



INDOOR ENVIRONMENTAL STANDARDS ORGANIZATION

A WHOLLY-OWNED SUBSIDIARY OF THE INDOOR AIR QUALITY ASSOCIATION

IESO/RIA STANDARD 6001

**EVALUATION OF HEATING, VENTILATION AND AIR
CONDITIONING (HVAC) INTERIOR SURFACES TO DETERMINE THE
PRESENCE OF FIRE-RELATED PARTICULATE AS A RESULT OF A
FIRE IN A STRUCTURE**

*2012 Edition
an American National Standard*





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**Designation IESO/RIA Standard 6001
(Supersedes: None)**



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PREFACE

This Indoor Environmental Standards Organization (IESO)/ Restoration Industry Association (RIA) standard was developed through a process that brought together volunteers representing varied viewpoints and interests to achieve consensus on the evaluation of HVAC interior surfaces for the presence or absence of fire-related residue.

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This edition of IESO/RIA 6001, Evaluation of Heating, Ventilation and Air Conditioning (HVAC) Interior Surfaces to Determine the Presence of Fire-Related Particulate as a Result of a Fire in a Structure, was prepared by the RIA HVAC Soot Standard Sub-Committee of IESO in November 2010. It was issued by IESO on May 18, 2011 with an effective date of May 18, 2011, and supersedes all previous editions.

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INTRODUCTION

HAZARDOUS MATERIALS

This Standard does not address or identify hazardous materials (including but not limited to asbestos, lead paint, PCBs and mercury) that are present and/or involved in Heating, Ventilation, and Air Conditioning (HVAC) systems as a result of a fire. These situations shall be identified and addressed prior to usage of this standard.

INDICATORS OF FIRE-RELATED PARTICULATE

The purpose of this standard is to evaluate if fire-related residues have been deposited on HVAC interior surfaces. It is not the intent of this standard to determine what materials have been burned in the fire or what specific materials have been deposited on a surface. Instead, char is used as the primary indicator and soot is used as the secondary indicator of fire-related particulate. The standard requires the quantification of char or soot concentrations to allow comparisons with a control sample, since merely identifying the presence or absence of char is not sufficient.

Char and soot have been selected as indicators because char is a byproduct of almost all fires and is easily identifiable under most circumstances. Soot is also a byproduct of almost all fires and is easily identifiable if the sample is appropriately collected and properly analyzed. This standard is designed to be applied to structural fires. Limited structure fires do not produce large amounts of ash, therefore ash is not included as an indicator of residue for this standard.

PRIORITY OF INDICATORS

If the primary indicator is present according to the provisions of this standard, then the lab analysis need not include the secondary indicator. If the primary indicator is not present, then the samples shall be analyzed for the secondary indicator according to the provisions of this standard.

CHAR

Char is the primary indicator in determining if residue from a fire has been deposited on an HVAC interior surface. Char consists of fragments of combusted material typically greater than one micron in size and are irregular in shape. These physical characteristics allow char fragments to be identified by a trained microscopist using appropriate optical microscopy methods.

SOOT

Soot particles are the secondary indicator of fire residue. Because individual soot particles are sub-micron in size, surfaces may look visibly clean. However, when wiped, the clustered clumps may darken the surface of the wipe. Analysis of the wipe sample(s) (see section 8.7.2) by a trained microscopist using appropriate optical microscopy methods is necessary to confirm that the darkened wipe has collected soot and not dirt or other particles that could be mistaken for fire residue.

OTHER CONSIDERATIONS

Under some circumstances there are interferences that could make the determination of the presence of char and soot difficult. However, in the vast majority of cases char is easily identifiable. In those cases where there are interferences, other analysis methods can be used, although usually at additional costs in terms of money and time. Any alternative methods are not included as part of this standard.

There may be circumstances when the collection of samples from non-affected fire- and/or smoke-damaged areas may be useful for comparison purposes. Such background and baseline samples may help in interpretation of sampling data.

IESO/RIA 6001: Evaluation of Heating, Ventilation and Air Conditioning (HVAC) Interior Surfaces to Determine the Presence of Fire-Related Particulate as a Result of a Fire in a Structure. 2012 Edition

1 SCOPE

- 1.1 HVAC interior surfaces have the potential to collect particulate, smoke, moisture, gaseous emissions and other contaminants as the result of a fire or smoke event. This can occur even while the HVAC system is in a de-energized (non-operational) state. Deposition of these foreign materials may alter the HVAC system's components, potentially affecting system performance, corrosion resistance, and the general hygiene of the HVAC interior surfaces. A standardized evaluation of the HVAC interior surface conditions is necessary to determine when HVAC interior surfaces have been impacted by a fire-related particulate.
- 1.2 The methodologies used in this standard address the evaluation of HVAC interior surfaces for the presence or absence of fire-related particulate (char and/or soot).
- 1.3 EXCLUSIONS:
 - 1.3.1 This standard does not address the disturbance, cleaning, removal, abatement or handling of any material and/or substances regulated by federal, state or local law.
 - 1.3.2 This standard does not address identifying individual char and/or soot particulates below 1 micron in size.
 - 1.3.3 This standard does not address cleaning methodologies or define clearance standards.

2 DEVIATIONS

- 2.1 Deviations from and exceptions to terms, conditions, specifications or the manner of inspection described in this standard shall be included in the inspection and sampling report (section 10).

3 PURPOSE

- 3.1 The purpose of this document is to specify the evaluation process through a specific inspection and sampling protocol to determine the presence or absence of char and/or soot on HVAC interior surfaces.

- 3.1.1 This Standard uses char as the primary marker for fire-related residue on surfaces and soot as the secondary marker.
- 3.1.2 Defines testing criteria and an assessment procedure to determine when HVAC interior surfaces have the presence or absence of char and/or soot related to a fire.

4 TERMINOLOGY

AGGLOMERATE: (soot) A group of individual, sub-micron-sized soot particles (which individually cannot be resolved using light microscopy techniques) that have clustered together to form a larger soot particle (subsequently greater than one micron in size and visible during an optical microscope examination). (See soot clusters.)

AIRBORNE PARTICLE: any solid or liquid suspended in air, regardless of size or composition, for a measureable time.

AIR DISTRIBUTION SYSTEM: See HVAC Interior Surface definition.

AIR DUCT: A conduit for conveying air.

AIR DUCT COVERING: A material such as adhesive, insulation, banding, coating, film, or jacketing used to cover the outside surface of an air duct, fan casing, or duct plenum.

AIR DUCT LINING: A material applied to the inside surface of an air duct, fan casing, or duct plenum to reduce the transmission of energy such as temperature, sound, or light.

AIR INLET: Any opening through which air is removed from a space and returned to an air distribution system or exhausted from the space.

AIR OUTLET: Any opening through which air is delivered to a space from an air distribution system.

BULK SAMPLING: A sample of material found in the HVAC system.

CHAR: Particulate greater than or equal to 1 micron in size made by incomplete combustion which may not deagglomerate or disperse by ordinary techniques, may contain material which is not black, and may contain some of the original material's cell structure and inorganic materials.

COILS: Devices inside an HVAC system that temper and/or dehumidify the air handled by the HVAC system. These include heat exchangers, with or without extended surfaces, through which water, ethylene glycol solution, brine, volatile refrigerant, or steam is circulated for the purpose of total cooling (sensible cooling plus latent cooling) or sensible heating of a forced-circulation air stream.

COMBINATION FIRE AND SMOKE DAMPER: A device that meets both the fire damper and smoke damper requirements.

DAMPER: A valve or plate that stops or regulates the flow of air inside a duct, chimney, vav box, air handler or other air handling equipment.

DUAL DUCT SYSTEM: A type of air-conditioning system in which two supply air ducts run to each space being conditioned, one for cold air, the other for warm air. Air from the two ducts is blended in a sheet-metal box (called a "mixing box") and then supplied to the conditioned space.

FAN: An air moving device that creates a pressure difference causing airflow.

FIRE/SMOKE DAMPER: A device that meets the fire and/or smoke damper requirements.

HEPA: High efficiency particulate air (filter). A filter that is capable of removing 99.97% of particles at 0.3 microns.

HVAC COMPONENT ACCESS POINT: The point at which the ductwork or HVAC unit is accessed for inspection and sampling.

HVAC INTERIOR SURFACE: Any surface of the HVAC system in contact with the air stream.

HVAC MECHANICAL COMPONENT: See HVAC Interior Surface.

HVAC SYSTEM: Any heating, ventilation and air conditioning (HVAC) air distribution system's interior surface. In this standard, any designed system of ducts, plenums and air-handling equipment that circulates air within a space and includes systems comprising one or more air-handling units. Examples of equipment and components include but are not limited to: blower housings, cooling and heating coils, blower wheels, filter banks, air handling units, insulation, condensate pans, grilles or registers, acoustic sound devices, dampers, manifolds, ductwork interiors, mixing and distribution boxes, humidifiers, dehumidifiers, energy recovery ventilators, heat recover ventilators, VAV boxes, turning vanes, interior controls, air straighteners and air monitoring devices. The air distribution system may also include but is not limited to outdoor air ducting, exhaust and make-up air systems.

INSPECTION: Documentation of visual condition of a surface.

MICROSCOPIST: An analyst trained and experienced in the use of one or more microscopes.

NON-POROUS: Any surface of the HVAC system in contact with the air stream that cannot be penetrated by water or air, such as sheet metal, aluminum foil, or polymeric film used to line flexible duct.

PARTICULATE AIR FILTER: A device used to reduce or remove airborne solids from heating, ventilation, and air conditioning systems.

PLENUM: A compartment or chamber of the air distribution system to which one or more air ducts are connected and that forms part of the air distribution system.

POROUS: Any surface of the HVAC system in contact with the air stream that is capable of penetration by either water or air. Examples include fiber glass duct liner, fiber glass duct board, wood, and concrete.

PYROLYSIS: The chemical decomposition of a compound into one or more other substances by heat alone; pyrolysis often precedes combustion.

SAMPLE: n. A small fractional part of a material or a specified number of objects that are selected for testing, inspection, specific observations or particular characteristics, i.e., containing char fragments. v. Collecting a representative portion of material of interest for analysis or further assessment.

SHALL: When the term *shall* is used in this document, it means that the practice or procedure is mandatory

SHOULD: When the term *should* is used in this document, it means that the practice or procedure is recommended.

SMOKE: An airborne particulate product of incomplete combustion suspended in gases, vapors, or solid and liquid aerosols.

SOOT: A submicron black powder generally produced as an unwanted by-product of combustion or pyrolysis. It consists of various quantities of carbonaceous and inorganic solids in conjunction with absorbed or occluded organic tars and resins.

SOOT CLUSTER: A group or agglomeration of individual soot particles.

STICKY TAPE: A section of clear tape with a sticky, solvent soluble adhesive used in the collection of particles from surfaces. "Clear" or "Crystal Clear" 3/4 inch transparent tape 2 inches in length. "Frosted" type tapes shall not be used.

VAV BOX: Variable Air Volume Box.

WIPE: A small piece of uncolored, non-fragranced cellulosic or synthetic material used to collect combustion particles (char, soot, etc.) from a surface. Examples would be a cotton ball or pad.

ACRONYMS:

- 4.1.1 COC – Chain of Custody
- 4.1.2 DF – Dark field illumination
- 4.1.3 EDS – Energy dispersive spectroscopy used in conjunction with SEM and/or TEM for elemental identification
- 4.1.4 GC/MS – Gas chromatography with mass spectrometry detection
- 4.1.5 LM – Light microscope
- 4.1.6 PLM – Polarizing light microscopy
- 4.1.7 SEM – Scanning electron microscopy
- 4.1.8 TEM – Transmission electron microscopy

5 HEALTH AND SAFETY

- 5.1 Compliance: Evaluation personnel shall comply with applicable federal, state, and local requirements for protecting the safety of the contractor’s employees, building occupants, and the environment.

6 INVESTIGATOR(S) QUALIFICATIONS

- 6.1 This standard can be implemented by a single individual or a team of professionals in their respective disciplines based upon the size and complexity of the fire-related event.
- 6.2 Knowledge of HVAC/Mechanical systems of the type and size system being evaluated shall include but is not limited to:
 - 6.2.1 Air distribution design.
 - 6.2.2 Air distribution operation.
 - 6.2.3 Pollutant pathways.
 - 6.2.4 HVAC/Mechanical components.
 - 6.2.5 Duct construction materials.
 - 6.2.6 Ability to access and close HVAC components in accordance with all federal, state and local regulations.
 - 6.2.7 Surface sampling principles and procedures of this standard.

- 6.2.8 Ability to interpret laboratory data and visual observations for fire- related events on similar projects.

7 HVAC INTERIOR SURFACE INSPECTION AND SAMPLING LOCATIONS

- 7.1 This standard defines the inspection and sampling process for HVAC interior surfaces to determine the presence or absence of fire- and/or smoke-related particulate as a result of a fire in a structure.
- 7.2 The inspection and sampling protocol shall include the following:
 - 7.2.1 Access to the HVAC interior surface for the purpose of inspection and sampling.
 - 7.2.2 Photographic documentation of the area visibly inspected.
 - 7.2.3 A tape lift sample close to the HVAC component access point. (See sections 8.2, 8.3, 8.6)
 - 7.2.4 A wipe sample close to the HVAC component access point. (See sections 8.2, 8.3, 8.7)
- 7.3 The HVAC Component access point for the inspection and sampling process shall:
 - 7.3.1 Be accessed in accordance with the Sheet Metal and Air Conditioning Contractors’ National Association (SMACNA) or North American Insulation Manufacturers Association (NAIMA) guidelines/standards.
 - 7.3.2 Have sufficient access size for visual inspection for the performance of a tape lift and a wipe sampling for photographic documentation.
 - 7.3.3 Have sufficient lighting to evaluate the visible conditions of the duct, take photographs, and take tape lift and/or wipe samples. (See sections 8.6, 8.7)
 - 7.3.4 Be closed in accordance with SMACNA or NAIMA guidelines/standards.
- 7.4 This section describes the minimum HVAC inspection and sampling locations. Additional inspection and sampling locations may also be necessary to determine the presence or absence of fire- and/or smoke-related particulate in the HVAC system(s):
 - 7.4.1 The sampled surface should be continuous, no sample should be taken across a seam of a spiral or galvanized duct.

- 7.4.2 An HVAC/Mechanical system without ducting shall be inspected and sampled at a minimum of one internal location.
- 7.4.3 A 2-ton residential HVAC system or smaller that is return and supply ducted shall have as a minimum of three inspection and sampling locations; the return duct, the unit and the supply duct. The specific inspection and sampling locations shall at minimum be taken from the following areas:
- 7.4.3.1 Return duct: At least three (3) feet from the unit and at least two (2) feet from a register. This should be in the main trunk and there shall not be any branch ducting between the unit and the sampling location.
- 7.4.3.2 HVAC Unit: Downstream of the outside air/return air mixing chamber and filters. It shall not be in the condensate drain pan.
- 7.4.3.3 Supply Duct: At least five (5) feet from the unit within the main trunk line, downstream of the unit and prior to any branch transitions.
- 7.4.3.4 An HVAC system without a return duct shall be inspected and sampled in a minimum of two locations: the unit and ducted portion.
- 7.4.4 An HVAC system larger than two tons with supply and return duct work shall at a minimum have three inspection and sampling locations as defined in section 7.4.3 for a two-ton system and address other potential areas of soot and char deposition in an HVAC system. Additional inspection and sampling locations should be evaluated during the initial sampling strategy to ensure all potential fire residue migration and/or settling points are considered for inspection and sampling. The number of additional inspection and sampling locations will depend on the type and complexity of the fire, building pressurization during and after the fire, and the HVAC system configuration.
- 7.4.5 In a multi-zone HVAC system, the inspection and sampling points should be located in the ducting inside the fire area and in the ducting possibly affected by fire- and/or smoke-related particulate due to air (smoke) pathways.
- 7.4.5.1 In a dual duct HVAC system, both the hot and cold duct supplies should be inspected and sampled (i.e., two sampling points – one on the cold deck and one on the hot deck).
- 7.4.6 In any air distribution system that consists of a multiple unit configuration, each unit shall be inspected and sampled individually.
- 7.4.7 Units not in the fire affected area should be considered for inspection based on the professional judgment of the investigator.
- 7.5 HVAC systems in locations of the building that were not directly serving the immediate fire area can also be affected through pressure differentials, allowing char and/or soot to enter an HVAC system. These systems shall be considered during the inspection period.
- 7.6 Fires may affect one unit in a building or multiple units, therefore additional HVAC interior surface inspection and testing may be required.
- 8 HVAC INTERIOR SURFACE SAMPLING PROTOCOLS**
- 8.1 Scope: This procedure covers sampling for fire- and/or smoke-related particulate potentially deposited on HVAC interior surfaces after structure fire and smoke events.
- 8.2 Sampling Protocol: This protocol describes the procedures to collect samples from HVAC interior surfaces potentially affected by fire- and/or smoke-related particulate. The sampling protocol shall consider the HVAC component's interior surface type, configuration and orientation, and shall be representative of the potentially impacted surface. In order of preference, the sampling surfaces are:
- 8.2.1 Non-porous surfaces, as defined in Section 4, should be sampled in a relatively smooth, flat area.
- 8.2.2 Porous surfaces, as defined in Section 4, should be sampled in a relatively smooth, flat area. It may be necessary to perform bulk sampling to identify char or soot particulate on or within the porous surface.
- 8.2.3 Exceptions: Samples shall not be obtained from the following locations: painted surfaces, heavily oxidized surfaces, surfaces with water deposits, and surfaces that have grease or non-manufactured oil residue.
- 8.3 Sample Materials
- 8.3.1 "Clear" or "Crystal Clear" ¾ inch transparent tape 2 inches in length. "Frosted" type tapes shall not be used.
- 8.3.2 Permanent marker.
- 8.3.3 Small zip-lock type plastic bags.
- 8.3.4 Wipes - A small piece of uncolored, non-fragranced cellulosic or synthetic material used

- to collect combustion particles (char, soot, etc.) from a surface.
- 8.3.5 Protective unpowdered latex, Nitrile or other polymer type glove shall be used when collecting samples.
- 8.4 Comparison samples: There may be conditions where having control samples could be useful, but is not required as part of this protocol.
- 8.5 Samples for char and soot shall be taken at each sampling location. See section 8.6 for char sampling procedure and section 8.7 for soot sampling procedure. For both sample acquisition methods, precautions should be taken in order to carefully collect, handle and transport samples in a manner to not cross-contaminate or introduce additional foreign particles to the samples.
- 8.6 Sample collection for the determination of the presence of char
 - 8.6.1 Access sampling location.
 - 8.6.2 Put on protective gloves.
 - 8.6.3 Discard the first piece of exposed tape.
 - 8.6.4 Remove a 2-inch piece of tape and fold over ½-inch of tape to use as a handle and minimize sample contamination.
 - 8.6.5 Lightly press the entire tape surface onto the surface to be sampled.
 - 8.6.6 Carefully remove tape using the folded section.
 - 8.6.7 Press the tape sample sticky side down onto the inside surface of a plastic bag. Seal the zip-lock portion of the bag.
 - 8.6.8 Clearly identify the sample using a permanent marker to write on the outside of the plastic bag.
 - 8.6.9 Place all sample bags into a larger zip-lock bag and securely package for shipment to the laboratory.
- 8.7 Sample collection for the determination of the presence of soot
 - 8.7.1 Put on protective gloves.
 - 8.7.2 Using a wipe, lightly rub in a back and forth motion the surface to be sampled. (See ASTM D6602.) If possible, wipe an area approximately 100cm² (10cm x 10cm). Measure the wiped area to the nearest 5mm and record the measurement noting the value on the chain of custody form. Place each wipe sample in an individual plastic bag. Note the sample identification on the outside surface of the plastic bag.

- 8.7.3 Clearly identify the sample using a permanent marker to write on the outside of the plastic bag.
- 8.7.4 Place all sample bags into a larger zip-lock bag and securely package for shipment to the laboratory.
- 8.8 Complete a chain of custody form at the time of sample collection. (See Section 13.3 in Appendix for sample.) At a minimum, information on the chain of custody should include the job identification, sample identification, sampler's initials, sample location, sample date, size of sampled area (for wipes), type of sample (tape or wipe), descriptive notes and analysis requested. Enclose the original form with the samples and retain a copy. Package the samples securely so that the sample bags cannot open and are not damaged during shipment. If applicable, forward to an analytical laboratory using a traceable shipping method.

9 LABORATORY ANALYSIS PROTOCOLS

- 9.1 Scope: This is a screening method designed to detect the presence of fire residue as indicated by the presence of char and soot particles using light microscopy techniques such as stereo, PLM and DF illumination. It inherently assumes that the overwhelming majority of char and soot particles observed originated from the fire. The method is not designed to provide identification of individual char particles nor to determine the origin of soot particles through the analysis of residual fuel (GC/MS) or high magnification microscopy techniques such as SEM and/or TEM.
- 9.2 The microscopist shall be trained or have experience in identifying the morphological characteristics of carbon particles, as well as partially combusted material utilizing optical microscopy techniques.
- 9.3 Apparatus
 - 9.3.1 Light stereomicroscope, capable of 40X magnification.
 - 9.3.2 Reflected light microscope, capable of dark field illumination and up to 200X magnification.
 - 9.3.3 Polarized light microscope, capable of 400X magnification.
 - 9.3.4 Camera, preferably digital, to capture microscopic image.
 - 9.3.5 Microscope slides and coverslips.
 - 9.3.6 Mounting liquid.
 - 9.3.7 Stainless steel tweezers.

- 9.3.8 Tungsten micro tool (needle).
- 9.3.9 Small scissors.
- 9.3.10 Small magnet.
- 9.4 Procedure to determine the presence of char particles and soot clusters (larger than 1 μm in size) on the tape samples.
- 9.4.1 Clean glass microscope slides so that no visible streaks or particles are present. Remove the tape sample from a plastic bag and press sticky side down onto a clean microscope slide in a manner to minimize air bubbles under the tape surface. Repeat for each tape sample.
- 9.4.2 For each sample, use a stereo microscope at 40X magnification to scan the tape to determine an area for analysis where the tape is well adhered to the slide, i.e., free of bubbles, large foreign particles, etc. Define a 1cm x 1cm area using either a template or ruler and draw the outline on the tape surface. When selecting area to be examined, avoid 2 mm from edges of tapes because the side of a roll of tape can pick up particles in the job field.
- 9.4.3 Using a reflected light microscope with DF illumination at 200X, obtain focus in the plane of the particles between the tape and slide. Moving in a clockwise fashion, for each field of view, estimate and record the number of black or partially combusted char fragments and soot clusters. Analyze one hundred (100) total fields of view counting the total number of char fragments or soot clusters in each field. Record the average number of black particles per field. It is unnecessary to count any more than twenty (20) char fragments or soot clusters per field of view. A representative photograph should be obtained to document each sample.
- 9.5 If there are no visible char or soot clusters greater than 1 μm in size (the approximate resolution of the optical microscope), use this procedure to determine the presence of soot not initially visible on the tape samples. This analysis is designed to detect soot particles that have been agglomerated during the sampling process into clusters that would otherwise have been too small to detect using light microscopy examination of tape lift samples. The wipe samples are to be used for this analysis.
- 9.5.1 Clean glass microscope slides and cover slips so that no visible streaks or particles are present. For each wipe sample, while viewing under a stereo microscope, either pull out with tweezers or cut out darkened fibers and place them on a microscope slide. Place a drop of mounting refractive index liquid on a cover slip and invert onto the fibers to cover them. If necessary, add additional refractive index liquid to the edge of the cover slip and allow it to wick underneath the slide so that the fibers are immersed in liquid and there are minimal air bubbles.
- 9.5.2 Using a polarized light microscope at 400X magnification, examine each slide preparation for the presence of black soot agglomerates on the surface of the wipe fibers. Using reflected light or dark field illumination, confirm that the particles on the wipe fibers are black and non-reflective. Place a small magnet next to the cover slip and confirm that the particles are not magnetic. If they are magnetic, they will rotate and align with the magnet. A representative photograph should be obtained to document each sample.
- 9.6 Additional Analytical Methods
- 9.6.1 If the optical microscopy methods used above are deemed by the analyst to be inconclusive with respect to the identification of agglomerated particles comprising the individual soot particles (e.g., extremely small particles of zinc from the galvanized duct surfaces can also appear black, non-magnetic and non-reflective), scanning electron microscopy (SEM) with energy dispersive spectroscopy (EDS) may be employed on the wipe samples.
- 9.6.2 If the soot particles are suspected to be unrelated to the fire (e.g., combustion of diesel fuel, candles, oil, etc.) or carbon black, additional techniques such as TEM or GC/MS may be used. These analysis techniques are not part of this standard.
- 9.7 Laboratory Analysis Report
- 9.7.1 Prepare a table that includes the following information. (See 13.1 for example)
- 9.7.2 Sample number.
- 9.7.3 Sampling location.
- 9.7.4 Type of surface sampled.
- 9.7.5 Date of sample.
- 9.7.6 Initials of the sampler.
- 9.7.7 Average number of char fragments and soot clusters observed in each tape lift from the analysis in section 9.4.
- 9.7.8 If wipe samples were analyzed, record the presence or absence of soot analyzed in section 9.5.

9.8 One of the accepted authoritative publications on how to identify soot and char particles is the McCrone Particle Atlas. See Section 12 in Appendix for the citation.

10 INSPECTION AND SAMPLING REPORT

10.1 The inspection and sampling report prepared and delivered to the client shall include the following:

- 10.1.1 Background statement of the fire related event.
- 10.1.2 Deviations.
- 10.1.3 Inspection and sampling strategy.
- 10.1.4 Inspection and sampling location information for each sample including:
 - 10.1.4.1 Sample location.
 - 10.1.4.2 Laboratory analysis result.
 - 10.1.4.3 Photographic documentation of inspection and sampling location surface.
- 10.1.5 Chain of Custody.
- 10.1.6 Summary of findings.
- 10.1.7 Other Project Specific Considerations.

11 APPENDIX

The data contained in this appendix is provided as a supplement to the standard and lists issues to be considered by an individual performing inspection and sampling of HVAC interior surfaces.

- 11.1 Health & Safety Considerations: The evaluator who conducts inspections to determine the presence of fire-related residue should consider regulated materials.
- 11.2 The evaluator shall comply with all applicable regulations regarding worker and environmental health and safety including, but not limited to:
 - 11.2.1 Confined Space Entry, OSHA Standard 29 CFR 1910.146.
 - 11.2.2 Control of Hazardous Energy (Lockout/Tagout), OSHA 29 standard CFR 1910.147.
 - 11.2.3 Respiratory Protection Standard, OSHA Standard 29 CFR 1910.134.
 - 11.2.4 Personal Protective Equipment (PPE), OSHA Standard 29 CFR 1910.132, 133, 135, & 138.
 - 11.2.5 Hazard Communication Standard, OSHA Standard 29 CFR 1910.1200.

11.2.6 Various standards under 29 CFR subpart D, walking and working surfaces, including OSHA Standards 29 CFR 1910.21 – 1910.30.

11.2.7 Various standards under 29 CFR subpart F, powered platforms, man lifts, and vehicle-mounted work platforms, including OSHA standards 29 CFR 1910.66 – 1910.68.

11.2.8 Fall Protection various standards under 29 CFR 1926 subpart M, fall protection, including OSHA Standards 29 CFR 1926.500 – 1926.504 and subpart M appendices A through E.

11.2.9 Investigators who conduct post-fire inspections to determine the presence of fire-related residues on HVAC interior surfaces should utilize the following personal protective equipment (PPE):

11.2.9.1 Respiratory protection against particulate exposure: at minimum an N-95 respirator should be used. Respiratory protective equipment shall not be utilized unless all aspects of the OSHA Respiratory Protection Standard are complied with.

11.2.9.2 Eye Protection.

11.2.9.3 Impervious gloves.

11.2.9.4 Coveralls.

11.3 Please note that hazards may vary depending on what was burned by the fire. The investigator shall perform due diligence to determine if any hazardous materials were burned or formed in the fire that would be present in fire residues from the fire prior to performing any inspection. This appendix does not apply to situations where hazardous materials were known to be or suspected to have been involved in the fire. Those situations shall be handled on a case by case basis.

11.4 Pre-existing conditions: Often mechanical systems contain fine particulate and other foreign matter. These existing particulates are often too small to differentiate visually from fire-related particulate.

11.4.1 Historical background should be obtained to aid the investigator in determining if char and soot deposition from past events have occurred prior to the current fire event. This standard is not designed to define between multiple char and soot-related events.

12 REFERENCE DOCUMENTS

- 12.1. *ASTM D6602 – 03b Standard Practice for Sampling and Testing of Possible Carbon Black Fugitive Emissions or Other Environmental Particulate, or Both*, ASTM International, West Conshohocken, PA, 2010.
- 12.2. *OSHA 1910 – Occupational Health and Safety Standards*, United States Department of Labor, Washington, D.C.
- 12.3. *SMACNA – Duct Construction Standards – Metal and Flexible*, Sheet Metal and Air Conditioning Contractors' National Association, Chantilly, VA, 2005.
- 12.4. *NAIMA Fibrous Glass Residential Duct Construction Standards (Ductboard/Duct Board) – TI Edition (AH119)*, North American Insulation Manufacturers Association, Alexandria, VA, 2002.
- 12.5. *ACCA Standard 6, Restoring the Cleanliness of HVAC Systems*, Air Conditioning Contractors of America, Arlington, VA, 2007.
- 12.6. *ANSI/ASHRAE/ACCA Standard 180-2008 Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems*, 2006.
- 12.7. *ASHRAE Standard 33-78, Methods of Testing Forced Circulation Air Cooling and Air Heating Coils*, ASHRAE, Atlanta, GA, 1978.
- 12.8. *NFPA 90A: Standard for the Installation of Air-Conditioning and Ventilating Systems*, National Fire Protection Association, Quincy, MA, 2012.
- 12.9. *ANSI/ARI 410-91 Forced-Circulation Air-Cooling and Air-Heating Coils*, Air-Conditioning, Heating and Refrigeration Institute, Arlington, VA, 2001
- 12.10. *ACR 2006 Assessment, Cleaning, and Restoration of HVAC Systems*, National Air Duct Cleaners Association, Washington, D.C., 2006.
- 12.11. *IICRC S520 Standard and Reference Guide for Professional Mold Remediation*, Institute of Inspection Cleaning and Restoration, Vancouver, WA, 2008.
- 12.12. McCrone, W.C. and J.G. Delly. *The Particle Atlas*, 2nd ed., Ann Arbor Science Publishers, Ann Arbor, MI, 1972.

13 SAMPLE FIELD REPORTS

These are examples of ways to format the information that should be included in the various reports, but any reasonable format that includes the elements listed in section 9.7 will suffice.

13.1 Sample Analysis Report

Example of a Sample Analysis Report

Project Name:

Project Number:

Sample Number	Sample Location	Surface Sampled	Sampler Initials	Sample Type	Date Taken	Date Analyzed	Analysis Method	Average Particle Count per 100 Fields Tape Sample	Soot Present On Wipe Sample
321A	Family room return	Side, drywall	XXX	Tape	1/1/2009	1/3/2009	LM	4	n/a
321B	Supply plenum	Bottom, metal	XXX	Wipe	1/1/2009	1/4/2009	PLM	n/a	yes

14 SAMPLE I.D. FORM

Sample ID: _____
Date of Analysis: _____ Analyst: _____

Field No.	Count	Field No.	Count	Field No.	Count	Field No.	Count
1		26		51		76	
2		27		52		77	
3		28		53		78	
4		29		54		79	
5		30		55		80	
6		31		56		81	
7		32		57		82	
8		33		58		83	
9		34		59		84	
10		35		60		85	
11		36		61		86	
12		37		62		87	
13		38		63		88	
14		39		64		89	
15		40		65		90	
16		41		66		91	
17		42		67		92	
18		43		68		93	
19		44		69		94	
20		45		70		95	
21		46		71		96	
22		47		72		97	
23		48		73		98	
24		49		74		99	
25		50		75		100	

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