Assessment:**
    a. The indoor hazard analysis and risk assessment are based in part on outside influences as mentioned above. Other considerations include but are not limited to:
        i. How occupants feel when they enter their home or business.
        ii. When occupants have diagnosed health effects including COPD, immune system disorders, or a diagnosis that potential environmental influences are impacting health.

iii. When air or surface analysis confirm the presence of asbestos, lead, and other regulated materials.
iv. When air or surface analysis confirm the presence of chemicals, VOCs and SVOCs.
v. When regulated materials or hazardous waste is present, consult with state regulators on who is qualified to preform mitigation.

b. Other Influences that can Impact Occupancy:
   i. When potable water and electricity is not available.
   ii. When the mechanical ventilation systems are not operating, they require repair or replacement.
   iii. When portions of the building are heat damaged and require repair.
   iv. When smoke odor and/or particulate matter is substantial that they affect occupant health, the indoor environment, and furnishings.
   v. When extensive cleanup, cleaning and/or restoration is required.

2. Wildfire Cleanup Procedures Completed by Professionals:

a. Documentation:
   i. To document property damage and wildfire debris impaction, the building owner should hire an independent company specializing in photo documentation to capture video or photos of the entire property and landscape, the exterior and interior, and personal possessions. Properly completed, this form of documentation is defensible in arbitration and court.
      1. Note, initial documentation provides views the naked eye can see under normal light. It is incumbent on the building owner to have the documentation company consult with contractors when they are investigating ventilation systems, crawlspaces and attics, heat damaged and charred building components and roofing.

b. Direct Hire:
   i. When the building owner hires a wildfire cleanup contractor directly, generally, an environmental professional is not involved to independently inspect and assess property damage and wildfire impaction.
   ii. The written agreement between the building owner and cleanup contractor should have line items specifying what the cleanup contractor is to complete, the associated charges, and what the cleanup contractor is not going to do.
   iii. Recognizing the cleanup contractor is likely on multiple projects, where equipment and manpower could be stretched thin, make sure there is a start date and an agreed completion date.

iv. When the cleanup contractor's trained staff are on multiple projects, they may supplement their staff with a supervisor and day laborers. Make sure having temporary day laborers are acceptable to you, since their knowledge about using proper cleanup equipment and methods may be lacking.
v. It is not unusual for the cleanup contractor to hire subcontractors, such as waste haulers to cut down fire damaged trees and remove debris, to hiring specialty cleaning contractors, such as the dry cleaning of draperies and clothing.
vi. At some point, the building owner may file an insurance claim, where all aspects of the cleanup and deodorization processes and associated costs will be scrutinized. The insurer may or may not agree with the work completed, including payments, where the insured may be in dispute with their own insurance company.

c. Insurance Hire:

i. When you file an insurance claim, the insurer may ask you to sign an agreement (Work Authorization) with their recommended (preferred vendor) cleanup and cleaning and restoration contractor.
ii. In the Terms and Conditions, likely, you gave Power of Attorney to the cleanup and restoration contractor to invoice the insurance company pre-established costs and be paid directly by the insurer for their costs.
iii. On the face of this decision, the building owner is not out-of-pocket for expenses except for their deductible (cleaning and deodorization is not depreciated, but some forms of restoration or replacement may be). The insurer's adjuster is expected to oversee how your building and personal possessions are cleaned, deodorized and restored, and to bring your wildfire impacted property back to pre-loss condition.
iv. Throughout the claim's management process, the insured should maintain open communication with their adjuster and contractor by phone and email.

3. Light Smoke and Wildfire Particulate Impaction:

a. Depending on conditions, where light smoke odor and wildfire debris is present, usually particulate matter is around the interior of doors, windows, window coverings, and flooring:
   i. HEPA vacuum loose particulate.
   ii. Detergent wet clean doors, windows, window coverings (e.g., draperies, shades, and blinds) and flooring.
      1. Note, some fabric window coverings, shadow boxes and valences must be professionally dry cleaned; some cordless cellular shades are not cleanable and may require replacement.

2. Note, hardwood, vinyl, tile, stone, and carpeted floors must be cleaned following manufacturer recommended cleaning processes. It is recommended to clean the entire floor and in some situations, a floor finish may need to be applied.
3. Note, HEPA vacuuming and detergent cleaning are expected to remove particulate matter and smoke film. When smoke odor remains, further inspection and cleaning recommendations should be considered.

4. Moderate Smoke and Wildfire Particulate Impaction:

a. Building on the above light impaction, and depending on conditions, where moderate smoke odor and wildfire debris are present, particulate matter may extend past doors, windows, window coverings, and impact surfaces inside the home or business. This condition likely came from wildfire driven weather that forces itself into the building, such as through doors, windows, soffit and roof vents, fireplace chimneys and flue, bathroom and kitchen fans and ducting, and HVAC system ducting.

i. HEPA vacuum loose particulate from all horizontal building surfaces, including furniture and contents having signs of visible particulate matter.
ii. Detergent wet clean doors, windows, window coverings (e.g., draperies, shades, and blinds) and flooring.
iii. Detergent wet clean other horizontal surfaces including shelves, tops of cabinets, appliances, etc.

1. Note, some fabric window coverings, shadow boxes and valences must be professionally dry cleaned; some cordless cellular shades are not cleanable and may require replacement.
2. Note, linens and clothing should be cleaned and deodorized when they have signs of particulate matter and/or occupants confirm the presence of smoke odor in fabrics.
3. Note, HVAC systems, ducting and attic insulation should be inspected, which may require replacement of insulation and cleaning of the attic, mechanical systems, and ducting.

5. Heavy Smoke and Wildfire Particulate Impaction:

a. Building on the above moderate impaction, and depending on conditions, where heavy smoke odor and wildfire debris are present, where particulate matter is on many surfaces inside the home or business, extensive cleaning and deodorization may be required including but not necessarily limited to:

i. Personal Possessions:
   1. Complete an inventory of personal items, including furniture, appliances, clothing, fine art, and antiques, followed by either packing them out of the building and taking them to a cleaning plant, or moving them to a designed clean and odor free controlled environment, where cleaning and deodorization of personal possessions occurs.

ii. Structure:
   1. Mechanical System(s) and Ducting:
      a. Seal-off the ventilation system to the building, including fireplace flue, bathroom and kitchen exhaust fans and ducting, and clean them as close to the end of the buildings cleaning process as possible.
   2. Attic and Crawlspace:
      a. Identify attic and crawlspace insulation that requires removal and replacement.
      b. HEPA vacuum all exposed areas in the attic including raw wood framing and roof sheathing.
      c. A flat urethane sealer may need to be applied after cleaning.
   3. Interior:
      a. Rooms are expected to be free of personal items including carpeting, where HEPA vacuuming starts at ceilings, fixtures, then walls, windows, doors, cabinets, and then flooring.
      b. Detergent wet cleaning generally starts by smoke washing and drying flooring, then smoke washing cabinets (interior and exterior), walls, windows, doors, fixtures, and ceiling. At the end of the wet cleaning process, floors are wet cleaned a second time.

6. **Final Walkthrough with the Building Owner, Adjuster, and Restoration Contractor:**
   a. Assuming an environmental company was not involved for overseeing the cleaning contractor's Scope of Work, where establishing "Clearance and Closure" is up to the owner, adjuster, and restoration contractor, the intended goal is to ensure the building and its systems are clean and smoke odor free.
7. **Final Walkthrough with the Environmental Company's Inspector, Building Owner, Adjuster, and Restoration Contractor:**
   a. Inspection, assessment, and clearance is expected to rest on the "inspector" who wrote the Scope of Work for the cleaning contractor. When sampling results drove the need for creating the Scope of Work, sampling may be necessary to provide Clearance and Closure.

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16.0 Closing Comments:

1. This Bulletin:
    a. Bulletin 201 is about how wildfire impact assessments should be completed by industrial hygienists and other qualified experts. However, there is a cross-over involving the inspection, assessment, sampling, and report writing, leading to cleaning, and restoration services.
2. General Reading:
    a. Some individuals reading Bulletin 201 should find it to be informative, where they may elect to bypass hiring a qualified environmental professional, which is understood, and in some cases, it is the correct decision.
3. Hiring an IH and Other Qualified Experts and Their Charges:
    a. The inspector has contracts with them, where after completing the occupant interview, followed by inspecting, and assessing the wildfire impacted structure, and determining whether sampling is required or not, including how many samples, and what type of laboratory analysis is required, an agreement of exact costs will be established.
    b. Hiring an environmental professional (our company and others) to complete inspection and assessment of a 2,000 to 3,000 square foot home, where the report is supported with photos, these services can cost $950.00 to $1500.00 (depending on location, time involved, degree of wildfire impaction, and answering questions in the occupant interview).
    c. When "surface soot, char and ash" must be sampled to document impaction (light, medium, heavy), an additional $950.00 to $1800.00 to cover laboratory costs will apply, depending upon the number of samples needed.
    d. Environmental professionals hired to inspect and assess large residential structures and commercial buildings often have a minimum cost of $1250.00 to $1500.00, and costs including additional laboratory charges will increase accordingly.
    e. We outlined the above to help building owners and their agents understand the costs in hiring environmental companies.
    f. Unless the building owner or their agent has an open account with the environmental company, all services, including laboratory charges and report writing, are generally due and payable at the time of inspection and/or sampling.
4. Limitations:
    a. Bulletin 201 is for wildfire impact assessments of buildings having smoke and particulate matter, where inspection, assessment, and surface particulate sampling can be quantified using vacuum cassette and tapelift sample methods. Other sample methods can be incorporated into wildfire impact studies that analyze the potential presence of asbestos, lead, chemicals, VOCs and SVOCs. The charges for those studies are not included above.

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17.0 About the Author:

1. Patrick Moffett is a general contractor, an industrial hygienist specializing in wildfire assessments, an IICRC instructor who instructs classes on fire and smoke damage remediation, and he teaches webinars on wildfire heat damage and particulate matter impaction, including inspection and assessments, and the means and methods of cleaning and restoration.

Technical Committees and Taskforces:

- Consensus body developing "*Standard for Illicit Drugs, Cannabis, Nicotine Residue*" (IICRC, 2020)
- Committee developing the "*Standard for Professional Wildfire Restoration*" (IICRC, 2020)
- Committee developing the "*Standard for Professional Fire and Smoke Damage Restoration*" (IICRC, 2019)
- Committee that developed "*Fire Loss Specialist*" (RIA, 2019)
- Committee that developed "*Standards for Restoration of Buildings Impacted by Combustible Particles*," (ASHRAE/IAQA/RIA, 2018)
- Committee that developed "*Technical Guide for Wildfire Impaction Assessment for the OEHS Professional*" (AIHA, 2018)
- Committee that developed "*Standard for Professional Fire and Smoke Damage Restoration*" (IICRC, 2018)
- Certification Taskforce "*Contents Loss Specialist*" (RIA, 2018)
- Certification Taskforce "*Fire Damage Restoration*" (IICRC, 2014-2018)
- Committee that developed "*Fire and Smoke Damage Certification Program*" (IAQA, 2017)
- Past Contributors to:
    - IICRC Training Manuals for "*Fire and Smoke Damaged Restoration*" (2005 to 2018)
    - ASCR International; National Institute of Disaster Restoration "*Guidelines for Fire and Smoke Damage Repair*," (1985; 2002)
    - IICRC S500 "*Standard and Reference Guide for Professional Water Damage Restoration*"
    - IICRC S520 "*Standard and Reference Guide for Professional Mold Remediation*"
    - IICRC S540 "*Standard for Trauma and Crime Scene Cleanup*"

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