# A History of the Assessment of Wildfire Impacts in the Indoor Environment

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# Wildfire Assessments

Objective of the Assessment Process: to design and conduct a wildfire forensic investigation and/or health assessment after a wildfire using reliable and defensible assessment approaches, sampling strategy, analytical techniques, and data interpretation to support conclusions and recommendations.

No Federal, State, Local Standards for wildfire residues on surfaces.

Prior to 2018, there were no assessment guidelines on conducting an assessment

# Some Key Factors to Consider

| WILDFIRE | BUILDING |
| --- | --- |
| Time | Time |
| Distance | Distance |
| Size of the fire | Size of the fire |
| Material burned in burn zone (Vegetation, WUI!!) | Material burned proximal to building (WUI!!) |
| Weather Conditions and Temperature | Weather Conditions and Temperature– Localized |
| | Outdoors vs. Indoors |
| | Impact vs. Damage |
| | Health of Occupants |
| | Building configuration, systems and operation |
| | Other combustion sources and background |

# Wildfire Smoke vs. Wildfire Residues

**Wildfire smoke** contains a mixture of chemicals from combustion of vegetative matter including gasses, VOCs/SVOCs, dioxins/furans, inorganic material, and metals.  Its composition and emissions change due to a verity of factors (e.g., including fuel source, temperature, and weather conditions).

**Wildfire residues** deposit on surfaces and its composition is influenced by the factors of wildfire smoke listed above, time, distance, and a host of other factors (e.g., air velocity, particle generation rate, particle size distribution, etc.).

# Settled Wildfire Particulate – Typical Analytes During Sampling

Ash

- Brown to silver/gray residues comprised of the partial to fully combusted residual debris

Soot

- Small dark black/brown clusters of micron aciniform (spherical) particles comprised of carbon and organic compounds.  Not typically associated with settled wildfire residues.

Char

- Partially burned black/brown debris that still retains characteristics of the original plant or cellulosic material – vegetative “Char” can be determined.

Source: Getty images.

# Other Indicators

Assemblage analysis

Phytoliths

Large char particles

Burned soil

Elevated pH

VOCs, SVOCs

Metals, Inorganics

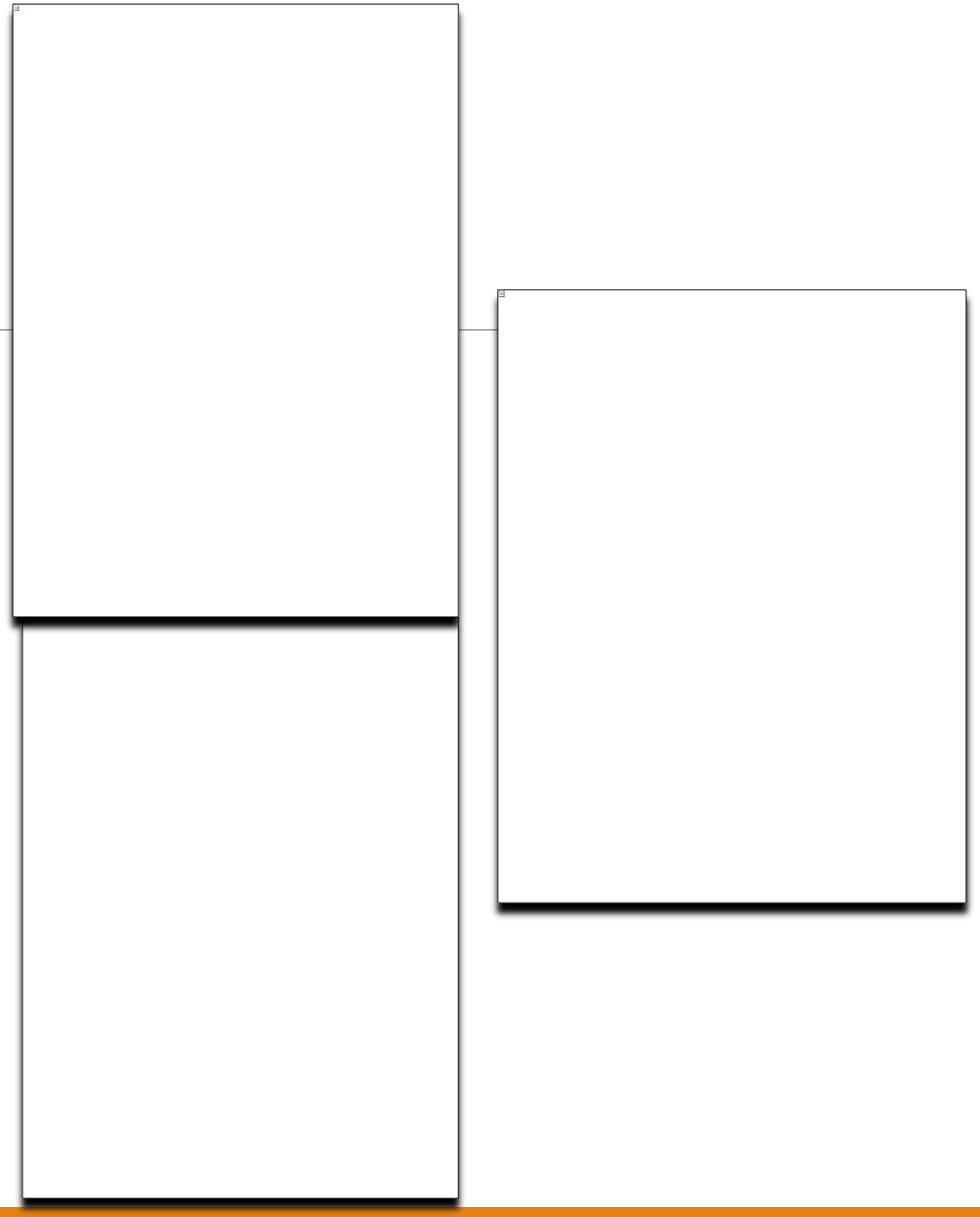
# Pre-2018

Few guidelines on existed fire residue assessment or restoration.

- FEMA and State cleanup guidelines.
- Industry Guidelines (e.g., Restoration Industry Association (RIA) Guidelines for Smoke Damage and Repair)
- Publications in professional journals.
- Analytical laboratory guidelines.

Many investigators were generally following “classic” investigative approaches and professional judgement – some were not.

Analytical techniques were evolving.



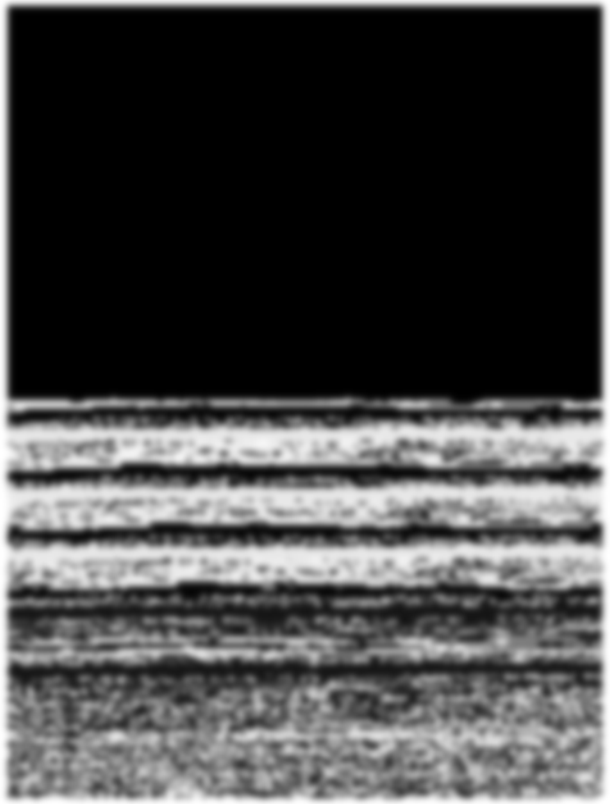
# 2018 – AIHA's Technical Guideline for Wildfire Impact Assessments for the OEHS Professional ("Red Book")

The purpose was to assist professionals to "*become familiar with the fundamental concepts of investigating and evaluating wildfire impacts on structures.*"

Main Topics:

- Wildfire Impacts
- Initial Assessment Process
- Sampling Techniques
- Analytical Methods
- Restoration

Drafted by 25 professionals working in the field.



# What did the “Red Book” Accomplish?

The first guideline to address the assessment of wildfire impacts.

Developed a consensus among practitioners in the field of wildfire assessment on core concepts.

Established a defendable framework for the assessment process.

Outlined the health effects and impacts of wildfires at the time of publication.

Detailed the strengths and limitations of sampling techniques.

Formalized sampling and analytical techniques and identified the limitations.

Discussed common restoration techniques.

# General Assessment Process

Information gathering

Inspection

- Visual
- Olfactory
- Sampling, if necessary
- Other considerations – Background Sources

Interpretation of Inspection Results

Recommendations

# Sampling Strategy and Methods

A sampling strategy, including number of samples and sample methods, should be determined by the investigator to support their conclusions and consider the specifics of the property being investigated.

Results of the visual assessment should be used.

Recommends consulting with the analytical laboratory.

Several methods of sample collection (and their limitations discussed):

- Tape-Lifts
- Wipes
- Micro-Vacuuming

# Analytical Techniques

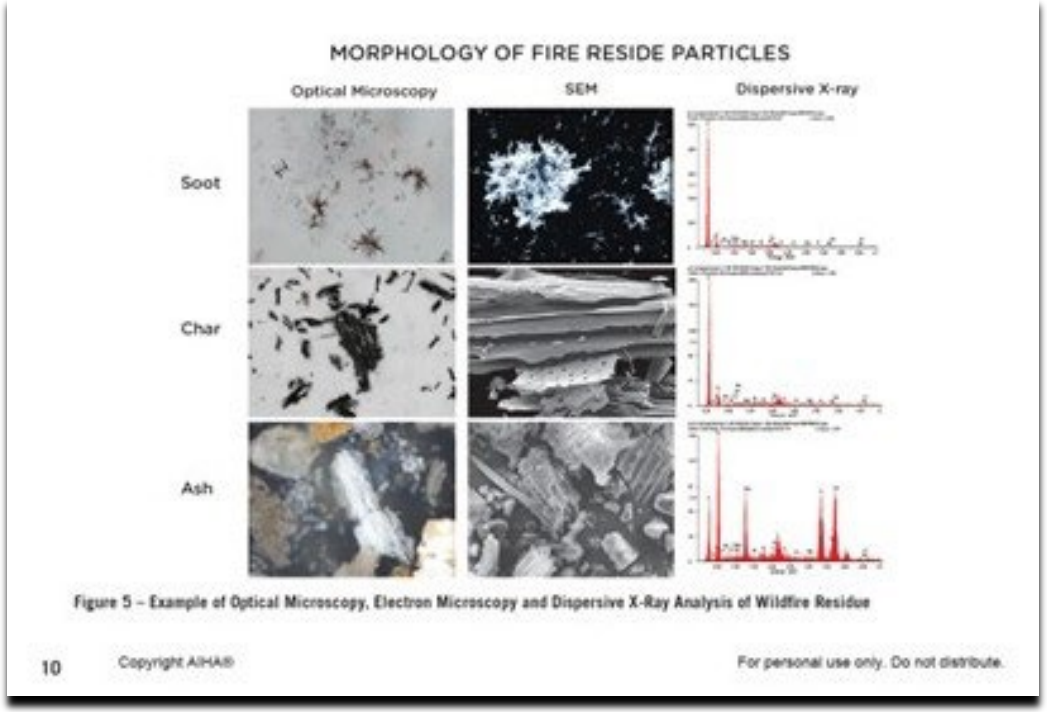
Aimed at identifying soot, char, ash and assemblage analysis.

Advantages and disadvantages of several microscopic techniques:

- PLM
- TEM
- SEM
- EDX/EDS

pH

VOCs/SVOCs



# Restoration/Remediation - *"return the property to a pre-fire condition."*

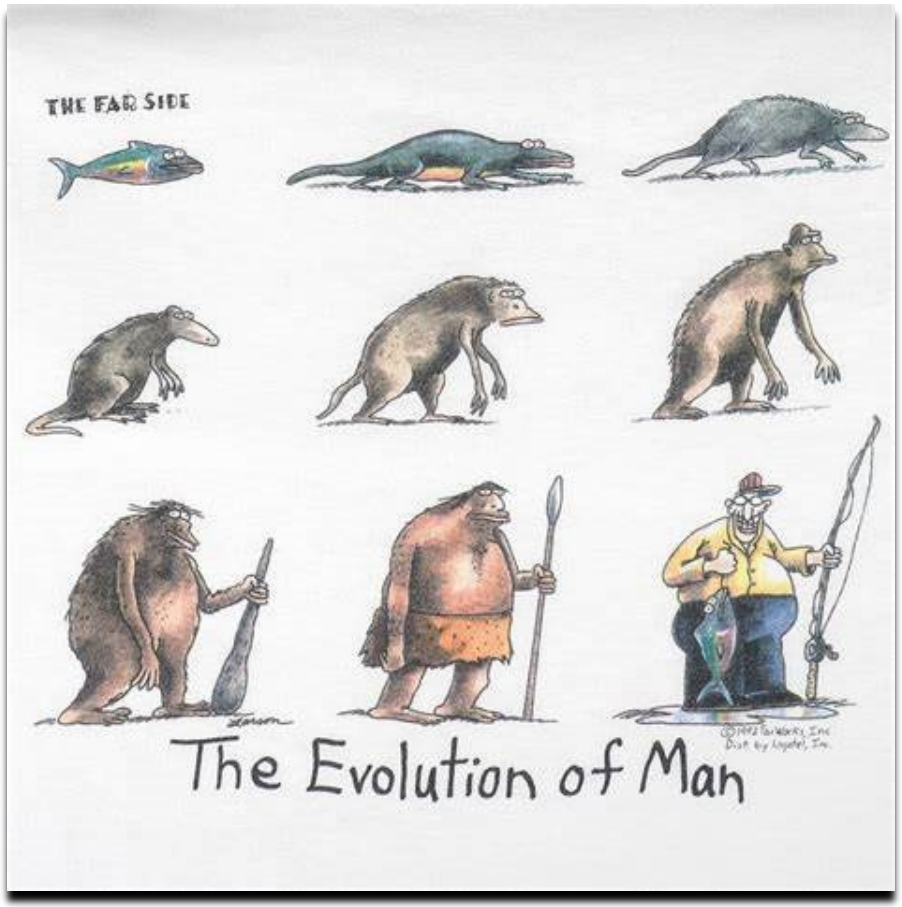
Provided general recommendations during the startup, during, and after the restoration process.

Restoration practices and considerations for:

- Basic cleanup.
- More aggressive cleanup techniques specific to:
  - Building surfaces
  - Contents
  - Attics
  - Appliances and Electronics
  - HVAC

Recommends a post-remediation verification inspection.

# Science Evolves!




Source: Gary Larson.

# Camp Fire – November 8, 2018

Source: SF Gate.

Source: NASA.

# Maui Fire

SEPT. 15, 2022

AUG. 9, 2023

# Developments and Research Since The Red Book

Several scientific publications, including Synergist articles on the assessment process; health effects and assessment; analytical techniques.

Lessons learned from the application of the Red Book in practice.

Other guidelines are under development:

- IICRC S700 (DRAFT) – Standard for Professional Wildfire Investigations and Restoration of Impacts to Structures, Systems and Contents.

# Update – AIHA Technical Guide for Wildfire Impact Assessment and Restoration

Build on and update to the Red Book based on the current science.

Draft is currently in the review phase with AIHA.

Contributions from over 30 subject matter experts and practitioners:

- Wildfire and structural fire assessment
- Industrial hygiene
- Medicine
- Toxicology
- Risk assessment
- Optical and organic laboratory science
- Professional restoration
- Statistics
- Exposure assessment

# Key Topics Added or Expanded Upon

Wildfire Smoke Impacts, Chemistry, and Distribution

Impact of Time and Distance

Wildland Urban Interface (WUI)

Health effects characterization and assessment

Assessment Process and Sample Analysis Planning

Sampling Techniques

Real-time Sampling

Microscopic, Chemical, and Inorganic Analytical Methods

Data Analysis and Interpretation

Restoration/Remediation

Insurance Claim Issues

# Closing and Thank You