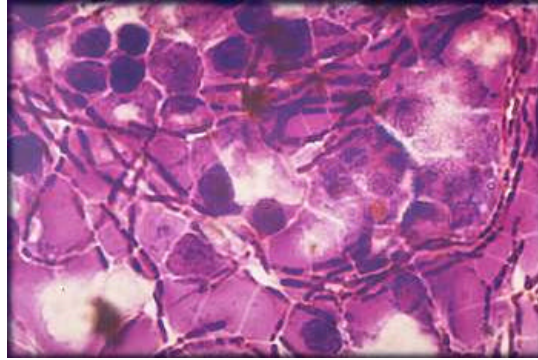

Anthrax



Definitions, Questions, Answers & Precautions



**Clean Air Solutions
Air Filter Systems & Equipment**

Anthrax

Anthrax is an acute infectious disease caused by the spore-forming bacterium *Bacillus anthracis*. Anthrax most commonly occurs in wild and domestic animals including cattle, sheep, goats, camels, antelopes, and other herbivores, but it can also occur in humans when they are exposed to infected animals or tissue from infected animals.

Anthrax is most common in agricultural regions. These include South and Central America, Southern and Eastern Europe, Asia, Africa, the Caribbean, and the Middle East. When anthrax affects humans, it is usually due to an occupational exposure to infected animals or their products. It is rare to find infected animals in the United States.

As a biological weapon, anthrax may be inhaled by humans. It is also very cheap to produce, costing about \$50 per kilogram. One test tube of feed stock (samples of anthrax) can produce a kilogram of anthrax in about 96 hours in a fermenter. Samples are relatively easy to find because it is a naturally occurring disease throughout the world. Anthrax is easy to deliver in the form of a weapon (crop dusting, air distribution systems, and enclosed spaces). Since HVAC air distribution systems may be a path of contamination access to these areas should be secure.

Symptoms of disease vary depending on how the disease was contracted, but symptoms usually occur within 7 days. Once exposure to anthrax has been identified, timely medical treatment of the exposed individuals is recommended as the bacteria can be fatal.

There are three ways in which humans can be infected by Anthrax spores:

Cutaneous (or through the skin): Most (about 95%) anthrax infections occur when the bacterium enters a cut or abrasion on the skin, such as when handling contaminated wool, hides, leather or hair products (especially goat hair) of infected animals. Skin infection begins as a raised itchy bump that resembles an insect bite but within 1-2 days develops into a vesicle and then a painless ulcer, usually 1-3 cm in diameter, with a characteristic black necrotic (dying) area in the center. Lymph glands in the adjacent area may swell. About 20% of untreated cases of cutaneous anthrax will result in death. Deaths are rare with appropriate antimicrobial therapy.



Inhalation (or through the respiratory system): Initial symptoms may resemble the common cold. After several days, the symptoms may progress to severe breathing problems and shock. Inhalation anthrax can be fatal if treatment lags infection.

Intestinal (or through eating contaminated products): The intestinal disease form of anthrax may follow the consumption of contaminated meat and is characterized by an acute inflammation of the intestinal tract. Initial signs of nausea, loss of appetite, vomiting, fever are followed by abdominal pain, vomiting of blood, and severe diarrhea. Intestinal anthrax may result in death in 25% to 60% of cases.

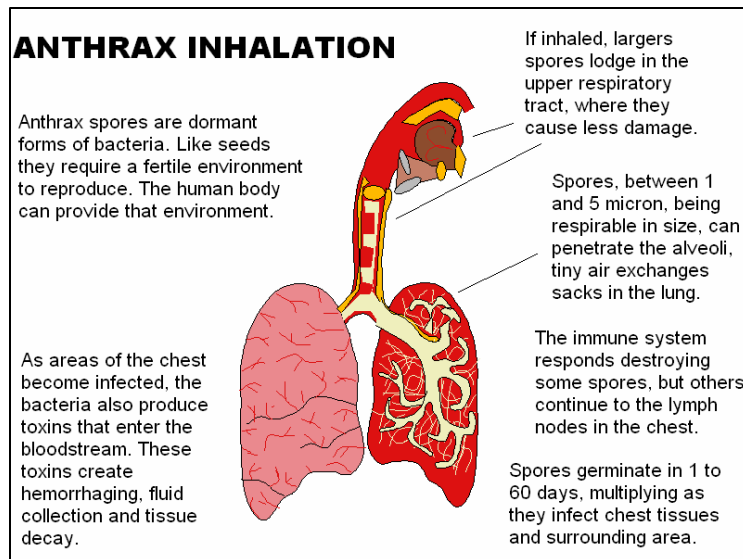
Direct person-to-person spread of anthrax is extremely unlikely to occur. Communicability is not a concern in managing or visiting with patients with anthrax. There is no evidence of person-to-person transmission of anthrax so quarantine of affected individuals is therefore not recommended. Anthrax

spores may survive in the soil, water and on surfaces for many years. Spores can only be destroyed by steam sterilization or by burning. Disinfection of contaminated articles may be accomplished using a 0.05% hypochlorite solution (1 tablespoon of bleach per gallon of water). Spore destruction requires steam sterilization." It has also been reported that boiling (100 degrees C) for 30 minutes kills the offending spores.

Given the current state of world affairs, anthrax bio-terrorism may include spores disseminated by the aerosol route, causing inhalation anthrax. Because atmospheric stability is important to its efficient spread, and because sunlight is highly toxic to biological agents, the most likely time of release will be at night. Particles from 1 to 5 microns in size (respirable size particles) are most efficient in causing infection. The considered infectious dose for man is upwards of 3000 particles. Some authorities quote the infectious range as 6000 to 8000 spores.

When questioned about anthrax the following points apply:

- There is extremely low risk of biological attack if the facility is outside of a major urban area. Hence, if you are tens of miles outside of a major city, you probably do not need to do much to be prepared other than have food, water, power, supplies, etc. stored up in case of long infrastructure outages due to biological attacks.
- The only true air filtration protection for anthrax is a HEPA filter. To be effective, this must be an air distribution system that takes outside air in through the filter and



pushes this filtered air back out through the leak paths in the building — thus the HEPA system creates a slight positive overpressure in the facility. Such building positive pressure creates a balloon effect that helps keep contaminated air from entering the building. HEPA units that merely cleanse the recirculation air would provide little protection against anthrax laden air that is sucked into your facility, unless an area is provided with complete positive overpressure protection.

- A document already exists that may be used to combat airborne anthrax spores in a facility. The CDC Guidelines for the Control of Mycobacterium Tuberculosis has some excellent recommendations for control of this type of contaminant. Airborne tuberculosis in its respirable form is also 1-5 microns in size. When considering controls these guidelines provide sound mechanical system advice that may be applied to reduce the airborne level of infectious anthrax
- One additional point on filters bears mentioning. Although a HEPA filter is the only sure way of eliminating airborne

spores, they may also be removed to a lesser degree by ASHRAE grade filters. MERV 14 and higher ASHRAE grade filters can remove more than 97%+ of the particles in the 1 to 5 micron range although they should not be considered a failsafe alternative to HEPA filter application. A MERV 16 (commonly referred to as 95% DOP) filter is at least 99% efficient in this range.

- Additionally any filter in an HVAC system only performs when air is moved through the system. To decrease numbers of particles per cubic foot, increase the number of air changes to the space (thus moving more air through the filter, decreasing the number of particles per cubic foot with each pass). Given a particular particle size, and a filter efficiency approaching 100%, the following chart demonstrates the importance of increased air changes.

Air changes per hour	Minutes required for a removal efficiency of		
	90%	99%	99.9%
6	23	46	69
10	14	28	41
15	9	18	28
20	7	14	21
30	5	9	14
40	3	7	10
50	3	6	8

- The typical commercial building with a constant volume system offers 6-8 air changes per hour. VAV systems sometimes operate as low as 2-3 air changes per hour. During incidences of infectious control (flu season, etc.), increasing air changes can reduce the number of infectious airborne contaminant. If the system has a fan 'on' switch for constant flow volume, you can increase the number of air changes per hour, by moving this

switch to 'on'. As an example, in the aforementioned chart increasing air changes from 6 to 15 will 'clean' the air to a 99% removal rate in 18 minutes as opposed to 46 minutes.

If anthrax exposure is suspected:

- Isolate any item suspected including mail or other items.
- Isolate individuals that may have been exposed.
- Call 911, or contact authorities, and state what has occurred.
- Notify building maintenance to turn off any ventilation systems.
- Ensure that all persons who may have been exposed wash their hands with soap and water.
- List all persons who may have been exposed and provide the list to public health authorities.
- Wait for the police and HAZMAT team to arrive. They will provide further directions.

The following web pages contain more information on the subject.

<http://jama.ama-assn.org/issues/v281n18/ffull/jst80027.html>
http://www.cdc.gov/ncidod/dbmd/diseaseinfo/anthrax_g.htm
<http://www.bt.cdc.gov/>
<http://www.hc-sc.gc.ca/hpb/lcdc/biosafety/msds/msds12e.html>

This information is available in portable document format (PDF) from your Camfil Farr Regional Manager. Additionally PDF copies of the CDC Guidelines are also available.

The material contained herein is presented for informational purposes. In any suspected case of contamination the proper authorities should be notified. For updates and additional materials please check <http://www.camfilfarr.com>. For filtration guidance please contact your local Camfil Farr distributor or representative.

