THE HARMFUL AFTER-EFFECTS OF DISINFECTING FOGGING AGENTS ON ELECTRONIC AND ELECTRICAL EQUIPMENT

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With the global coronavirus (COVID-19) pandemic, concerns regarding high-touch surface safety have become top-of-mind. These concerns have caused increased use of disinfecting chemicals and techniques by educational institutions, manufacturing facilities, airlines and other entities that are inadvertently introducing these chemicals into equipment containing sensitive electronic circuitry. While certain materials such as doorknobs, light switches and countertops may be able to withstand exposure to these disinfecting agents, electronic components may not fare so well. The Environmental Protection Agency (EPA) has conducted year-long studies to determine how these chemicals affect different types of equipment.

Highlights

- Fogging Agents Explained
- How Fogging Can Harm Your Equipment
- How to Test Your Equipment
- How to Fog Safely

Disinfection by Fogging Explained

Fogging is an application method designed to disperse a disinfectant aerosol to reduce the number of airborne micro-organisms, as well as to capture surfaces that may be difficult to reach.

Using either a built-in static system with strategically placed nozzles, or more commonly, a mobile handheld unit, the equipment saturates the atmosphere with a disinfecting fog. The area covered varies depending on the application system used but is typically carried out for a minimum of 15 to 30 minutes to enable the fog to disperse and the chemical action to occur. After fogging, an additional 45 to 60 minutes is required for the droplets to settle from the air onto the surfaces.

The Harmful After-Effects of Fogging

While hand-wiping disinfection techniques allow a controlled spread of the utilized solution, fogging causes widespread exposure in the area applied. Equipment designed to be cooled with fans will draw in the airborne agents and moisture, introducing the fogging chemical into sensitive electronic modules.

Environmental Protection Agency (EPA) Material Studies

An EPA study titled, "Assessment of the Impact of Decontamination Fumigants on Electronic Equipment," discusses how chlorine dioxide (ClO_2), hydrogen peroxide (H_2O_2), methyl bromide (MeBr) and ethylene bromide (EtO) impacted equipment over the course of a year. The study described visual abnormalities, as well as functional failures.

The EPA study also documented functional failures against a control group not exposed to these fumigation chemicals. After using common desktop PCs and a routine error-detection program, following prolonged exposure the measured error rates were higher in the fumigated PCs. One of the highest error rates came from a popular COVID-19 fogging disinfectant: chlorine dioxide (ClO_2).

Product Name	Active Ingredient	Water %
Biospray D	Isopropyl Alcohol (55-75%)	25-45%
Mediclean Disinfectant Spray Plus	Isopropyl Alcohol (10%)	90%
Viraclean	Ethanol (10%)	90%
Bioesque Botanical Disinfectant Solution	Thymol - Several Alcohols (0.23%)	99.8%
Benefect Botanical 30 Disinfectant	Thyme Oil - Several Alcohols (0.1%)	99.9%
Clorox Total 360	Organic Compounds with Chlorides (7%)	93%
D-125	Organic Compounds with Chlorides (<50%)	>50%
Prokure	Aqueous Sodium Chlorite, $NaClO_2$, or Aqueous Chlorine Dioxide, ClO_2 (<10%)	>90%
Halomist	Hydrogen Peroxide (7.8%)	93.2%
Steramist	Hydrogen Peroxide + Inert Ingredients (13%)	87%
Purtabs (Dilution 0.5-5550 ppm)	Salts (0.5%)	99.5%
Odox-DF	Propane - 1, 2 Diol (60-80%), Hydrogen Peroxide Solution (5-10%)	10-35%

All of the noted disinfectants in the table above are comprised of varying percentages of water. Following a fogging application, water droplets settle on sensitive electronic circuitry. Aside from water, three disinfectants contained hydrogen peroxide, a strong oxidizing chemical known to promote corrosion. Three other disinfectants contained chlorides or chlorine dioxide, also known to promote corrosion.

A drop of mineralized water on an unprotected electronic circuit board will cause corrosion and lead to electrical failures. Some circuit boards, depending on their design specifications, are protected with a conformal coating. Therefore, some boards will suffer little to no degradation from exposure to corrosive disinfectants, while others will exhibit significant deterioration.

Based on reviewed disinfectant safety data sheets and EPA studies, it is expected that as fogging is repeatedly employed and introduced into equipment, material degradation and functional failures will occur.

What to Do If Your Equipment Was Fogged

If the equipment was fogged, analytical wipe samples should be harvested to quantify the level of introduced contaminants to the electronic circuitry. This is especially important when considering areas that have been fogged multiple times.

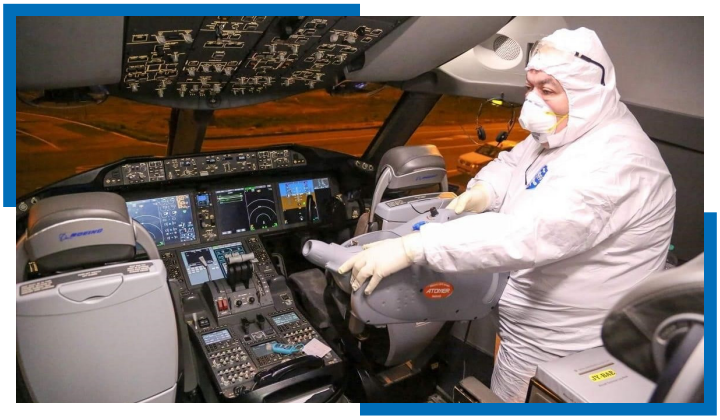

Image: FlightGlobal by David Kaminski-Morrow 2 February 2020

Why Are Analytical Wipe Samples Crucial?

According to the U.S. Department of Energy (DOE) Fire Protection Handbook Volume II, the probability of equipment failure increases exponentially with increasing corrosive contamination levels. Equipment with contamination levels more than 500 $\mu g/in^2$ (micrograms per square inch) of aggregate chlorine equivalent (Cl) will experience higher rates of failure if the equipment resumes production before removing the corrosive matter. The IPC J-standard for newly manufactured circuit board cleanliness sets a threshold of 10.06 $\mu g/in^2$ of aggregate sodium chloride (NaCl) equivalent as the maximum level permitted on a newly fabricated board. Should wipe samples return contamination levels exceeding industry levels, equipment preservation and decontamination protocols may be required.

Guidelines to Follow If You Must Fog

When fogging, the equipment in the space being addressed should be powered off and covered so that the disinfectant does not penetrate the sensitive electronic circuitry. If powering off and covering the equipment is not an option, fogging should not be considered. Surfaces that may be compromised by the virus should be hand wiped to disinfect.

If you know or suspect your equipment has been fogged without following the recommended guidelines to protect it, contact Envista Forensics to schedule a wipe sample analysis or speak with one of our equipment damage specialists.