

# Safety cabinet for collecting specimens contaminated with airborne pathogens

Puskas Ferenc<sup>1</sup>, Doina Pisla<sup>2</sup>, Bogdan Gherman<sup>2</sup>, Marius Roman<sup>3</sup>,  
Eniko Kovacs<sup>3</sup>, Cecilia Roman<sup>3\*</sup>

<sup>1</sup>ELECTRONIC APRIL, Aparatura Electronica Speciala, Cluj-Napoca <sup>2</sup>Research Center for Industrial Robots Simulation and Testing, CESTER, Cluj-Napoca,

<sup>3</sup>INCDO-INOE 2000, Institutul de Cercetari pentru Instrumentatie Analitica, ICIA, Cluj-Napoca

\*corresponding author: [cecilia.roman@icia.ro](mailto:cecilia.roman@icia.ro)

## Abstract

Recent years, the concern regarding both the development of new technologies for microbiological air purification and methods, equipment for microbiological protection of medical staff and/or the patients has been increased. In order to prevent the transmission of diseases caused by airborne pathogens (possible infections of anthrax, tuberculosis, pulmonary anthracosis), air quality must be ensured in medical units by ventilating, diluting and removing contaminated air, to reduce the concentration of airborne pathogens in the environment.

Construction principles of a safety cabinet for collecting specimens contaminated with airborne pathogens, which ensures the protection of the environment during the collecting act is presented. This safety cabinet is an enclosure designed to collect sputum in conditions in which the patient, the person who assists the collection, but also the environment are simultaneously protected from exposure to infectious particles. These particles emitted by the patient during the collecting procedure could contain *M tuberculosis* and other airborne pathogens (anthrax, pulmonary anthracosis).

## Construction

**Cabinet:** has a metal profile skeleton with transparent panels (glossy surface) to allow maintaining the desired Clean Class. The walls are made of anti-break glass, creating comfort and safety for the patient. Access to the interior is through a door that opens from the inside to the outside

**Purity of the air inside the cabinet:** prefilters (G4) and high efficiency filters (HEPA, porosity H14 and ULPA) are mounted on the air duct, the air being introduced with controlled speed and flow. Air quality monitoring is performed with a particle counter.

**Exhaust air:** with the help of the exhaust fan, a negative internal pressure is maintained. The exhaust air has its own route. The cabinet is equipped with a dispenser of products for disinfection.

**Biosecurity:** an atmosphere with negative pressure is created inside the cabinet with the help of a centrifugal fan, which through an ingenious air circuit draws 30% of the air from the environment in which the cabinet is installed through a dust prefilter, 70% recycles through the main HEPA filter and, evacuates 30% also through a HEPA filter in the environment

**Disinfection methods:** ultrasound evaporator - makes a mist from a disinfectant inside the cabinet or UVC sterilization lamp

**Touchscreen:** The large color touchscreen allows easy reading from a distance the operating parameters

## Conclusions

- A safety cabinet that ensures three protections: patient, specimen and environment was constructed
- Further development of the safety cabinet and its launch will contribute to the decrease of morbidity and mortality caused by tuberculosis but, especially, will contribute to the limitation of the spread of infection, disease and / or associated nosocomial infections. The realized business plan demonstrates the necessity and the opportunity of the product

## Safety cabinet construction: principles, materials and methods

- ensures uncontaminated air in the access area for the patient
- has the ISO 5 Clean Room (maximum level - with a number of 100,000 particles/m<sup>3</sup> with the size of 0.1 microns, ensuring a number of 400 air changes/hour i.e. Class 100 Clean Room safety cabinet)
- corresponds to the Class 2 Microbiological Safety Cabinet.
- ensures comfort and a feeling of security for the person inside without creating a feeling claustrophobic
- allows easy access to, and from the cabinet
- can be decontaminated using multiple methods
- the indoor environment is constantly monitored both on site and via the Internet
- simple use and maintenance, with average qualified staff

Fig.1 Safety cabinet layout

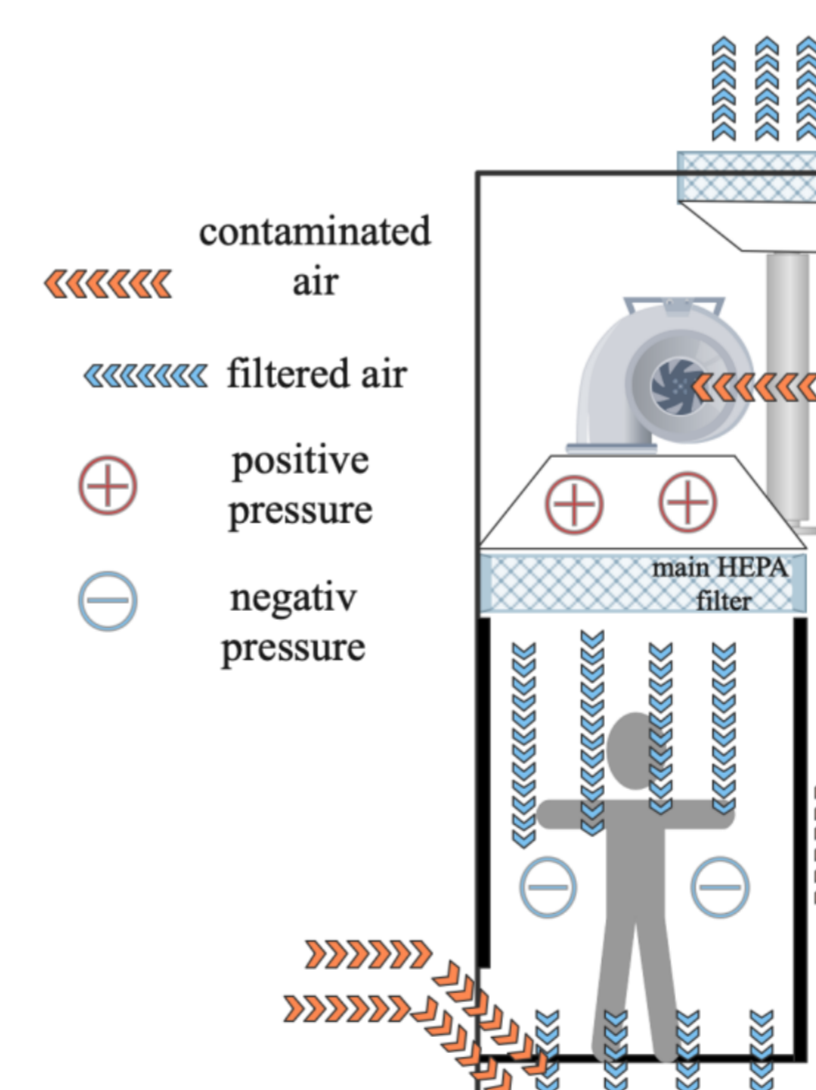
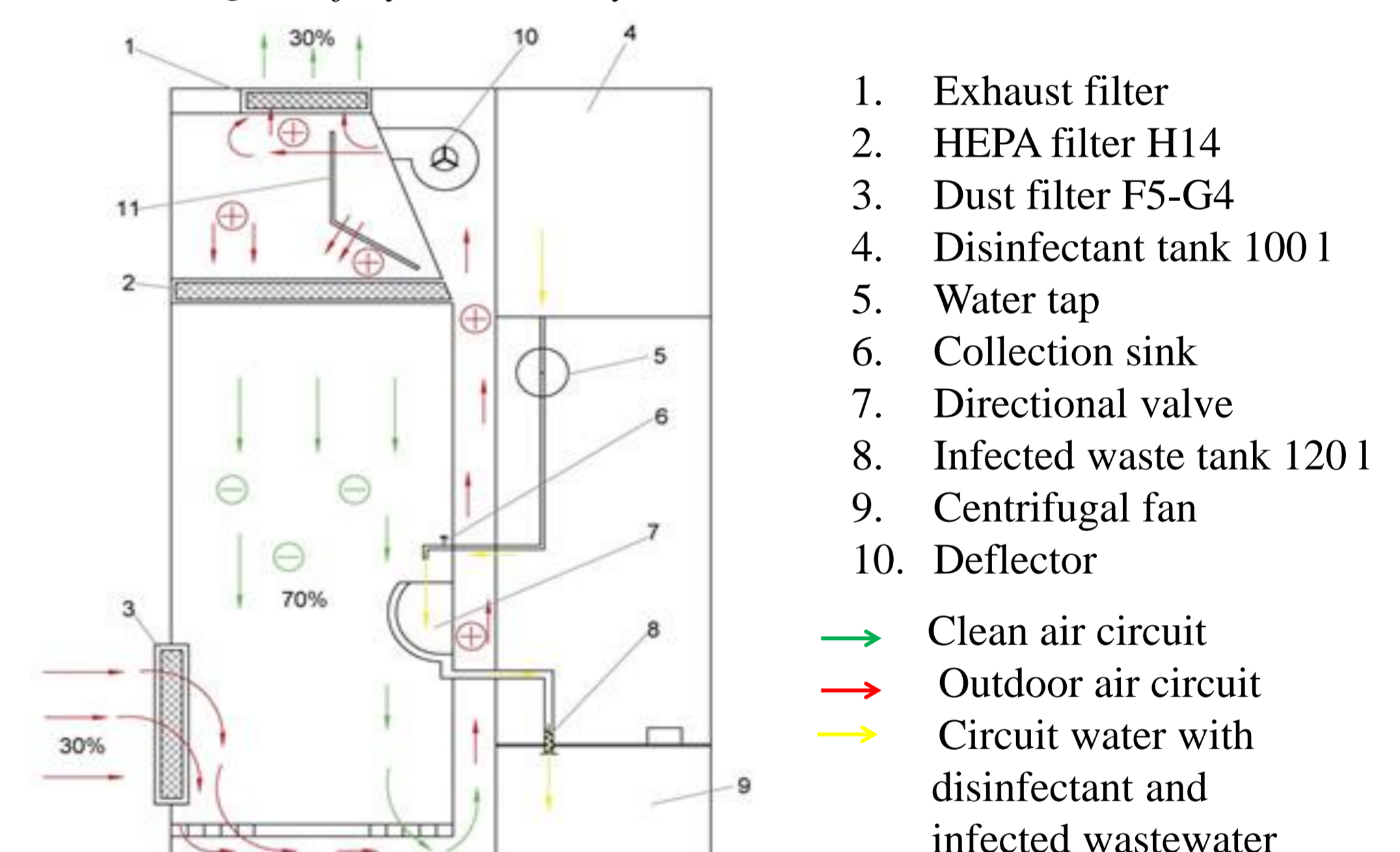


Fig.1 Safety cabinet layout

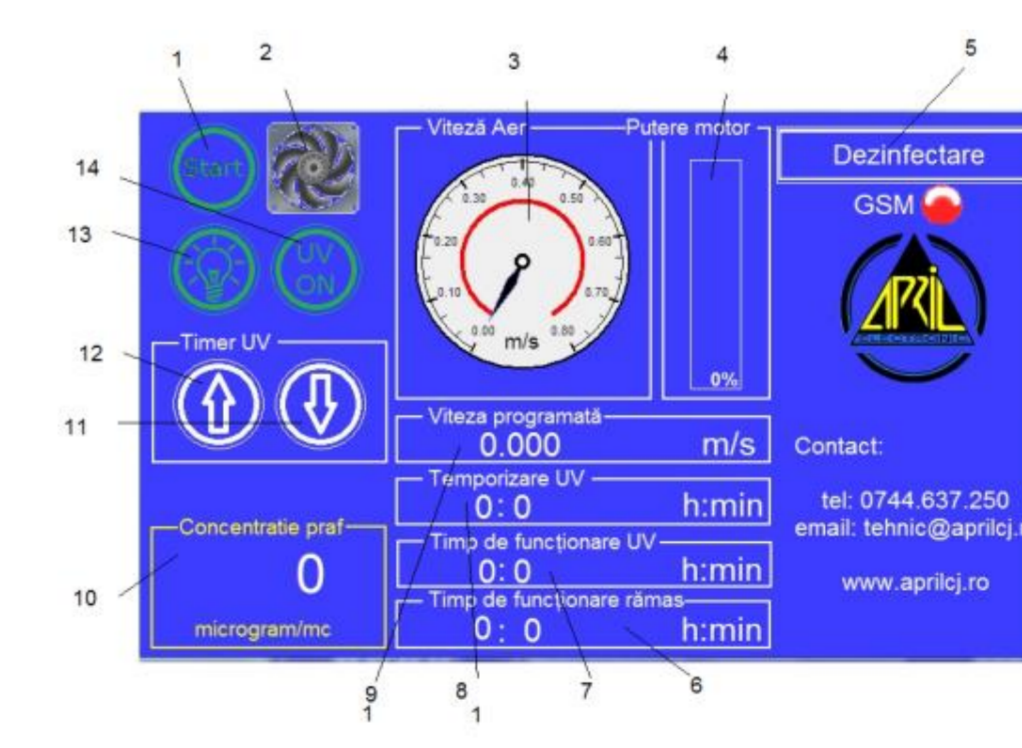


Fig.1 Safety cabinet layout

## ACKNOWLEDGMENTS

This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI –UEFISCDI, contract number 65PTE/2020, within PNCDI III