NAFA®
National Air Filtration Association

Guidelines

Recommended Practices for

Filtration for Spray Finishing Particulate

About this publication

Why NAFA Guidelines?
The National Air Filtration Association (NAFA) provides "Best Practice Guidelines" to help supplement existing information on the control and cleaning of air through proper filtration. Many organizations recommend "minimum" air cleaning levels. NAFA publishes best practice based on the experience and expertise of our membership along with information and research of the governmental, medical and scientific communities showing the short and long term impact particulate and molecular contaminants have on human health and productivity.

This Guideline provides advice on achieving the cleanest air possible based on the design limits of existing HVAC equipment and with consideration of the impact on energy and the environment. For a more complete explanation of principles and techniques found in this Guideline, go to the website www.nafahq.org and purchase the *NAFA Guide to Air Filtration*, 5th Edition.

Disclaimer
The information contained in this Guideline is intended for reference purposes only. NAFA has used its best efforts to assure the accuracy of information and industry practice. NAFA encourages the user to work with a NAFA Certified Air Filter Specialist (CAFS), to assure that these Guidelines address specific user equipment and facility needs.

Issues regarding health information may be superseded by new developments in the field of industrial hygiene. Users are therefore advised to regard these recommendations as general guidelines and to determine whether new information is available.

NAFA does not guarantee, certify or assure the performance of any products (other than those bearing the NAFA Certified Product label), components, or systems operated in accordance with NAFA Guidelines.

NAFA®

National Air Filtration Association
(NAFA)
22 N. Carroll St, Ste 300
Madison, WI 53703
(608) 310-7542
nafahq.org

Committee Chair

Trey Fly, CAFS, NCT II
Joe W. Fly Co., Inc.

Committee Members

Mike Beier, CAFS
Products Unlimited, Inc.

Steven Brown, CAFS, NCT II
TEX-AIR Filters

Bob Buckley, CAFS
Aero Filter, Inc.

Shelby Calvert, CAFS
Filtration Group, Inc.

Bill Cawley, CAFS
Flanders Corporation

Carol Christensen, CAFS
The Filter Man, Ltd.

Larry Clark, CAFS
Clark Air Systems, Inc.

Kevin Delahunt, CAFS
B.G.E. Service & Supply Ltd.

Harry C. Elinsky, Jr., CAFS
Filtech, Inc.

Rupert Langston, CAFS
Air Flow Technology, Inc.

Paula Levasseur, CAFS
Cameron Great Lakes, Inc.

Stephen W. Nicholas, CAFS, NCT II
Air Industries, Inc.

Domenick Orlando, CAFS
Dave Downing & Associates

Phil Maybee, CAFS
The Filter Man, Ltd.

Bill Palmer
AeroMed, Inc.

Bill Patterson, CAFS
Dave Downing & Associates

Steve Peege, CAFS
Columbus Industries, Inc.

Thomas Riddell, CAFS
Air Filter Sales & Service

Wayne Vickers, CAFS
Columbus Industries, Inc.

Bob Williams, CAFS
Superior Fibers LLC

Chris Zaker, CAFS, NCT
Glasfloss Industries, Inc.

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Photos courtesy of CLARCOR Air Filtration Products

Purpose

This best recommended practice establishes air filtration and spray collection guidelines for the removal of airborne contaminants for the protection of the employees, equipment, and environment in commercial and industrial spray booths.

Scope

To identify air filtration intake and exhaust requirements associated with commercial and industrial spray booth and to provide an air filtration spray booth component selection, and applications guideline. Included in this guideline will be a brief overview of pertinent federal health safety and environmental regulations.

Note: It is the end user's responsibility to meet all Federal, State, and Local Government regulations pertaining to their spray booth and operation.

This guideline does not address water wash-style of spray booths.

This guideline does not address volatile organic compound (VOC) removal. For more information on VOC removal see the *NAFA Guide to Air Filtration*.

Background

Exhaust emissions from commercial and industrial spray booths can present a potential risk to employees, the environment, equipment, and to the general public. Over the years various Federal, State, and Local rules have been put in place to protect the aforementioned. Intake and Exhaust Filtration plays an integral role in reducing the risks of airborne contamination and directly reduces finished surface contamination and lowers rework costs.

The reason for this guideline is:

- Types of chemical finishes have changed
- Spray equipment has changed
- Disposal processes have changed
- Collection processes have changed
- Filtration requirements and expectations have changed
- Federal, State, and Local regulations have changed

A History of Paint Overspray Filtration

A broad summary of the evolution in paint overspray filtration is important to help understand the products used today and the broad range of applications. The advent of the high production assembly lines and the high volume of painted/coated parts caused the creation of the first spray rooms, which eventually evolved into today's spray booths. With large quantities of paint being sprayed, it became apparent that fresh air had to be supplied to insure employee health, which is today required by OSHA through the code of federal regulation 1910.107. Also the overspray particles had to be removed to protect the environment.

There were very few options for filter media available at the time, which led to the use of materials such as cheesecloth, bonded "hogs-hair" and various single stage products that were used to filter out the particles from the airstream. There were no filters available specifically for paint overspray removal. In recent years, as industry and government demand for better overspray arrestance increased, significant improvements in dry overspray filters have been made that have resulted in holding capacity, service life, and arrestance efficiency many times greater than what was available over the last 30 years.

Before the advent of dry filter media, filtration of overspray was performed through the use of water-wash systems. In a water-wash system, exhaust fans pull the overspray through a stream or curtain of water, which captures the particulates. In addition, baffles in front of the water curtain force the overspray to change direction, thus causing most of the overspray to separate out of the airstream due to its mass and inertia and collect on the baffles. Water flushes any additional overspray left in the airstream into a collecting pan. The contaminated wash water is treated with certain chemicals, causing the overspray particles to coagulate and allows for more efficient cleaning. Water-wash systems are most effective in high volume, constant material-flow spray application processes.

The development of many new paint overspray media today combine extremely long service life with high efficiency. This has led to the replacement of most of the water-wash booths. In addition, the spray equipment used today applies much more of the paint to the part, which significantly reduces overspray by increasing transfer efficiency. With this new filter technology and equipment evolution, the use of dry overspray filtration is now the best option for most applications, including high volume production operations.

Today, exhaust filtration is typically accomplished through the use of dry filter media. There are a variety of materials and designs used in spray booth overspray filters.

Determining the correct overspray filter requires balancing filter efficiency, pressure drop and holding capacity. Against this backdrop, the overspray filter must also comply with Federal, State and Local regulations.

Photos courtesy of Columbus Industries (A, D) and The Paint Pockets Company (C)

Spray Booth Design and Related Dry Filtration Products

A spray booth is a power-ventilated structure designed to (1) introduce clean air into the spray booth chamber and (2) limit and trap the escape of overspray from the spray booth chamber. Spray booths may be fully-enclosed, with large doors used to move objects to be sprayed in and out of the spraying chamber. Another option is to have conveyor openings on the side to permit the target item to access the spraying area. Spray booths may also be open-faced, which is typically used for industrial applications, spray preparation and/or minor touch-ups.

Spray booths are typically classified into two general categories based upon the direction of air flow – cross draft or down draft. Cross draft spray booths draw air horizontally over the object to be sprayed. Air enters the spray booth through intake filters in one side wall and exits through exhaust filters in the other side wall. Down draft spray booths draw air, typically through the ceiling, where air is filtered before it enters the spray booth chamber. As air enters the spray booth chamber, it is directed down vertically through final intake filters, often a diffusion filter, and exits through exhaust filters located in the floor or lower sides of the spray booth.

Downdraft Ceiling Diffusion Media

Photo Courtesy of Freudenberg Filtration Technologies, LP

Photo Courtesy of Columbus Industries, Inc.

Many spray booths incorporate an air make up system, which is designed to regulate the amount of air introduced into the spraying chamber with the air exiting the spraying chamber. When incoming air volume slightly exceeds exhaust air volume, positive pressure is created between the spraying chamber and the area surrounding it. This positive pressure lessens the opportunity for unfiltered air to enter the spraying chamber through cracks and openings, further limiting contamination of the finished product.

Some applications require negative pressure, where exhaust air volume exceeds incoming air volume, to prevent the sprayed finish from leaving the booth chamber through unfiltered openings. This is typically required where potential hazards to the spray operator and surrounding environment exist from toxic components of the finish.

While air flow direction may help classify a spray booth, other configurations can vary significantly. For example, a spray booth may be a single "box" into which an object is placed for spraying and then removed; or, a spray booth may be incorporated into a manufacturing conveyor system. Spray application may be manual or conducted through the use of automated machinery. Regardless of air flow direction or physical configuration, the objective is the same, to properly filter incoming air and eliminate contaminates in exiting air.

Intake filters effectively reduce dirt particles from entering the spraying chamber, and thus, reduce surface finish imperfections. Intake filters are typically designed in either ring, linked panel, blanket media or extended surface filters. Panel intake filters are constructed of non-woven media, sealed around the perimeter edge of an internal wire frame, which when inserted into a holding frame creates a friction fit. Blanket intake filters are also constructed of non-woven media, but without an internal wire frame and are held into place by brackets in the spray booth. Intake filters for a down draft booth include diffusion filters which, in addition to removing dirt particles, also spread, or distribute, air flow evenly throughout the entire spraying chamber. Diffusion filters are usually complemented by less expensive upstream filters, which pre-filter the air before it reaches the diffusion filter. By limiting the amount of large contaminants reaching the diffusion media, these pre-filters extend the life of the diffusion filters.

Filters located downstream of the target item are designed to capture spray particles before they exit the spray chamber. These filters, also called exhaust or overspray filters, perform a variety of functions. Spray operations use overspray filters to capture excess spray particulates - also called overspray - that does not adhere to the item being sprayed. As the exhaust fan draws air through the spray chamber, the overspray is captured by the airstream and drawn through the exhaust filter. Without proper filtration, overspray could escape into, and potentially contaminate, the spraying chamber and the surrounding external environment. Exhaust filters also prevent overspray from entering into the spray booth's mechanical system, reducing stress on equipment, thereby lowering repair and maintenance costs.

Multi-stage Overspray Filtration and Abatement System

The purpose of dry overspray collectors is to remove the paint particulate matter from the air stream prior to exhaust to the environment and is not to remove the solvents or VOC's from the exhaust air stream even though a small portion may become temporarily entrapped in the paint particles. There are abatement systems in operation that act as a final stage of exhaust air stream treatment that are designed to either trap or incinerate the VOCs. These systems require much higher particulate removal efficiency than a normal non-abated spray booth. These abatement systems also allow for the partial recirculation of exhausted air provided certain employee safety requirements are met.

The particulate filtration in an abated booth will likely consist of three to four stages that become more efficient in each downstream stage. Each filtration stage should be more efficient than the prior stage in order to create the optimum and most cost effective operation possible. The first stage in the booths exhaust airstream will collect the majority of overspray particles and must have a long service life as well as being efficient enough to prolong the service life of the more efficient, and likely more expensive, downstream filters. The final stage efficiency requirement in such a system may be as high as 95% ASHRAE or MERV 15 in order to maintain the efficient operation of the abatement system. The suggested efficiency requirement provided by the engineering firm/manufacturer that supplied the abatement system should be always be followed. With the known efficiency requirement, a trained air filter specialist can guide in choosing the best effective and least costly filter configuration that will meet these performance needs.

Why Booth Maintenance is Important

Proper booth maintenance is critical to the success of a spraying operation. It directly impacts the quality of part finishing, as well as the health and safety of plant workers and the environment. Improperly maintained spray booths may increase the risk for fires in the booth and may result in non-compliance of emission standards.

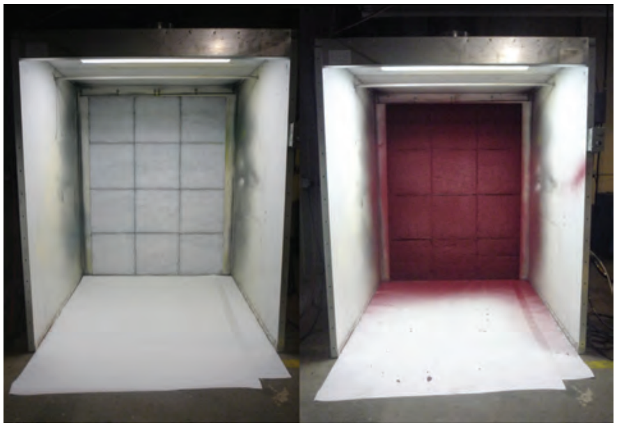


Photo Courtesy of Columbus Industries, Inc.

Booth paper can capture larger particles that fall from the airstream onto the floor and get sprayed onto walls.

In addition, various regulatory and technical organizations require or recommend a booth maintenance program. NFPA-33, 2007 Ed., Chapter 10, Operations and Maintenance, Section 10.4 reads: *"Maintenance procedures shall be established to ensure that overspray collector filters are replaced before excessive restriction to airflow occurs. Overspray collectors shall be inspected after each period of use and clogged filters shall be discarded and CFR Part 1910.107 (b)(5)(i) state that "spraying operations shall be so designed , installed and maintained that the average air velocity over the open face of the booth (or booth cross section during spraying operations) shall be not less than 100 linear feet per minute…"*

In addition, air velocity in electrostatic applications may not fall below 60 lineal feet per minute (FPM). Most State OSHA regulations require similar or more stringent airflows.

Dry Overspray Collectors

Filter Performance

Various "baffle" and "strainer" type media are used to capture overspray particles in spray booths. Baffle type media redirect the airflow within the media. Inertia brings the heavier-than-air overspray particles into contact with the filter surface, removing it from the exhaust airstream. The strainer type media is primarily effective by forming a screen where the particles larger than the openings in the screen are captured and a portion of the finer particles pass through.

Overspray from spraying operations will remain tacky to some extent while traveling the typical distance from the spray gun to the filter bank. This tackiness is not consistent and depends on the type of coating being sprayed and several other factors. A bake-dry paint, for example, remains very tacky until heat is applied to cure the coating. A spray adhesive may be sticky or stringy for an extended period of time after spraying. Whereas, varnishes or air dry coatings may have much drier overspray particles that hit the filter. Other coatings such as two-component, ultra-violet cured, clear automotive finishes, and many others will have different particle characteristics when coming into contact with the filters in the airstream. The particulate arrestance and service life of any filter media in a field application is dependent on the actual finish applied, amount of overspray, and air velocity in the booth.

The Code of Federal Regulations – 40 CFR Part 63, Subpart HHHHHH provides a minimum weight arrestance efficiency standard for overspray filtration of 98 percent for coating operations that are Area Sources. This weight arrestance efficiency standard is known as Generally Available Control Technology (GACT). The testing protocol to determine a filter's GACT efficiency ensures a minimum level of performance is obtained by the various filter types used in overspray collection. However, this test procedure is not indicative of a filter's actual performance in a field application or with a different coating. (For more information on the testing procedures, please see the section on Overspray Filter Testing Overview, page 16.)

Other variables that impact the actual performance of overspray filter media in the field are as follows:

- Spray gun pressures
- Application rate of the coating per minute
- Distance between the spray gun and the filter media
- Tackiness of the overspray particles when reaching the filter
- Velocity or airflow rate
- Spray gun type and orifice opening
- Paint transfer efficiency (the percent of coating actually getting on the part)
- Coating type and viscosity
- Shape and size of the part being sprayed
- Booth balance and design

Which Filter to Use

It is important to understand that, in order to meet operating parameters established by the spray booth operator, proper efficiency and longevity of the overspray filters must be identified. Spray booth operators often decide which overspray filter to use based solely on the cost of the filter itself without considering how they will affect booth performance or other operating costs. As a general rule of thumb, the price of an overspray filter depends on how efficient it is over its useful life. Typically, less efficient overspray filters last longer than higher efficient filters, but allow greater amounts of overspray through. This, in turn, resulting in higher spray booth operating costs because of more frequent maintenance, cleanings, and repairs to remove excess particulates that failed to be captured by the overspray filter, having been deposited on the surface of the spray booth equipment as it transits through the system.

Any overspray particulates that make it through the entire system without either being captured by the filters or depositing on the interior of the ductwork will be ejected into the environment, often coating unintended targets. Adequate airflow and filter life are key to proper ventilation and operation of the spray booth.

Preferably, the best way to determine which overspray filter works best in a given situation is to perform field tests in the actual spray booth. Sometimes it is difficult to conduct accurate testing in large spray booths. In such cases, a reasonable alternative would be to conduct a laboratory test which duplicates as many of the field variables as possible. The results of a laboratory test should provide results that predict field performance.

Exhaust ducting from paint booth where filter efficiency was not high enough to capture and remove entrained particles

Photos Courtesy of Columbus Industries, Inc.

Types of Overspray Filter Media

Expanded Kraft™

Photo Courtesy of Columbus Industries, Inc.

Multiple layers of Kraft™ paper that have been slit and expanded, typically constructed in a staggered arrangement to enhance overspray collection.

Synthetic Media

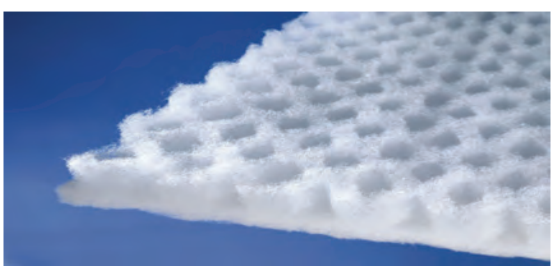


Photo Courtesy of The Paint Pockets Company

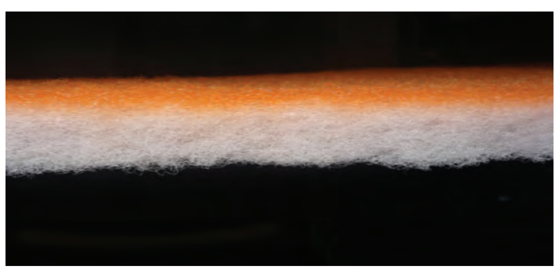
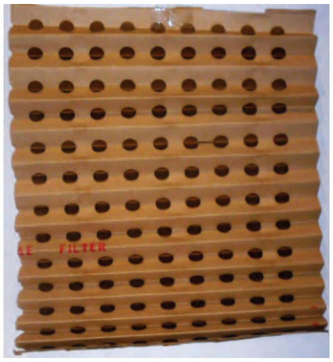


Photo Courtesy of Columbus Industries, Inc.

Synthetic bonded fiber, typically made from polyester, manipulated through the use of graduated density, different size fibers, fiber orientation, tackifiers, as well as structural modifications, such as pockets and channels, to increase surface area and lower the initial air pressure drop of the clean filter.

Pleated and Corrugated Kraft™



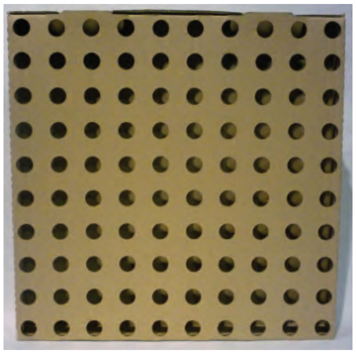


Photo Courtesy of Columbus Industries, Inc.

Paper and Styrofoam™: Kraft™ paper, cardboard, and Styrofoam™ media with holes, constructed of multiple layers in a staggered arrangement. The filter design causes the air to change direction impinging overspray particles onto the solid surfaces of the media.

Fiberglass

Photo Courtesy of Columbus Industries, Inc.

Spun glass material, usually of graduated density, frequently incorporating a "skin" backing to capture finer overspray particles.

Combination

Air Entering Side

Photos Courtesy of Columbus Industries, Inc.

This filter combines two or more filter media types.

Maintenance of Acceptable Booth Airflow

Per OSHA requirements, a means must be established for maintaining booth airflow so it remains at or above minimum acceptable levels, typically, 100 FPM average across the face of the booth (60FPM for electrostatic operations). However, it is the operator's responsibility to ensure that airborne concentrations of chemicals do not exceed the maximum levels allowed by OSHA 1910.107 and State and Local regulations, and that these concentrations never exceed 25% of their lower explosion limits (LEL). One method for measuring booth airflow velocity is with direct-read velometer or thermal anemometer. However, many velocity-sensing instruments are delicate and not well-suited to daily use in a spray environment since they are susceptible to fouling by airborne overspray particulate.

An alternative method for maintenance of booth airflows at or above the minimum acceptable levels is to utilize the relationship that exists between booth airflow and pressure drop across the exhaust filters.

How to Relate Filter Pressure Drop to Booth Airflow

Pressure-sensing instrumentation such as manometers and Magnehelic® gauges are commonly employed for this purpose. These instruments are discussed in more detail in the NAFA Installation, Operation, and Maintenance of Air Filtration Systems Manual, Chapter 2, page 7. Gauges are to be installed using the manufacturer's installation instructions.

A full set of clean overspray filters should be installed and the fan should be started. The differential pressure of the clean filters should be recorded and posted near the pressure gauge. Filter loading is then simulated by placing sheets of paper in a uniform pattern over the air entering side of the exhaust filters. The average velocity is determined through the use of a velometer/anemometer and the restriction of the airflow using paper sheets until the average airflow velocity drops close to the OSHA minimum (see http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9734). Average velocity is typically determined by averaging one reading approximately every eight square feet of filter surface area. Another option for extremely large booths is to safely take airflow readings over time as the filter loads to ensure the minimum average velocity is above the OSHA requirement. The differential pressure is recorded and posted near the gauge. This pressure becomes the filter change out point.

Multiple stages of filtration require the monitoring of pressure between each stage. Overspray-laden filters should be replaced when the OSHA minimum velocity can no longer be maintained. End users may choose to install clean filters before the minimum airflow is reached based upon other priorities such as shift changes, etc.

Pressure drop instrumentation and all other penetrations through the booth wall, such as taps and connective tubing and hoses, must be kept in good working condition as part of a booth maintenance program. Tubing, hoses and small tap orifices, in particular, are subject to clogging and obstruction due to their small diameter and exposure to paint overspray.

Measuring points for velocity measurements

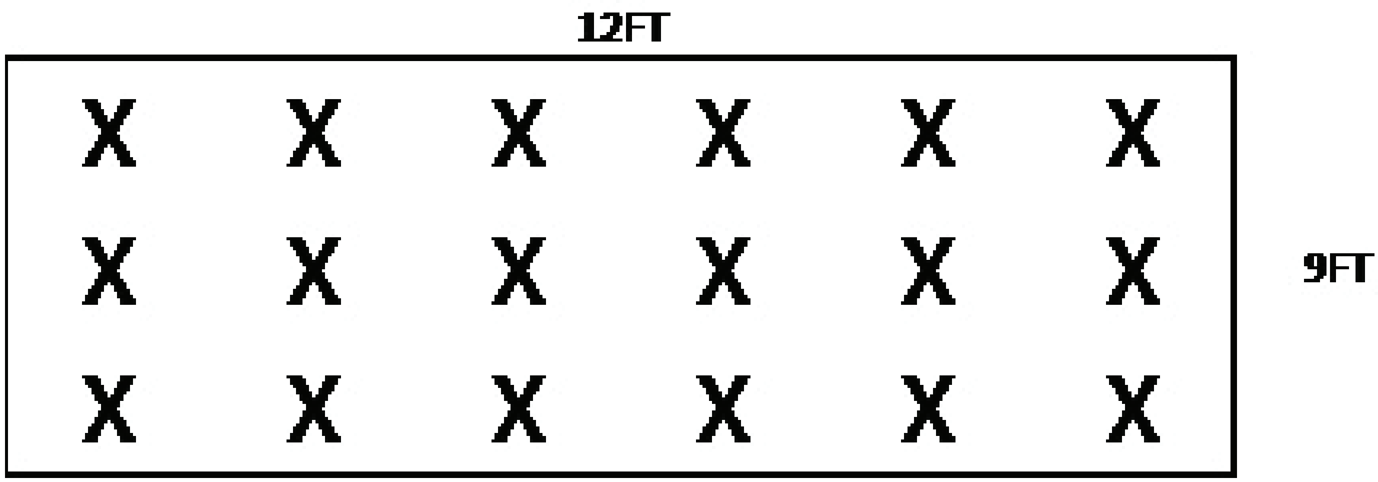


Photo Courtesy of Columbus Industries, Inc.

Filter Installation

Proper filter installation is one of the most critical elements of a booth maintenance program. Because airflow will always follow the path of least resistance, the finest overspray filter in the world will fail to work if the particulate-laden airstream is not forced through the filters. Air bypass in industrial finishing systems is unique in that it may result in significant additional costs to the operation due to contamination of painted parts outside of the spray booth and subsequent rework/scrap costs, as well as worker safety, facility cleanliness, and environmental concerns. In addition, excess spray that has bypassed the overspray filters, or was inadequately filtered, may accumulate in the exhaust stacks, on fan blades, on the roof of the facility, or on personal property such as parked cars outside of the facility.

Overspray filters should always be installed such that there are no air gaps between the individual filter or along the edges of the filter bank. It is imperative that spray booth owners and operators ensure overspray filters remain properly in place throughout the booth operation. For filtration media that is not sufficiently rigid, securely fasten filters in place with mechanical fasteners as recommended by the overspray filter manufacturer.

Disposal

Individuals, companies or institutions that generate waste overspray filters must determine if the waste is hazardous or non-hazardous and the proper handling for disposal.

According to the Resource Conservation and Recovery Act (RCRA), the EPA considers discarded overspray filters as hazardous waste only if they meet one of the characteristics of a hazardous waste; corrosivity, ignitability, reactivity, or toxicity. Based on the chemistries of paints, resins and solvents, it is unlikely that discarded overspray filters would be corrosive or reactive.

Since the definition of a solid ignitable waste (40CFR261.21) includes "is capable under standard temperature and pressure, of causing fire through friction, absorption of moisture or the spontaneous chemical changes and when ignited, burns so vigorously and persistently that it creates a hazard", discarded overspray filters could meet this definition. However, due to the vagueness of this statement, additional data and/or lab testing may be performed in order to determine if the waste is "ignitable".

Since coating and finishes may contain metals and solvents, a toxicity characteristics leaching procedure (TCLP) may need to be performed in order to determine if the waste is "toxic". Review of the Material Safety Data Sheet (MSDS) and/or technical data sheets for the coatings and solvents being sprayed would begin to show the classification of any waste. Even if the discarded overspray filters do not meet EPA hazardous waste characteristics, there may be more stringent state or local requirements and the landfill may have its own acceptability limitations.

The bottom line is the end-user (waste generator) is responsible for characterizing the waste based upon knowledge of process, process chemicals and analysis and document the results.

Once the determination has been made as to the class of waste, arrangements can be made for handling the waste stream. When removing filters from the spray booth the filter material may have wet, dry or a combination of overspray material. Personal protection equipment (PPE) should be worn at all times when handling used filters. The minimum required personnel protection equipment includes: full face respirator with eye protection; protective coveralls; rubber or latex gloves.

Unless known otherwise, operators should treat all overspray filters as if it is hazardous.

It is strongly suggested that once removed, the overspray filters should be put in single layer configuration on drying racks in a safe location. Rolled-up or folded filters have been known to spontaneously combust. If the filters are completely dry before removal, organic particles and ignitability should be of no concern. Removing filters and drying them may be considered treatment subject to the hazardous waste facility licensing requirements of NR664, NR670, and 40 CFR.

Records should be kept of the amounts and time of removal of overspray filters. This is mandatory if the waste is classified hazardous or, in the case of non-hazardous waste, it will help with the process of ordering new filters.
The technician who services the spray booth must be aware that at any time in the storage of used overspray filters they may ignite from chemical action. All storage, including the location of the final waste receptacle, must be located to minimize the risk of spreading a fire to adjacent structures.

This document is not meant to be a step by step instruction for disposal of used overspray filters, but a general outline of some of the steps of filter disposal. Final determination of the disposal of dirty filters should be in written form from the generator of the waste stream after consulting with Federal, State, Local and insurance company authorities.

Overspray Filter Testing Overview

The Code of Federal Regulations – 40 CFR Part 63 Subpart HHHHHH provides a minimum arrestance efficiency standard of 98% for overspray filters. According to the regulation, the method for establishing a filter's overspray efficiency is as follows: *"The procedure used to demonstrate filter efficiency must be consistent with the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Method 52.1, 'Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter, June 4, 1992' … The test coating for measuring filter efficiency shall be a high solids bake enamel delivered at a rate of at least 135 grams per minute from a conventional (non-HVLP) air-atomized spray gun operating at 40 pounds per square inch (psi) air pressure; the air flow rate across the filter shall be 150 feet per minute."*[1]

40 CFR Part 63 Subpart HHHHHH modified 52.1 efficiency test differs from the standard ASHRAE 52.1 efficiency test in that the challenge substance required by the regulation uses high solids baked enamel paint instead of ASHRAE synthetic dust. Efficiency is determined by comparing the weight of paint captured by the test filter inside the test apparatus against the weight of the paint that is captured by a high efficiency secondary filter downstream of the test filter.

$$({}^{W}\text{dirty target filter} - {}^{W}\text{clean target filter}) \quad {}^{W}\text{paint challenge} = \%\ \text{Filter efficiency}$$

The regulation does not require operators and owners to perform this measurement. Instead, operators and owners may rely on filter efficiency data provided by their filter vendor.

Method 319 – Aerospace Industry

The EPA has enacted stringent paint booth exhaust emission standards for coating operations in the aerospace industry. These regulations, known as National Emission Standard or Hazardous Air Pollutants (NESHAP), are the first to specify Method 319 for the capture of paint overspray that contains chromates. Method 319 includes the evaluation of paint overspray filter efficiencies. To determine efficiency, the filter is tested in a duct similar in design to the one designated for ANSI/ASHRAE 52.2 Standard with the exception of the aerosol generating section. Method 319 utilizes both a dry particulate challenge (potassium chloride) and a wet particulate challenge (oleic acid). The potassium chloride challenge is to simulate dry overspray and the oleic acid is to mimic wet overspray.

The Standards establish minimum efficiency depending upon the date the spray booth was initially put into service. For "existing" booths, put into service before September 01, 1995, an overspray filter system that meets or exceeds the efficiency standard established by the EPA using a two-stage filter set-up is required. Spray booths built after that date, described as "new" booths, must use an overspray filtering system the meets or exceeds efficiency standards established by the EPA using a three-stage system. It is a common misconception that Method 319 requires two-stage systems to use two filters and three-stage system must use three. However, according to 40 CFR Part 63 subpart II item G, "these new filtration requirements reflect a performance based standard rather than specified equipment, thus allowing more flexibility for affected sources to comply with the NESHAP". In other words, any number of filters may be incorporated into an overspray system as long as the filter system performs in accordance with the efficiency standards of the regulation. Further, it should also be noted that since the EPA is required to apply technologies developed in one industry sector to other industry sectors with similar HAP emissions, the EPA website should always be referenced for spray booth overspray requirements.

More information about Method 319 can be found in the *NAFA Guide to Air Filtration*, available on the NAFA website www.nafahq.org.

[1] Environmental Protection Agency, National Emission Standards for Hazardous Air Pollutants: Paint Stripping and Miscellaneous Surface Coating Operations at Area Sources; Final Rule. (40 CFR Part 63, §63.11173), (http://www.epa.gov/ttn/atw/area/fr09ja08.pdf), March 24, 2011, pg. 1761.

Conclusion

Proper maintenance of a spray booth is critical to operating the equipment successfully over the long term. One of the most important decisions a spray booth operator must make is which type of filtration system is best for them. An analysis should be conducted by the booth operator to assist them in determining the operating philosophy they wish to use in managing the booth. Trade-offs between cost and efficiency are normal considerations when determining the appropriate filter system.

Deciding which filter system to use can be a confusing process. A clear understanding of current filter technology is critical to making the correct filter system decision. A NAFA Certified Technician possesses the knowledge to assist the booth operator in making the proper filter system decision. Further questions or comments regarding this Guidelines or booth filtration maintenance may be directed to the National Air Filtration Association (NAFA) headquartered in Virginia Beach, Virginia, at www.nafahq.org or by direct contact at 757-313-7400.

Glossary

Air Filter/Air Cleaning: A device used for the removal of particulate or gaseous impurities from the air.

ANSI: American National Standards Institute – As the voice of the U.S. standards and conformity assessment system, ANSI empowers its members and constituents to strengthen the U.S. marketplace position in the global economy while helping to assure the safety and health of consumers and the protection of the environment.

ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers. ASHRAE is an international organization that sets standards and guidelines for the heating, ventilating, air conditioning, and refrigeration industry.

EPA: Environmental Protection Agency. This is the Federal agency that is responsible for setting standards for waterborne and airborne sources of pollution in the United States.

FPM: Feet per minute describes velocity of air. FPM is always positive and always measured in one direction

MERV: Minimum Efficiency Reporting Value refers to the lowest efficiency of a filter when tested in accordance with ANSI/ASHRAE Standard 52.2 2012.

NAFA®: registered acronym for the National Air Filtration Association, the trade association for air filter manufacturers and distributors.

OSHA: Occupational Safety and Health Administration, the group that is charged with enforcement of health and safety legislation.

Overspray: Coating that does not contact the object being spray-coated and remains airborne as a particulate discharge.

Pressure Drop: Describes the drop in static pressure of the air from the upstream side of a filter to the downstream side.

Velocity: The distance traveled in a given time. Air velocity is measured in feet per minute (fpm) or meters per second (m/s).

Volatile Organic Compound (VOC): An organic compound which evaporates at room temperature.

Bibliography

Environmental Protection Agency, National Emission Standards for Hazardous Air Pollutants: Paint Stripping and Miscellaneous Surface Coating Operations at Area Sources; Final Rule. (40 CFR Part 63, §63.11173), (http://www.epa.gov/ttn/atw/area/fr09ja08.pdf), March 24, 2011, pg. 1761.

The source for expertise, education and standards in air filtration.

National Air Filtration Association
22 N. Carroll St, Ste 300, Madison, WI 53703
(608) 310-7542
nafahq.org