



News release
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Containment systems for infectious diseases like Ebola – Facts, Figures and Containment Solutions from Camfil

The Camfil Group has decades of experience supplying complete air filtration solutions for safety and protection at laboratories, nuclear power stations, chemical plants and other high security facilities. Our solutions provide safety and protection when hazardous substances need to be contained to protect people and the environment. Key products include CamBox and CamSafe for radioactive, toxic and bacterial particles and gases, and CamContain to ensure maximum safety for operators, laboratory employees and the environment.

Enquiries about containment related to Ebola at biosafety labs and hospital isolation rooms

During 2014, we have read major stories in the news media about the Ebola outbreak in Africa and about patient treatment (both successes and failures, see Appendix 1). This has led to questions and enquiries about ventilation and containment systems for this infectious disease.

The treatment of patients in the United States in 2014 has prompted ASHRAE to comment on Ebola and we recommend you to read:

- The ASHRAE Journal (Nov. 2014) titled *“What ASHRAE says about Infectious Disease”*, a column written by one of its members, Lawrence J. Shoen.
- ASHRAE’s position document: *“Airborne Infectious Diseases”*, available for downloading as a PDF at www.ashrae.org/about-ashrae/position-documents

For general information about Ebola, you can also refer to:

- Appendix 1 of this paper. Please note that it is intended as a quick reference with some basic facts and figures about Ebola.
- If you are interested in getting more detailed information about Ebola, there are numerous references on the Internet, of which one is naturally the World Health Organisation’s website, www.who.org.int, specifically their website dedicated to the disease, *“Ebola virus disease”*, at www.who.int/csr/disease/ebola/en (also available in Arabic, Chinese, French, Russian and Spanish).
- Our reference material on www.camfil.com about containment systems and solutions, including product brochures, fact sheets and case stories – notably those for biosafety labs – can also be referenced or recommended to customers.

In summary:

From the HVAC industry’s standpoint, it can generally be stated that Ebola containment at health care facilities and biosafety labs is very much about control measures and precautions for airborne exposure. Measures include ventilation, pressure differentials, exhaust ventilation, air filtration and cleaning, ultraviolet and germicidal irradiation (UVGI) and even temperature and humidity control.

To our knowledge, the industry has taken no official position on the relevance of precautions for airborne exposure versus precautions for direct or indirect contact. However, anyone involved in the design, construction or operation of facilities with occupants who may be spread or be susceptible to diseases like Ebola need to be properly informed. The latter include biosafety labs and hospitals, which are two important customers for Camfil containment systems and filtration solutions.

How can Camfil help?

We are the leader in clean air solutions. Our expertise can be used to reduce the potential spread of disease through the air handling systems of biosafety labs and hospitals.

Here, it is important to distinguish two different areas where it is necessary to provide containment solutions to protect people and environment against viruses like Ebola:

1. BIOSAFETY LABORATORIES (BSLs)

A BSL, as indicated by the name, is a laboratory where biological research is conducted according to strict safety procedures.



2. HOSPITALS (ISOLATED ROOMS)

An isolated room is a room to treat an infected patient, or a patient suspected of having a disease.



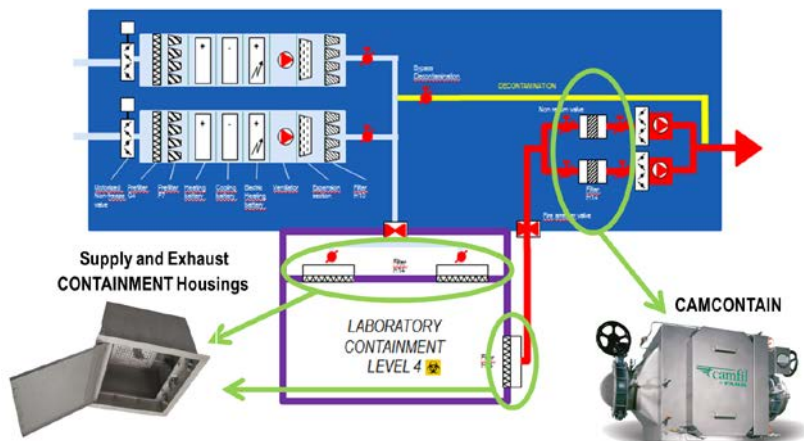
1. Biosafety labs:

All microbes, such as viruses, are classified from Biosafety Level 1 (lowest risk) to Biosafety Level 4 (highest risk) by international commissions, such as those based in the U.S. and EU. These levels are abbreviated BSL1 through BSL4. This classification is based on different criteria: the risks for people; the way a virus is spread; whether a vaccine exists or not, and other factors.

The Ebola virus is classified as Level 4, which means that this virus can only be studied for research purposes in a Level 4 Biosafety Laboratory (BSL4). This level is required for work with dangerous or exotic agents that pose a high individual risk, cause severe to fatal disease, or lack a vaccine or other treatment. A biological hazard at this level requires the use of special personnel equipment and clothing, as well as a segregated air supply, among other precautions.

Camfil has a dedicated set of containment solutions to provide this high level of safety.

Below is a typical sketch for a BSL4 ventilation system:



Housings

Two different housings in the BSL4 system supply and exhaust air to create the first filtration barrier in a biosafety laboratory. The exhaust line is also equipped with a second HEPA filtration stage (standard requirement), complete with a redundancy line, to ensure safe exhaust airflow from the lab.

The Camfil products are "S&E CONTAINMENT HOUSING" and "CAMCONTAIN".

The HEPA filters can suitably be different versions of MEGALAM or ABSOLUTE. Some are equipped with our PTFE media to be water-repellent, especially in rooms where there are decontamination showers.

There are more than 60 biosafety laboratories classified as Level 4 in the world. Camfil has already delivered containment solutions for many of them in China (WUHAN), France (INSERM, CEBIO and IRBA), Switzerland (SPIEZ), Germany (Hospital Charite, Berlin Airport) and the U.S. (University of Texas at Galveston, Boston University and the Plum Island Animal Disease Center outside New York).

Guidance from WHO and US CDC and USDA (Ref. WHO 2004, BMBL 5th ed. and ARS 242) recommend HEPA filtration on the supply and two HEPA filters in series on the exhaust. The supply HEPA is recommended in case of an upset condition where airflow may be reversed. The redundant HEPAs on the exhaust are recommended to ensure safe exhaust airflow from the lab. The room should have a negative pressure gradient.

2. Isolation rooms

Camfil normally recommends using the same configuration as for a Level 4 biosafety laboratory. But due to different constraints, various solutions could be also proposed, such as a mobile unit, or a less sophisticated solution, because the end-user safety processes are also different.

For further information

The different solutions and options in the CamContain range allow us to meet all customer requests and requirements. We are currently proposing solutions for hospitals in Madrid, Italy and France. Contact your local Camfil agent for more information or:

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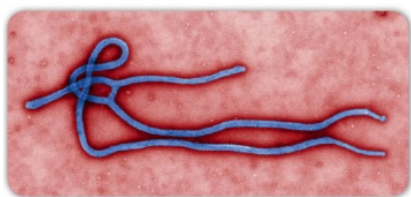
APPENDIX 1 – Brief facts and figures on viruses and Ebola

We also recommend reading the WHO website noted on page 1.

What is a virus?

A virus is an agent (a substance able to produce a physical, chemical or biological effect) or pathogen (can cause disease) with a very small size (<0.3 microns = the diameter of a strand of hair divided by 200) and with four essential characteristics:

- 1) It reproduces by single replication; there is no growth or fission (cell division) viruses.
- 2) It has to reproduce in a host cell; it uses the cell's components to multiply.
- 3) It has only one DNA or RNA type.
- 4) It has specialized structures.

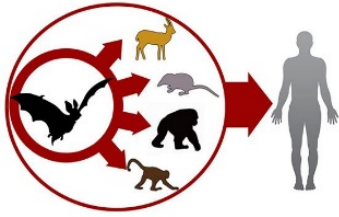


Created by CDC microbiologist Cynthia Goldsmith; this colorized transmission electron micrograph reveals some of the ultra-structural morphology displayed by an Ebola virus virion.

Where does the Ebola name come from?

This first outbreak of the virus occurred in 1976 in Sudan and Congo, near the Ebola River.

How is Ebola spread from animals to humans, and from humans to humans?



It is thought that fruit bats are natural Ebola virus hosts.

Ebola is introduced into the human population through close contact with the blood, secretions, organs or other bodily fluids of infected animals, such as chimpanzees, gorillas, fruit bats, monkeys, forest antelopes and porcupines found ill or dead or in the rainforest.

Ebola then spreads through human-to-human transmission via direct contact (through broken skin or mucous membranes) with the blood, secretions, organs or other bodily fluids of infected people, and with surfaces and materials (e.g. bedding, clothing) contaminated with these fluids.

Is it possible to diagnose a patient infected by Ebola?

It can be difficult to distinguish Ebola from other infectious diseases such as malaria, typhoid fever and meningitis. But the results of six different investigations, including cell cultures, can be used to determine the Ebola infection.

What are the main symptoms of Ebola?

The incubation period – that is, the time interval from infection with the virus to onset of symptoms – is 2 to 21 days. Humans are not infectious until they develop symptoms.

The first symptoms are the sudden onset of fever fatigue, muscle pain, headache and sore throat. This is followed by vomiting, diarrhoea, rash, symptoms of impaired kidney and liver function, and in some cases, both internal and external bleeding (e.g. oozing from the gums, blood in the stools).

Is it possible to treat or vaccinate against the Ebola disease?

Supportive care-rehydration with oral or intravenous fluids, and treatment of specific symptoms, improves survival. There is as yet no proven treatment available for Ebola. However, a range of potential treatments, including blood products, immune therapies and drug therapies, are currently being evaluated. No licensed vaccines are available yet, although two potential vaccines are undergoing human safety testing.

For current outbreak figures, please visit the WHO web page:

<http://www.who.int/csr/disease/ebola/situation-reports/en/>