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NADCA 1992-01

Mechanical Cleaning of Non-Porous Air Conveyance System Components

An Industry Standard Developed by the National Air Duct Cleaners Association

NADCA

National Air Duct Cleaners Association
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NADCA 01

Mechanical Cleaning of Non-Porous Air Conveyance System Components

1992 Edition

This edition of NADCA 01, *Mechanical Cleaning of Non-Porous Air Conveyance System Components*, was prepared by the Standards Committee of the association and acted on by the National Air Duct Cleaners Association Board Directors at its Fall Meeting held October 23, 1992.

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Preamble

NADCA Standard 1992-01 is the first standard governing air conveyance system cleaning to be finalized by the National Air Duct Cleaners Association and its Standards Committee. This Standard generally addresses the mechanical cleaning of air conveyance system components composed of non-porous materials. Standard 1992-01 is intended to provide a voluntary performance standard which cleaners and building owners may wish to consider in determining the requirements for specific cleaning projects, and which can ensure certain minimum cleaning results on particular cleaning projects.

It should be noted that this standard does not address mechanical cleaning or decontamination procedures when potentially hazardous materials are likely to be present in air conveyance systems. Such potentially hazardous materials include, but are not limited to, hazardous microbial contaminants, asbestos, lead, and other chemical contaminants. This Standard does not address such situations for two reasons. First, the worker safety and public safety aspects of operations involving hazardous materials are, in many cases, governed by legal requirements imposed by the Occupational Safety and Health Administration, the U.S. Environmental Protection Agency and various state and local agencies. Second, unless air conveyance system cleaners are engaged specifically to perform hazardous material decontamination, the building owner and/or occupant should better understand whether hazardous materials are likely to be present, and should bear responsibility for any consequences of encountering unexpected hazardous materials.

NADCA Standard 1992-01 represents only one in series of possible standards under consideration by the NADCA Standards Committee. Future standards may address issues such as cleaning of porous system components and mitigation of microbial contamination. Because this Standard represents only one step in NADCA's standards-making process, its limitations should be understood and it should be considered in conjunction with other standards, as they become available.

The NADCA Standards Committee has also prepared a Guideline to NADCA Standard 1992-01, which is included herein starting on page 9. *This Guideline does not constitute part of the Standard or establish requirements for complying with the Standard*; it is designed only to offer additional background information on cleaning air conveyance systems.

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Mechanical Cleaning of Non-Porous Air Conveyance System Components

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Chapter 1. Scope

1.1 General. This standard provides performance requirements and evaluation criteria for the mechanical cleaning of non-porous ductwork, fans, coils, and other non-porous components of commercial and residential air conveyance systems (ACS).

1.2 Purpose. This standard defines the requirements necessary to render non-porous ductwork and other non-porous ACS components clean, and to verify the cleanliness through inspection and/or testing.

Chapter 2. Applicable Documents

The following documents of the issue currently in effect form a part of this standard to the extent specified herein.

- *ASHRAE 62-1989, Ventilation for Acceptable Indoor Air Quality,* American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), 1989
- *Military Standard 282*, United States Department of Defense (DOD), 1956
- *Building Air Quality,* Environmental Protection Agency (EPA), December 1991
- *HVAC Duct Construction Standards — Metal and Flexible*, Sheet Metal and Air Conditioning Contractors National Association (SMACNA), 1985.
- *ASHRAE 33-78, Methods of Testing Forced Circulation Air-Cooling and Air-Heating Coils*, American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), 1978
- *ASHRAE Terminology of Heating, Ventilation, Air Conditioning, & Refrigeration*, American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), 1991
- *ARI 410-91 Forced-Circulation Air-Cooling and Air-Heating Coils*, Air Conditioning and Refrigeration Institute (ARI), 1991
- *Manual of Analytical Methods*, Third Edition, National Institute for Occupational Safety and Health (NIOSH), February 1984
- *AMCA 99-86, Standards Handbook*, Air Movement & Control Association, 1986.

Chapter 3. Definitions

3.1 Air Conveyance System: The air conveyance system is any interior surface of a building's air distribution system for conditioned spaces and/or occupied zones (See *ASHRAE 62-1989*). This includes the entire air moving system from the points that the air enters the system to the points where the air is discharged from the system. The return air grilles, air ducts (except ceiling plenums) to the air handling unit (AHU), the interior surface of the AHU, mixing box, coil compartment, condensate drain pans, humidifiers and dehumidifiers, supply air ducts, fans, fan housing, fan blades, air wash systems, spray eliminators, turning vanes, filters, filter housings, reheat coils, and supply diffusers are all considered part of the ACS.

3.2 Coils: Devices inside the ACS which temper and/or dehumidify the air handled by the ACS. These include heat exchangers, with or without extended surfaces, through which either 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 steam. (See *ASHRAE 33-78* and *ARI 410-91)*

3.3 Debris: Any solid materials, including particulate substances, in the ACS not intended to be present.

3.4 DOP Testing: The percentage removal of 0.3 micrometer particles of dioctylphthalate (DOP) is used to rate high efficiency air filters, those with efficiencies above about 98 percent. (See *Military Standard 282*, U.S. Department of Defense, 1956.)

3.5 Ductwork: A system of passageways for distribution and extraction of air. (See *ASHRAE Terminology of Heating, Ventilation, Air Conditioning, & Refrigeration*, 1991)

3.6 Fan: A power driven machine which moves a volume of air by converting rotational mechanical energy to an increase in the total pressure of the moving air. (See *AMCA 99-86*)

3.7 Mechanical Cleaning: Physical removal of Debris and other foreign matter from ACS surfaces.

3.8 NADCA Vacuum Test: A measurable performance test to verify the cleanliness of any Non-Porous surface of an ACS, in which loose Debris is collected from a defined area within an ACS, using the vacuum equipment and method specified in Appendix A of this standard. This collected Debris is weighed to determine the amount present in the specified area.

3.9 Non-Porous ACS Surface: Any surface of the ACS in contact with the air stream which cannot be penetrated by either solutions or air. This would exclude materials such as wood, fiberboard, thermal insulation, and concrete.

3.10 Particulate Collection Equipment: A device used for collecting and containing particulate material.

3.11 Pressure Drop: 1. Loss in pressure, as from one end of a refrigerant line to the other, from friction, static, heat, etc. 2. Difference in pressure between two points in a flow system, usually caused by frictional resistance to fluid flow in a conduit, filter, or other flow system. (See *ASHRAE Terminology of Heating, Ventilation, Air Conditioning, & Refrigeration*, 1991)

3.12 Static Pressure: The normal force per unit area that is exerted on the interior surfaces of the ACS by the air.

3.13 Visibly Clean: Determined by internal Visual Inspection, that all portions or components of the ACS are both 1) free of any Debris (see 3.3), and 2) in the cleaners' professional judgement, capable of Cleaning Verification (see 6.2, 6.3).

3.14 Visual Inspection: Examination of the cleaned components of the ACS to evaluate the effectiveness of the cleaning process using the human eye or another optical instrument.

Chapter 4. Requirements

4.1 General Requirements

4.1.1 Containment. Debris removed during cleaning shall be collected and precautions must be taken to ensure that Debris is not otherwise dispersed outside the ACS during the cleaning process. After ACS cleaning, any areas which could be affected by the cleaning contractor's work must be as clean or cleaner than their condition prior to the commencement of the cleaning operation.

4.1.2 Particulate Collection. Where the Particulate Collection Equipment is exhausting inside the building, HEPA filtration with 99.97% collection efficiency for 0.3-micron size particles shall be used (See EPA's *Building Air Quality*). When the Particulate Collection Equipment is exhausting outside the building, Mechanical Cleaning operations shall be undertaken only with Particulate Collection Equipment in place, including adequate filtration to contain Debris removed from the ACS. When the Particulate Collection Equipment is exhausting outside the building, precautions shall be taken to ensure that exhausted air does not re-enter the building.

4.1.3 Filtration Integrity. When using Particulate Collection Equipment exhausting inside the building, contractors shall be able to certify equipment effectiveness of 99.97% collection efficiency for 0.3-micron size particles through DOP test results, from an independent testing agency, for any collection device intended for use on a particular job.

4.1.4 Controlling Odors. All reasonable measures shall be taken to control offensive odors and/or mist vapors during the cleaning process.

4.1.5 Component Cleaning. Cleaning methods shall be employed such that all Non-Porous ACS Surface components must be Visibly Clean (see 3.13). Upon completion, all components must be returned to those settings recorded just prior to cleaning operations.

4.1.6 Air-Volume Control Devices. Dampers and any air-directional mechanical devices inside the ACS must have their position marked prior to cleaning and, upon completion, must be restored to their marked position.

4.1.7 Access Holes. Any access holes cut for the cleaning process must be repaired so that they shall not significantly alter the airflow. All openings made to facilitate the cleaning must be sealed in accordance with industry standards and local codes, using materials acceptable under those standards and codes. (See SMACNA's *HVAC Duct Construction Standards — Metal and Flexible*, 1985.)

4.2 Health and Safety

4.2.1 Cleaning contractors shall comply with all applicable federal, state, and local requirements for protecting the safety of the contractors' employees, building occupants, and the environment. In particular, all applicable standards of the Occupational Safety and Health Administration (OSHA) should be followed when working in accordance with this standard.

4.2.2 No processes or materials shall be employed in such a manner that they will create adverse health effects to the building occupants, cleaning contractors, or general public.

4.2.3 Disposal of Debris. All Debris removed from the ACS shall be disposed of in accordance with all applicable federal, state, and local requirements.

Chapter 5. Mechanical Cleaning

5.1 Non-Porous ACS Surfaces

5.1.1 Any Mechanical Cleaning method may be used which will render the ACS components Visibly Clean and capable of Non-Porous Surfaces Cleaning Verification (see 6.2). No cleaning method should be used which could potentially damage components of the ACS or negatively alter the integrity of the system.

5.2 Coils

5.2.1 Any cleaning method may be used which will render the Coil Visibly Clean and capable of passing Coil Cleaning Verification (see 6.3). Coil drain pans shall be subject to Non-Porous Surfaces Cleaning Verification (see 6.2). The drain for the condensate drain pan shall be operational. Cleaning methods shall not cause any appreciable damage to, displacement of, or erosion of the coil surface, and shall conform to coil manufacturer recommendations when available.

Chapter 6. Verification

6.1 General. Verification of ACS cleanliness will be determined after Mechanical Cleaning and before the application of any treatment or introduction of any treatment-related substance to the ACS. Verification of Non-Porous Surface Cleaning (see 6.2) and Verification of Coil Cleaning (see 6.3) shall be conducted after Mechanical Cleaning and before the ACS is restored to normal operation.

6.2 Verification of Non-Porous Surface Cleaning

6.2.1 All Non-Porous ACS Surfaces must be Visibly Clean and capable of passing the NADCA Vacuum Test.

6.2.2 The weight of Debris collected by the NADCA Vacuum Test, as outlined in Appendix A, shall not exceed 1.0 mg/100 cm^2.

6.3 Verification of Coil Cleaning

6.3.1 Mechanical Cleaning must restore the Coil-Pressure Drop to within 10 percent of the Pressure Drop measured when the Coil was first installed. If the original Pressure Drop is not known, the Coil will be considered clean only if the Coil is free of foreign matter and chemical residue, based on a thorough Visual Inspection.

Appendix A
Dust Vacuum Sampling Protocol

Chapter 1. Materials

1.1 Air Pump: A high volume air sampling pump capable of drawing 10 liters per minute through a cassette containing 37 mm matched weight filters (two 0.8 micron pore size mixed cellulose ester (MCE) filters in series), or pre-weighted PVC filters.

1.2 Filter Media: 37 mm mixed cellulose ester (MCE) matched weight filters (0.8 micron pore size) in three piece cassette or pre-weighed 37 mm polyvinyl chloride (PVC) filter (5.0 micron pore size) pre-loaded in three piece cassette.

1.3 Calibration: Calibration device that is accurate to +/- 5% at 10 liters per minute.

1.4 Template: 15 mil thick, 100 cm^2 sampling area: two 2 cm x 25 cm slots at least 2.5 cm apart.

The standard slot size for the NADCA Vacuum Test Template is 2 centimeters in width by 25 centimeters in length (see Figure 1). At times templates with slots of this size may not fit in a space where testing is necessary or desired. Slots of other sizes may be utilized, providing that the template adheres to the following specifications (see example in Figure 2):

The slot opening size and shape can vary provided that 1) the total area to be sampled is equal to 100 square centimeters; 2) the maximum width of the slot does not exceed 3.7 centimeters, so that the sample cassette does not touch the surface being sampled; and, 3) the minimum slot width is greater than or equal to 2.0 centimeters.

Chapter 2. Sampling Method

All sampling must be preceded by Visual Inspection (see 3.14).

2.1 Secure template to surface to be sampled so that it will not shift position during sample collection. The template must lay flat against the surface to be sampled. The surface to be sampled must be dry. Air handler must not be running when the sampling is being conducted.

2.2 Remove protective plugs (blue at inlet end, red at outlet end) from cassette. Cassettes should be wrapped with shrink tape.

2.3 Attach outlet end of cassette to pump tubing.

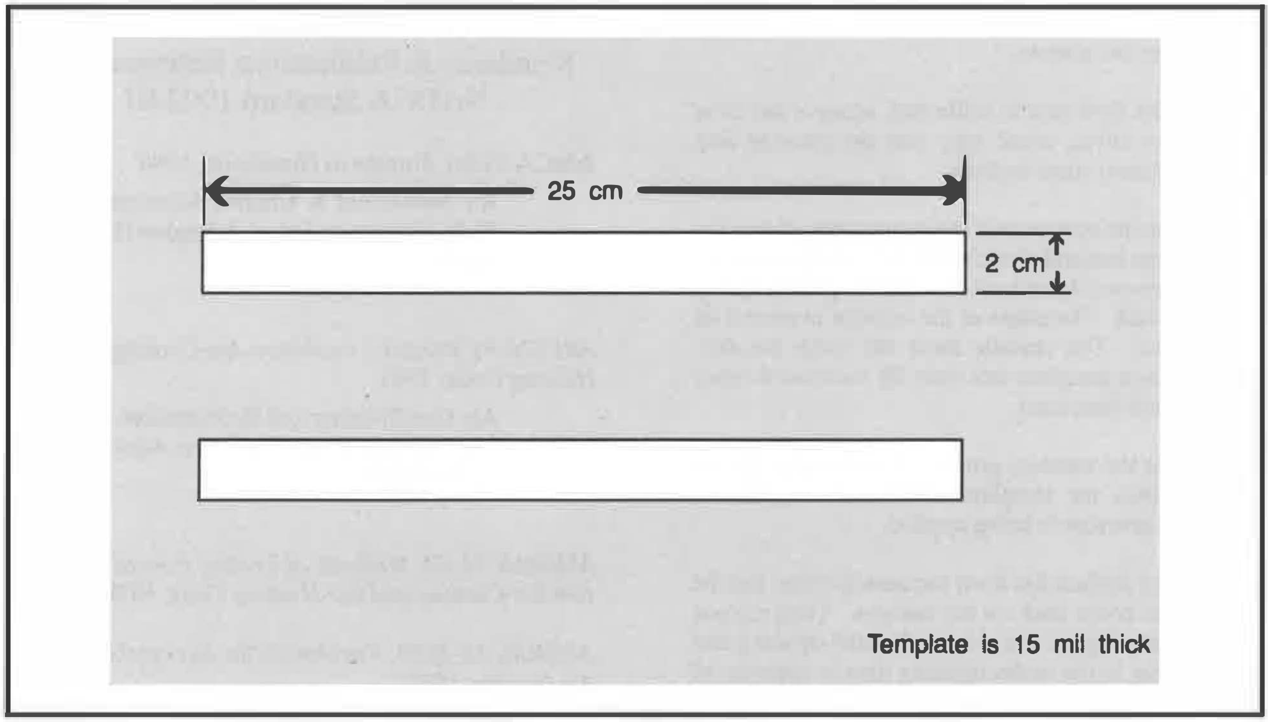

Figure 1

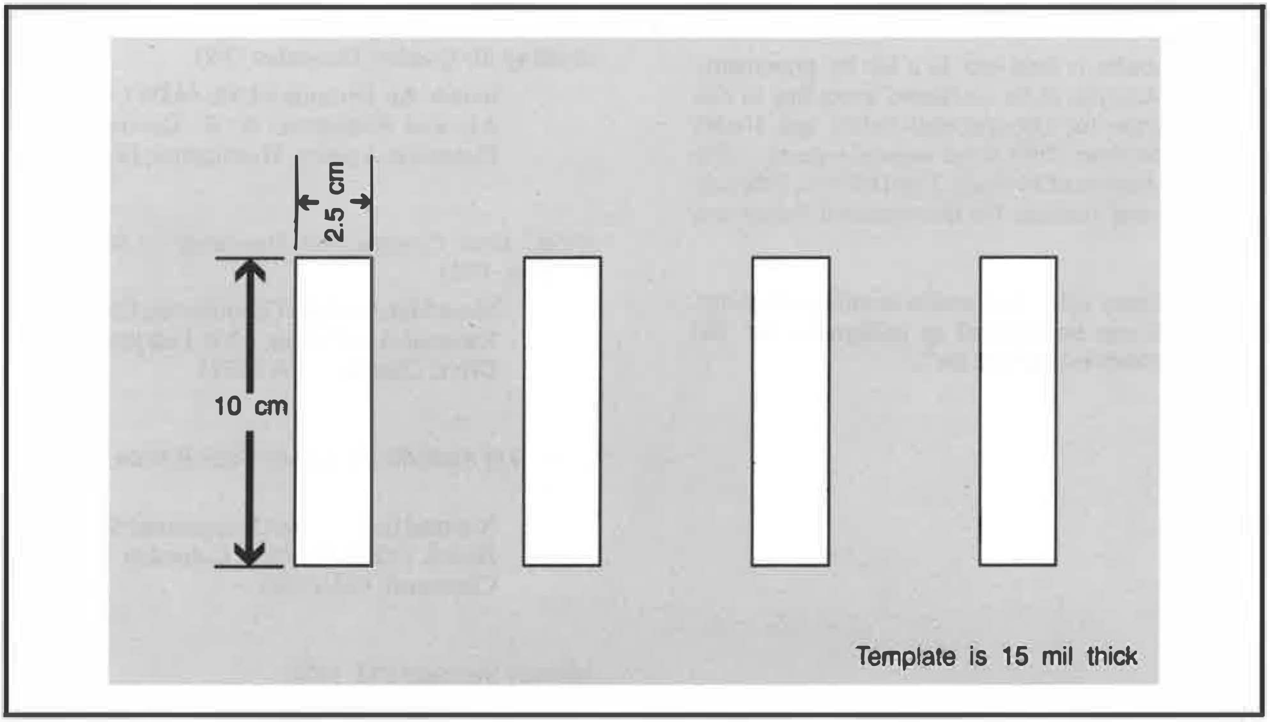

Figure 2

2.4 Adjust air flow using appropriate calibration device to 10.0 liters per minute.

2.5 Once the flow rate is calibrated, remove the clear plastic inlet cover, make sure that the retainer ring (middle section) stays in place.

2.6 Vacuum the open area of the template by sliding the cassette from one end of each template slot to the other. The cassette must be moved at a rate not greater than 5 cm per second. The edges of the cassette must rest on the template. The cassette must not touch the duct surface. Each template slot must be vacuumed twice (once in each direction).

Throughout the vacuum process, hold the cassette so that it touches the template surface, but so that no downward pressure is being applied.

2.7 After the surface has been vacuumed twice, put the clear plastic cover back on the cassette. Then replace the plugs, putting the red plug in the inlet opening and the blue plug in the outlet opening (this is opposite of the original configuration and indicates that the cassette has been used).

2.8 Label the cassette. The cassette can be labeled with a number/letter code. If such a code is used, it helps protect client confidentiality. A notebook should be kept to correlate the code with other important information such as job site, location in Ductwork, date, etc.

2.9 The cassette is then sent to a lab for gravimetric analysis. Analysis to be conducted according to National Institute for Occupational Safety and Health (NIOSH) Method 0500 (total nuisance dust). (See *Manual of Analytical Methods*, Third Edition, February 1984, National Institute for Occupational Safety and Health)

2.10 Laboratory will report results in milligrams (mg). The results can be reported as milligrams per 100 square centimeters (mg/100 cm^2).

TABLE I
Standards & Publications Referenced In NADCA Standard 1992-01

AMCA 99-86, *Standards Handbook*, 1986

Air Movement & Control Association, Inc., 30 W. University Drive, Arlington Heights, IL 60004

ARI 410-91 Forced-Circulation Air-Cooling and Air-Heating Coils, 1991

Air Conditioning and Refrigeration Institute, 1501 Wilson Blvd., 6th Floor, Arlington, VA 22209-2403

ASHRAE 33-78, Methods of Testing Forced Circulation Air-Cooling and Air-Heating Coils, 1978

ASHRAE 62-1989, Ventilation for Acceptable Indoor Air Quality, 1989

ASHRAE Terminology of Heating, Ventilation, Air Conditioning, & Refrigeration, 1991

American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc., 1791 Tullie Circle, NE, Atlanta, GA 30329

Building Air Quality, December 1991

Indoor Air Division (ANR-445W), Office of Air and Radiation, U. S. Environmental Protection Agency, Washington, DC 20460

HVAC Duct Construction Standards — Metal and Flexible, 1985

Sheet Metal and Air Conditioning Contractors National Association, 4201 Lafayette Center Drive, Chantilly, VA 22021

Manual of Analytical Methods, Third Edition, February 1984

National Institute for Occupational Safety and Health (NIOSH), 4676 Columbia Parkway, Cincinnati, OH 45226

Military Standard 282, 1956.

United States Department of Defense (DOD), Washington, DC.

Guideline to NADCA Standard 1992-01

Introduction

This guideline serves as a companion document to NADCA Standard 1992-01, *Mechanical Cleaning of Non-Porous Air Conveyance System Components*, developed by the National Air Duct Cleaners Association. The infonnation contained herein has been compiled for users of the standard to provide additional information about cleaning air conveyance systems (ACS).

"Duct Cleaning" is the tenn commonly applied to the work performed by an ACS cleaner. "Duct cleaning," however is a misnomer, because the term implies that only the ductwork is to be cleaned. Ventilation systems are comprised of a variety of components, some of which can be effectively cleaned by standard cleaning processes and some of which require special attention. In order to obtain the most effective results, it is recommended that all portions of an ACS be cleaned. Therefore, NADCA Standard 1992-01 calls for a total system cleaning.

In some instances, consumers of cleaning services may not desire to have their entire systems cleaned. Or, consumers may not be willing to allow the contractor to make modifications to the system which would be required to gain total access to the system. If a contractual agreement between the customer and the contractor calls for less than a total system cleaning, the verification methods specified in the standard only apply to those portions of the system which were cleaned. Verification of the results of the cleaning of a component or the entire system is primarily visual. It is recommended that the entire system be checked to insure Visual Cleanliness. The NADCA Vacuum Test is a supplement to the visual inspection and should be perfonned in areas of the ACS that are likely to contain the highest level of debris in order to determine the cleanliness of any areas where visual inspection is disputed.

ACS Construction Materials and Cleaning

NADCA Standard 1992-01 was designed to allow building owners or their representatives to obtain verification that duct cleaning services performed at their facilities were performed successfully to a designated, uniform level of cleanliness, as specified within the standard.

The NADCA Standards Committee first determined that the various types of materials used in the construction of air conveyance systems impacted greatly on their attempt to develop a standard. Several factors are involved.

First, there are a variety of cleaning procedures which can be used to effectively clean an ACS. Different procedures may be required for different types of systems. In order to avoid the possibility of excluding any viable cleaning method, NADCA Standard 1992-01 does not specify one cleaning method over another.

Second, the complexity and vast differences in duct construction materials made the selection of verification and/or validation of cleanliness dependant on the potential of any material for moisture absorbency. Thus, the standard development process was broken into two separate and distinct phases, the first of which addresses non-porous ACS components (sheet metal, plastics, etc.) and the second of which will address porous ACS components (fiberglass insulation, ductboard, wood, etc.).

Third, since there are no known industry standards which prescribe the acceptable level of microbials in the indoor environment — let alone within an ACS — the basis for cleanliness used within the standard is visibly clean. We recognize that in some instances where microbial contamination is known to adversely affect the health of building occupants, visual inspection may not be adequate. In such instances caution should be taken to use more stringent standards for cleanliness. NADCA Standard 1992-01, however, may be used as a first step in microbial remediation. Specifically, it may be the first level of cleaning, as the reduction of visual microbial growth generally reduces the amount of sanitizing which may be needed to complete the remediation.

NADCA Standard 1992-01 is designed to allow for the sampling of a given surface of an ACS after cleaning, in order to determine if the amount of remaining debris is acceptable. Within the standard, the term debris is defined as "Any solid materials, including particulate substances, in the ACS not intended to be present." However, the standard **does not** apply to hazardous materials, such as lead, asbestos, or volatile organic compounds (VOCs). The cleaning of systems which are known to contain hazardous materials requires additional safety precautions which fall outside of the scope of standard duct cleaning procedures and NADCA Standard 1992-01.

As with hazardous materials, NADCA Standard 1992-01 does not apply to microbial contamination, which, depending on the type of microbe, may be considered a hazardous material. Cleaning microbial contamination requires different methods, often including the use of sanitizers and biocides, than would be used for systems which do not contain microbial contamination.

The measures of remediation should be performed on a site specific basis.

Testing for Hazardous Materials

Depending upon the usage of a facility and the materials used to construct the facility, air conveyance systems may become contaminated with hazardous materials. In cases where hazardous materials are suspected to be present, testing should be conducted to determine the type of materials present and the proper course of mitigation.

It is the opinion of NADCA that it is the building owner's responsibility to determine if hazardous materials are present in the ACS prior to cleaning. If hazardous materials are known to be present, cleaning specifications should be written accordingly. Testing for the presence of hazardous materials should be performed by a qualified, independent third party.

In the vast majority of cases, testing for hazardous materials prior to the cleaning process is not performed. While such a procedure may be desirable in certain instances, it is not a common practice in the industry, and therefore NADCA Standard 1992-01 does not require the testing of materials found within a system. Likewise, the standard does not address the removal of hazardous waste from the cleaning site. However, the standard does address containment of debris found in an ACS. This is a precautionary measure employed primarily due to the fact that most air conveyance systems are cleaned without first testing the debris contained within.

Determining the Need for ACS Cleaning

The amount of debris which becomes trapped within an air conveyance system over a given period of time is dependent upon several different factors, such as the type of system, the air velocity within the system, the efficiency of the system's filtration, the humidity within the system, the housekeeping practices and preventative maintanence programs in place in the facility, and the types of activities which occur within the facility.

At the present time, there is no consensus of opinion on the recommended frequency of ACS cleaning, nor any government or code requirements for mandatory cleaning. In the future, when more research has been conducted, there may be sufficient data to devise more precise recommendations on ACS cleaning frequency.

It should be noted, however, that systems which service occupants who have special health concerns, such as allergies or asthma, should be cleaned more frequently, as should facilities which provide health care services or which are occupied by large numbers of people, such as schools and foodservice establishments.

Duct Cleaning and Indoor Air Quality (IAQ)

When NADCA determined the need to develop an industry standard, it was agreed that is was not the association's intent to draft an indoor air quality standard. In other words, this particular standard only addresses the mechanical cleaning of an air conveyance system and whether this cleaning can be verified as effective through scientific means, as established by performing the NADCA Vacuum Test.

For years, there was little demand for ACS cleaning services. Recently, however, with the growing awareness of the dangers of indoor air pollution, public concern for the cleanliness of ventilation systems has led to a significant increase in demand for these services. As such concerns grew, it became clear that there was a lack of understanding about what "clean" means in terms of a ventilation system. Since the professionalism and technology of the ACS cleaning industry is not widely understood, NADCA decided to be the leader and give other professionals an industry standard for cleanliness.

Indoor air pollution is a complex, multi-facet problem which no one profession is capable of completely solving. Solving IAQ problems often requires a team of multi-disciplined professionals, such as filtration experts, test and balance specialists, industrial hygienists, and of course professional ACS cleaners.

In most cases, duct cleaning alone will not solve IAQ problems. Dirty ventilation systems are most often an effect, not the cause, of poor indoor air quality. Duct cleaning can, however, greatly reduce the threat of indoor air pollution when performed in conjunction with a program of regular building maintenance and IAQ evaluation. The U.S. Environmental Protection Agency has published a comprehensive guide for building owners and managers which is designed to help reduce the risk of indoor air pollution. The publication, "Building Air Quality," provides guidelines which all owners and managers should use and implement in their facilities.

Verifying Cleanliness

It is the purpose of NADCA Standard 1992-01 to provide a method of verifying the cleanliness of an ACS. The verification process within the standard calls for two separate methods of inspection, Visual Inspection and the NADCA Vacuum Test.

Visual inspection is the primary, and in some cases may be the only, means to verify the cleanliness of a duct system. There are several methods which can be used to visually inspect an ACS. Specialized tools such as boroscopes, ductscopes, mirrors, and robots may be used to visually inspect an ACS. When performing a visual inspection, one should look to see if there are any visible contaminants within the system. NADCA Standard 1992-01 calls for the total removal of all visible contaminants. If visible contaminants are present after cleaning has been performed, the cleanliness level is considered unacceptable per NADCA Standard 1992-01.

The NADCA Vacuum Test serves as an additional, scientific method of determining cleanliness within an ACS. If visual inspection leaves any doubts as to the cleanliness of the system following cleaning, the NADCA Vacuum Test may be performed to conclusively determine the cleanliness level of a specific area.

Duct Leakage

The leakage of air from both residential and commercial systems can greatly contribute to poor system efficiency and poor indoor air quality. Duct leakage testing and repair is a complex field which should only be performed by individuals trained and qualified to perform these services. Improperly performed duct leakage repairs can lead to other more severe problems. In conjunction with ACS cleaning, it is recommended that buildings owners and managers have their systems checked for air leakage. In many cases, substantial cost savings can be realized.

Post Cleaning Practices

After ACS cleaning services have been performed, there are several considerations which building owners and managers should consider.

In addition to receiving verification of the effectiveness of the cleaning job, either through visual inspection and/or the NADCA Vacuum Test, consumers of ACS cleaning services should require that the contractor provide a full report of the services performed. Such a report should detail the areas of the system which were cleaned, the type of cleaning methods and/or cleaning agents which were used, and any components which are believed to be broken or damaged, whether found that way to begin with or as a result of the cleaning process.

In some instances, after a thorough ACS cleaning, the system may need to be balanced. This is due to the fact that air flow within the system will normally increase after cleaning as a result of removing large deposits of debris which may have been restricting air flow. It is recommended that testing and balancing be performed by a qualified and trained independent test and balance agency.

Methods Of ACS Cleaning

NADCA Standard 1992-01 does not specify any particular method of cleaning air conveyance systems. There are many different ways to effectively clean a system, and in order to avoid the possibility of excluding a potentially sound method, the NADCA Standards Committee focused its efforts on developing a means to determine that cleaning services have been performed successfully, rather than specifying certain ways to clean.

NADCA Standard 1992-01 is pertinent only to cleaning methods employing "Source Removal," the mechanical cleaning of system components to remove dirt and debris from air conveyance systems. Source removal methods employ vacuum units, compressed air, brushes, and other tools to loosen dirt and debris and convey it to a containment device for proper disposal.

Source removal requires two key elements to be effective. The first element is a means of agitating the dust and debris within the air conveyance system. Agitation may be achieved with brushes, compressed gases, sponges, and other tools of the trade, and must be sufficient in force to allow the system to ultimately pass the NADCA standard.

The second element is the removal of the materials from an ACS. The removal process can incorporate many different forms, techniques, and equipment. The removal method chosen must be capable of removing the foreign material to the levels specified with NADCA Standard 1992-01, and also must comply with other requirements of the standard, such as using HEPA filtration on all internally exhausted vacuum equipment, and control of particulate emissions within the building envelope.

This type of cleaning is not intended to address any bacterial problems, fungi growth, or other forms of microbial contamination. When cleaning an ACS contaminated with excessive microbiological growth, additional requirements will be necessary to provide for effective remediation. As a result, these treatments are beyond the scope of the guide and will be addressed in a future NADCA technical paper, as will various methods of source removal.

Guideline to Appendix A of NADCA Standard 1992-01

The information contained in this chapter is designed to provide users of NADCA Standard 1992-01 with additional guidance on performing the NADCA Vacuum Test.

Where to Sample

Sampling should be conducted in those areas where greatest potential exists for particulate deposits to remain after cleaning. These areas include but are not limited to:

- Duct terminations
- Elbows
- Turning Vanes
- Condensate Drain Pan
- Discharge Side of Coils
- Control Device Surfaces

Vertical surfaces are less likely to retain particulate matter. Therefore, under most conditions sampling will yield more conclusive results when conducted on horizontal surfaces where particulate matter is likely to settle.

Number of Samples

The number of samples to be taken in any given system will be determined by qualified personnel conducting the evaluation.

Minimum recommendations for residential sampling

- One (1) field blank (no analysis necessary unless other samples fail).
- Two (2) samples per system.

NOTE: Three (3) total sample minimum.

Any additional sampling should be at the discretion of a qualified inspector.

Minimum recommendations for commercial, industrial and institutional sampling

Level 1: 0 - 1,000 total linear feet of ACS.

- One (1) sample per 200' with minimum of two (2) samples.
- One (1) field blank.

Level 2: 1,001 - 5,000 total linear feet of ACS

- One (1) sample per 200 linear feet for the first 1,000 feet of ACS.
- One (1) sample per 300 linear feet after the first 1,000 feet of ACS.
- One (1) field blank per ten (10) samples.

Level 3: 5,001 + total linear feet of ACS

- One (1) sample per 300 linear feet for the first 5,000 feet of ACS.
- One (1) sample per 500 linear feet after the first 5,000 feet of ACS.
- One (1) field blank per ten (10) samples.