breathES

Air and Surface Sanitization

Air and Water Treatment

ECOSPRAY

technologies for the planet

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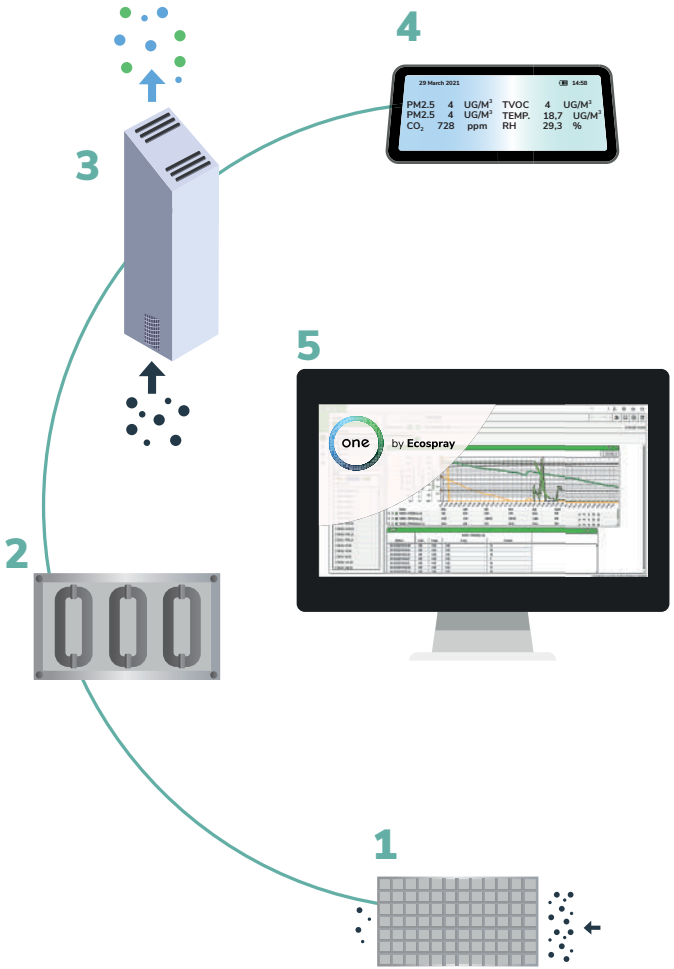
The key solution

A package of technologies to drastically reduce pathogens and contaminants, inside closed spaces, in air and on surfaces.



1	2	3	4	5
Filtration	UVGI lights	Bi-Polar Cold Plasma Ionizers	Air Quality Monitoring	Centralized control unit

- **Ensure a safely "return to service" for guests and crews**, onboard passenger ships, ferries, and all other ships with the combined use of **filters**, **UVGI and Bi-Polar Cold Plasma Ionizers.**
- Maintain pathogen free air and drastically **reduce the direct and indirect transmission of SARS-CoV-2** and other diseases spreading through respiratory droplets and the subsequent contact with contaminated surfaces.
- Monitor the key parameters (**on-site and remote**) with air quality analyzers, while the **centralized control** unit easily integrates each device for a comprehensive and easy to use interface.
- Operate easily all the devices and **monitor all the data** collected via our proprietary **IoT platform "*One*".**

Main benefits

Why choose the combination of *breathES* technologies?

1. **Filtration**
2. **UVGI lights**
3. **Bi-Polar Cold Plasma Ionizers**
4. **Air quality monitoring**
5. **Centralized automation with data collection and remote shore/cloud connection**

NON-STOP sanitizing action, 24/7, **even in presence of people**, without limitations and **without using chemical products**.

Highly **effective inhibiting viruses**, bacteria, other pathogens in air and on surfaces but also reducing odors, Volatile Organic Compounds (VOC) and Particulate Matter (PM) with efficacy proven by several lab analysis conducted by certified bodies.

A proper **sanitization of Air Handling Units**, air conditioning ducts, ambient air, close environments and surfaces, preventing the direct pathogens transmission.

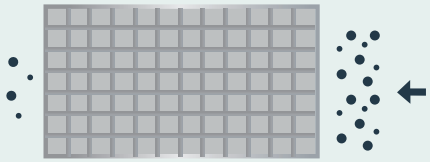
breathES components can be both integrated in the existing A/C systems and provided in stand-alone units to be installed in rooms.

breathES is in line with classification societies **requirements** for additional air and surfaces sanitization class notation (e.g. additional RINA class notation BIOSAFE SHIP).

How it works

breathES features five synergetic technologies

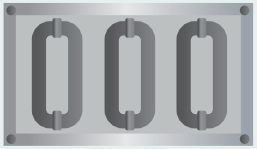
1. Filtration



Filters are installed in the AHU, the **primary effective barriers against dust and PM spreading.**

- ISO ePM10 60% type.
- Panel or v-bag filter type.
- Surface germicidal treatment.
- Higher filtration performances than standard filters.

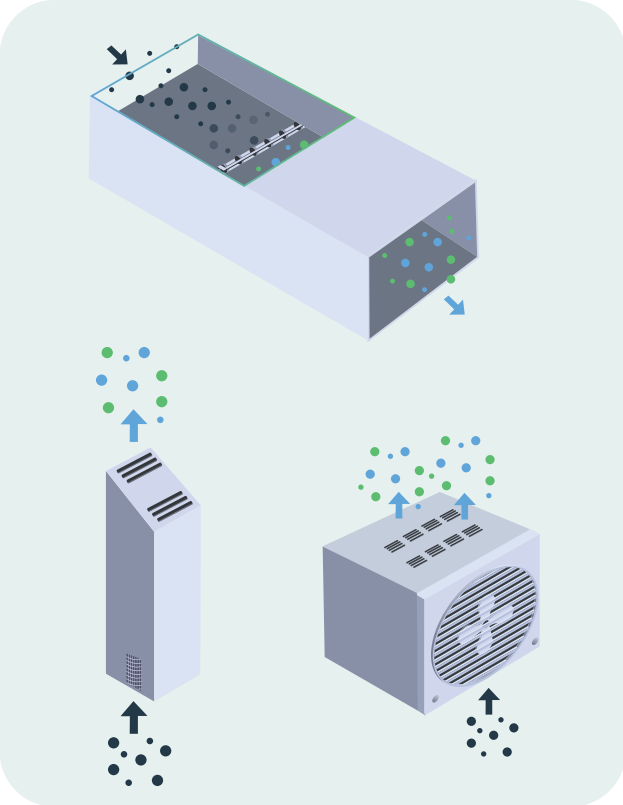
2. Induction UVGI lamps



breathES induction lamps are capable to emit **higher radiation quantity** (up to 30x) to ensure an increased effectiveness compared to the conventional systems. The limit of the conventional UVGI systems is the minimal (due to space constrains) installed power that doesn't allow the **full inactivation of Viruses and Bacteria in the air flow**, or requires a significant number of units to be installed.

- Effectiveness against pathogens up to 99,98%.
- Lamp lifetime up to 60.000 hrs (vs. 8.000 for the standard UV lamps).
- Extended temperature operational range (highly effective even in cold environment).
- Restoration of air recirculation and enthalpy wheels use with a strong focus on the energy efficiency.
- Live monitoring of the emitted UV radiation.
- Ozone free.

3. Bi-Polar Cold Plasma Ionization



Legend Data

Clean Air Ions Contaminants

Ion generators inject into ambient air billions of **Reactive Oxidation Species** (ROS) per second using **Cold Plasma Bi-Polar Ionization Technology**. Plasma is the 4th state of matter consisting of a state of ionized gas. The **ions generator** is in continuous contact with oxygen and water (humidity) molecules in the ambient air, ensuring 24/7 production of effective ROS.

ROS attack pathogens, inactivating them (e.g. damaging the spike protein or the SARS-CoV-2 spike protein) but also react with VOCs - forming safe and desirable gases already prevalent in our atmosphere and PM - making dust and smoke stick together and **fall out of the breathing zone.**

- Substantial reduction of proliferation and possible contamination from various type of viruses (SARS-CoV-2 included), bacteria, spores present in air and on surfaces, including hard-to-reach crevices.
- Substantial reduction of odors, VOCs and particulates that cannot be adequately removed using only mechanical devices such as high stop capacity filters, or activated carbon filters.
- Continuous protection, 24/7.
- No limitations of use in presence of people, no use of chemical products.
- Substantial improvement of the AQI.
- Self-cleaning (no maintenance is required).
- Negligible power consumption.
- No ozone or other by-products generation.

4. Air monitoring

A set of **analyzers** conveniently located in the room ensures:

- 24/7 live monitoring of several parameters, such as Particulate (PM10/2.5), VOC, CO_2 also used to determine the Air Quality Index.
- Onboard calculation and display of the Air Quality Index (AQI, according to ASHRAE).
- Parameters transmission to the *breathES* centralized control unit.

5. Centralized control unit

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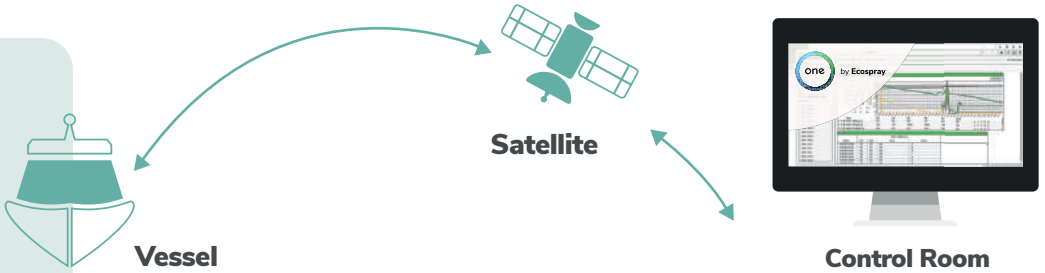


The centralized control unit ensures the monitoring and control of **every device of the system.**
The control unit has built-in compatibility with **«One»**, the Ecospray proprietary IoT platform.

- Live monitoring and management for all sanitization devices of the system for the optimal control of temperature, humidity and air changes based on AQI values.
- AQI index-based live maps and alerting.
- Performance monitoring and analysis.
- Data collection and ship-to-shore data-transferring.
- Historical Data analysis (e.g. trending, additional energy saving means implementation without jeopardizing the AQI, cross-fleet and historical analysis).

Case Study

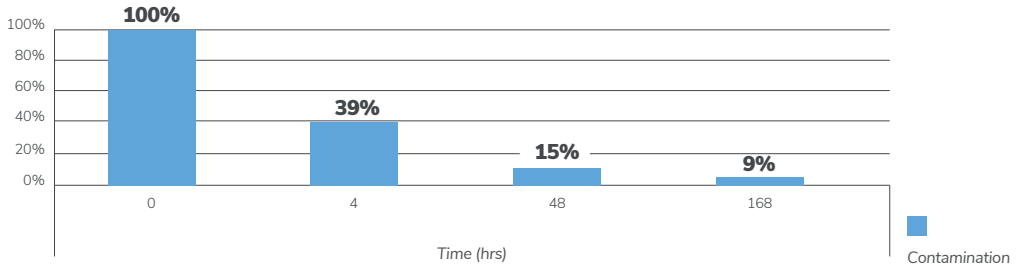
Cruise ship pilot project

Scope

Demonstrate the capability of the Units Cold Plasma Bi-Polar Ionization technology to **sanitize** and to **maintain sanitization 24/7 without limitations.**
The protocol was designed to primarily test the effect on microbial contamination in populated areas with typical traffic and during “normal use” by the ship’s staff. The test devices (cubes) have been installed in the Fitness Center, while the towers have been installed in two offices.

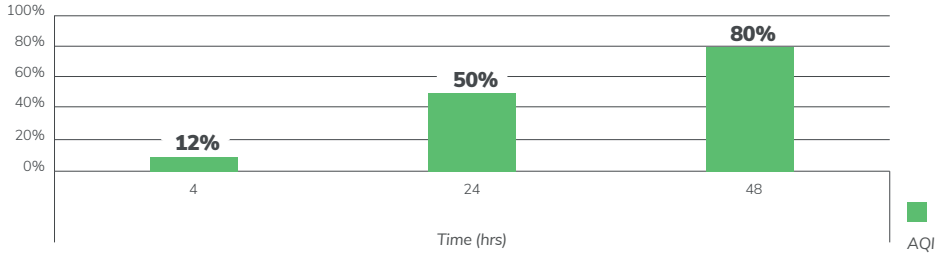
Tab.1

Surface contamination



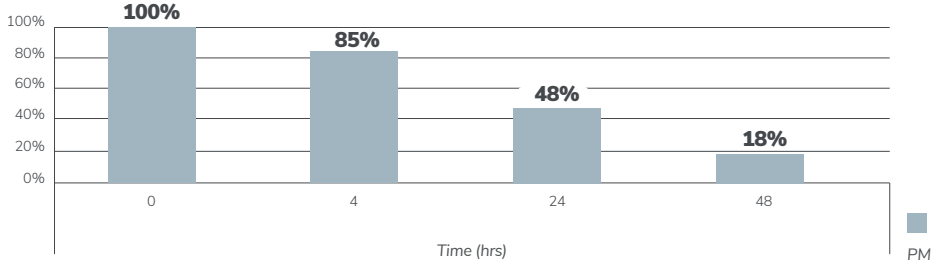
Tab.2

AQI improvement



Tab.3

PM reduction



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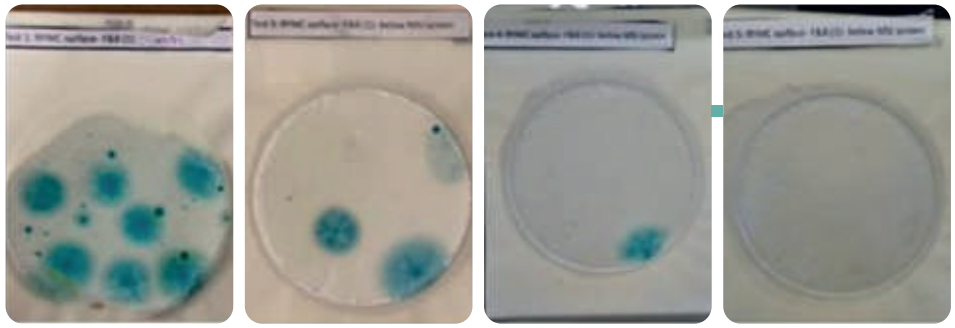
Case Study

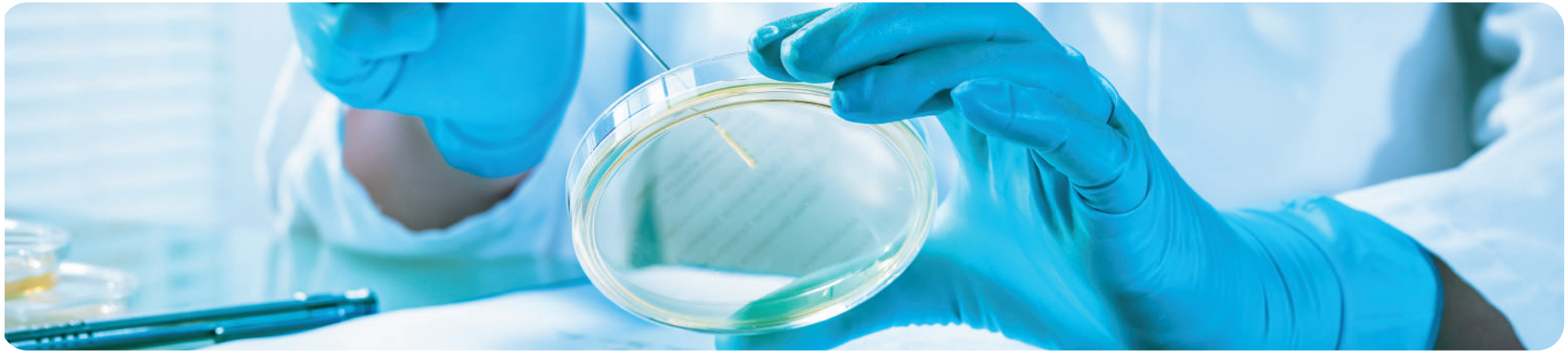
Results and conclusion



Baseline AW+3 hours AW+16 hours AW+24 hours

Petrifilms demonstrated a **61 to 91%** average **decline** in bacterial, yeast and mold **contamination** at week 1 of Bi-Polar Ionization activation.
Most remarkably, a 40-72% decline was achieved within just 3-5 hours of ionization treatment.
Indoor air quality **(AQI)** test results demonstrated **improvement up to 80%**, based on AQI values elaborated by the instruments used to spot check AQI into tested spaces.

Measured **PM** showed **reductions up to 72%** on average in a 48 hours timeframe.
In multiple controlled laboratory tests using this technology, significant airborne and **microbial inactivation** (including **SARS-Cov2**) was achieved within 10 minutes and **90-100% inactivation** within 30-60 minutes of ionization.



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Technology Map

Exhaust Gas Cleaning

Advanced DeSOx

Exhaust Gas Cleaning Systems
Smart Scrubber
Wet Technology
Dry and Semi-Dry Technology

Catalytic Abatement

DeNOx SCR
Diesel Oxidation Catalyst
Methane Slip Reduction
Water Fuel Emulsion

Filtration

Wet Electrostatic Precipitator
Diesel Particle Filtration
Baghouse Filters
Filter Cassettes

Clean Fuel

Pre-Treatment and Upgrading

Pre-Treatment
Smart Blending
Biogas Upgrading
Nitrogen Rejection Unit

Liquefaction

Methane and Biomethane Liquefaction

Green Power Generation

Lean Gas To Power

Lean Gas To Power

Decarbonization

Carbon Capture Utilization & Sequestration

Fuel Cell

Carbon Friendly Fuel Cells

Air and Water Treatment

Advanced Water Filtration

Wash Water Filtration

Sanitization

Air and Surface Sanitization

Fogging

Fogging

Gas Cooling

Gas Cooling

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