NAFA Position Statement on Bio-terrorism

Using ASHRAE Standard 52.2 in Preparedness for Bio-terrorism

The National Air Filtration Association (NAFA) recognizes the increased concern about dangerous airborne diseases and further understands that as an association of air filtration professionals, it has an obligation to present a position statement with respect to educating the consumer about the protection of the indoor environment.

Though contaminants, both biological and inert, have been present for many years in the air conveyance systems of buildings, the events of September 11, 2001 and after have made potential contamination with biological agents such as anthrax a source of much greater concern.

The first step in protecting your facility is educating yourself regarding possible contaminants. Once particle size and the potential for distribution are understood, you can develop preparedness plans. Each facility must establish areas and levels of risk.

The American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) has developed building design and heating, ventilating, and air conditioning (HVAC) system standards for human comfort. ANSI/ASHRAE Standard 52.2-1999, the new method for testing air filters, identifies filter performance based upon particle size. The data from this test makes it possible to choose a filter that will be effective on a specific size particle. How can this information be used to fight bio-terrorism?

The starting point is to understand the viable particle size of spores, bacteria and viruses and how they might enter an air conveyance system. Also, one must understand how diseases are transmitted and developed in humans.

Spores

Many organisms, from bacterial colonies to redwood forests, grow from spores. Most spores begin in the 0.5 to 2 micron size range. Typically spores are not round balls with smooth surfaces; more common are fuzzy seeds with a length greater then their diameter. The structure of spores makes them likely to agglomerate or join together into larger particles.

Bacteria

These organisms vary in size from sub-micron diameter to 10 microns in length. In particular, the anthrax bacterium is approximately 1 micron in diameter and up to 8 microns in length. Bacteria, like other living organisms, require food and water to sustain life.

Viruses

Virus particle sizes range from .05 to less than .005 microns. Particles that small act more like a gas than a solid, bouncing off other molecules in the air stream. Viruses are rarely found as single particles, instead normally existing attached to one another in clumps, or attached to other particles. These agglomerations are often large enough to be removed by filtration.

Disease Transmission

Anthrax is a unique organism, because the disease can develop from contact with spores through inhalation, skin abrasion, or ingestion. Other known spores from molds, such as stachybotrys or aspergillus, produce toxins in ideal conditions. Once imbedded in an area with nutrients, these spores

grow into bacteria, and disease results when the body's defense mechanisms react to toxins produced by the bacteria. Thus, direct contact with spores is the primary danger in disease transmission, while direct contact with growing mold or bacteria is less likely.

Viruses are transmitted from host to host, such as from person to person. Remaining even a few feet away from infected individuals dramatically reduces the chances of infection.

Recommendations

Looking at the total system of air conveyance in buildings is of vital importance. Identifying the areas most vulnerable to contamination and addressing them first will reduce the possibility of danger. Implementing administrative procedures and practices should always be the first steps for any facility.

Filtration

Most buildings utilize filter systems that only provide protection for the HVAC mechanical equipment. This level of filtration does not even address particles in the size range of spores. Some proactive organizations have taken steps to improve indoor air quality through filter system upgrades.

While high-efficiency particulate air (HEPA) filtration, which has a minimum particle removal efficiency of 99.97% on 0.3 micron particles, would be ideal to have in all areas, it is not practical. Most HVAC systems do not have the fan capacity or the framing systems necessary to support HEPA filters.

ASHRAE Standard 52.2 test reports are an excellent tool for selecting filters to remove specific contaminants, once the contaminants' size is known.

The following information from ASHRAE Standard 52.2, shows the composite average particle size efficiency (%) by size range, of the three size ranges, for the standard's Minimum Efficiency Reporting Value (MERV):

Standard 52.2 Minimum Efficiency Reporting Value (MERV)	Composite Average Particle Size Efficiency, % in Size Range,um		
	Range 1 0.30 - 1.0	Range 2 1.0 - 3.0	Range 3 3.0 - 10.0
1	n/a	n/a	E3 < 20
2	n/a	n/a	E3 < 20
3	n/a	n/a	E3 < 20
4	n/a	n/a	E3 < 20
5	n/a	n/a	20 ≤ E3 < 35
6	n/a	n/a	35 ≤ E3 < 50
7	n/a	n/a	50 ≤ E3 < 70
8	n/a	n/a	70 ≤ E3
9	n/a	E2 < 50	85 ≤ E3
10	n/a	50 ≤ E2 < 65	85 ≤ E3
11	n/a	65 ≤ E2 < 80	85 ≤ E3
12	n/a	80 ≤ E2	90 ≤ E3
13	E1 < 75	90 ≤ E2	90 ≤ E3
14	75 ≤ E1 < 85	90 ≤ E2	90 ≤ E3
15	85 ≤ E1 < 95	90 ≤ E2	90 ≤ E3
16	95 ≤ E1	95 ≤ E2	95 ≤ E3

Minimum Efficiency Reporting Value (MERV) Parameters

In addition to using the MERV number as a general guideline, exact data can be taken from test reports of a filter that has been tested to ASHRAE Standard 52.2. This will assist in choosing the proper filter for a specific application.

Outside Air
The best protection for any building is to maintain positive pressure to the outside environment. To achieve this, the outside air intake should always exceed the exhaust from the building to minimize infiltration of contaminants into the building. In the case of a known outside event, exhaust fans can be shut off to help pressurize the building.

Outside air should pass through a filter that has as high a MERV value as possible within the HVAC system's design capability. The filters must be on the suction side of the air handler to prevent leakage into mechanical room spaces, and ultimately the building environment.

Gas Phase Filtration
Gas phase filtration should be considered where there is the risk of a chemical disaster. If gas phase filtration is installed, consideration must be given to "single pass removal" efficiency, as the air only passes once through outside air systems. Ideally, gas phase filtration should be selected based on the specific gaseous contaminant to be removed. However, in the case of terrorism it is not possible to know in advance what chemical will be used, therefore, a good standard grade virgin coconut shell activated carbon or a blend of gas phase media is advisable.

Return Air
Improving filtration efficiency of return air in HVAC systems will reduce concentrations of all particulate including bio-organisms. Recirculation of the air will remove particulate on each pass through the filter system. Filters shall be installed in accordance with guidelines set forth in the *NAFA Installation, Operations and Maintenance Manual*. A minimum MERV filtration level of 11 is recommended, and higher filtration levels may be used for specific applications.

System Inspection
In all air conveyance systems, all possible bypass~~es~~ around the filters should be sealed. This includes gasketing of filters as well as gaps in framing systems. Air travels the path of least resistance, which is often between and around improperly installed filters.

Mail Rooms
Current events have shown that one of the biggest threats to a building comes from mail, making it important to evaluate the mailroom in regard to its pressure relationship to the rest of the building. If mail has entered the facility contaminated, it is advisable to contain it within the space using a negative pressure relationship between the mailroom and adjoining areas. Stand alone filtered air cleaning devices can create this environment economically while cleaning potentially harmful organisms from the air environment.

Conclusions

Facility investment in filtration upgrades should be carried out with the idea of long-term improvement in indoor air quality. Improving the filtration efficiency will aid in the overall reduction of microbial organisms as well as particulate in the air conveyance system, and ASHRAE Standard 52.2 provides a precise tool to measure the level of improvement.

Contact your local NAFA member company, and ask for a NAFA Certified Air Filtration Specialists (CAFS) to survey your systems and assist in selecting the proper filters for your needs and applications.