Ozone Aqueous Disinfectant Dispensing System

1. How does the system work?

The Hawkeye Aqueous Ozone Disinfectant Dispensing System is a fixed or transportable system that takes in air through an air compressor; dehumidifies the air and converts it to oxygen by removing nitrogen, carbon dioxide and other trace elements; converts the oxygen into ozone; cools it for stability; injects it into a water stream for use as a dispensing vehicle; and sprays the resulting aqueous ozone through an extendable hose.

2. How does Ozone work as a disinfectant?

Ozone Molecules (O_3) are converted from Oxygen (O_2) as a result of an electrical charge in the Hawkeye Aqueous Ozone Disinfectant Dispensing System. Oxygen has two atoms, and high voltage breaks these two atoms apart. Quickly, these atoms join back together in threes (O_3). These atoms do not like this arrangement and this unstable trio wants to dissolve itself. As this O_3 molecule floats in the air, if one of the atoms locates a contaminant molecule, it breaks away from the other two atoms and attaches itself to the contaminant. This attachment is actually an attack on the contaminant (oxidation) and creates a microscopic explosion. Both the contaminant and the atom are destroyed. This leaves the other two atoms behind as pure oxygen (O_2) without the presence of the contaminant. The explosion changes the contaminant into carbon dioxide and hydrogen, which we can breathe. Ozone is highly reactive, so it interacts with viruses, contaminates and allergens it encounters, rendering them harmless while also removing odors. Once a pollutant is oxidized by ozone, it is no longer toxic. As a result, even if an oxidized contaminant remains in the air and is inhaled, it has no negative effect. Microorganisms such as mold spores or bacteria that have been exposed to ozone are no longer able to reproduce, which causes their numbers to quickly diminish. However, should the O_3 molecule not find a contaminant in its environment, it will attack itself to change its configuration of O_3 back to O_2 (normal oxygen) in 2 to 7 minutes for low concentrations or in 20 to 30 minutes for higher concentrations at room temperature and normal humidity.

Ozone is biocidal, which means it kills harmful biological and bacterial contaminants. This biocidal action results from its reaction with the double bonds of fatty acids in bacterial cell walls, membranes and the protein capsid of viruses. In bacteria, the oxidation results in a change in cell permeability and leakage of cell contents into solution. Ozone attacks these cell walls, breaking down membranes and ultrastructural components of the organism. In more simple terms, the unstable electrons of ozone blast holes through the membranes. This occurs by cell lysing or rupturing the cell wall of viruses, bacteria, yeast and abnormal tissue cells, thereby destroying them by inactivation of the microorganism's enzymes. In viruses, alteration of the protein capsid prevents the virus from being taken up by susceptible cells. Ozone displays an "all or nothing" effort in terms of destroying bacteria. It is such a strong germicide that only a few micrograms per liter are required to demonstrate germicidal action. Factors like humidity, temperature, pH, ozone concentration levels, type of organism and time, determine the kill rate for pathogens. The action of ozone gas in water is instantaneous. After oxidation, ozone returns to its original form of oxygen, without leaving any toxic by-products or residues.

3. Is Ozone proven to kill bacteria and viruses?

Ozone has been proven to be a healthy and effective way of killing bacteria and viruses, including various coronaviruses. It has been proven to destroy Ebola, SARS, MERS, Cryptosporidium, and many other contaminants. Ozone works by penetrating the cell wall of the pathogen and destroying it from the outside. Ozone is documented to be 50 times stronger than choline bleach and 5,000 times more effective than Chloramine as a disinfectant. Clinical and scientific references are available upon request.

4. Are there any environmental or health risks?

There has been no evidence of negative environmental or health effects from exposure to ozone at concentrations that are set by OSHA and the EPA. If exposed to high concentration, short-term health effects that individuals may experience include respiratory discomfort, headache and eye irritation. The proper measurement established by OSHA and the EPA for an inhabited room is 0.02 ppm. With proper precautions of allowing 2 to 30 minutes for the ozone (O_3) to dissipate to oxygen (O_2), these effects will be avoided.

5. Is the product approved or certified anywhere?

The USDA and FDA have approved the use of ozone as a decontaminant for food and drinking water for human consumption. These organizations have also labeled ozone with GRAS (generally recognized as safe) approval for the use on surface sanitation of all food products. Ozone is widely used to clean municipal water and bottle water, as well as hospital laundry, grain, and other commercial items. OSHA has also set regulations as it pertains to the use and levels of ozone in the workplace. This is to ensure that the continuous exposure to ozone is at safe levels while also being effective in the cleanliness.

Badger Innovations is also applying for US Environmental Protection Agency (EPA) certification for the Hawkeye Aqueous Ozone Dispensing System.

6. Where is it being used?

Most Municipalities and many companies across the United States and Internationally are utilizing ozone in different capacities including agriculture, water purification, food production and cleaning services, as well as for at-home applications. The equipment has been proven to eliminate mold, odor, viruses and bacteria. What the Hawkeye Aqueous Ozone Disinfectant Dispensing System does is take that concept of using high concentrations of ozone to clean and disinfect at a large scale level. This is a proven application in the industrial world, and Badger Innovations has created a method to make this ozone cleaning accessible to more people, agencies and industries to help fight everyday pathogens for the current and any future public health crisis.

7. How fast can a Hawkeye system be delivered?

Production and delivery of the Hawkeye Aqueous Ozone Disinfectant Dispensing System is approximately 3-6 weeks from time of delivery based on our current workload at the

time of the order. If you are located internationally, the lead time may vary if one of our local production partners can support your requirement.

8. What are the recurring cost comparisons for the Hawkeye Aqueous Disinfectant Dispensing System as compared to chemical disinfectants?

Manual application of chemical disinfectants such as bleach-based products require large amounts of bleach wipes/rags, masks, gloves, and a large labor requirement. Based on the local labor cost and the complexity of the facility, the recurring cost of this application can be from $120-$200 per 10,000 sq ft (900 sq m). The Hawkeye Aqueous Ozone Disinfectant Dispensing System utilizes only air (free), electricity from the facility electrical outlets or self-contained generator (estimated <1 g of gasoline for this area), and water, for an approximate cost of $1 for this equivalent area. The initial procurement cost of the Hawkeye system can be recovered after only a few months.

9. What resources are needed to operate this system?

One major advantage of using the Hawkeye Aqueous Ozone Disinfectant Dispensing System is the ease of the process and operation. The inputs are only water, air and electricity to create the ozone on demand to be dispensed across surfaces and in spaces. One or two people can operate the system with a dispensing wand used to spray an ozone injected mist.