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VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

OZONATOR NG-1000

Developed by Ozonator Industries Ltd.
Regina, Saskatchewan, Canada

Registration: GPS-ETV_VR2019-07-31

In accordance with

ISO 14034:2016

Environmental Management —
Environmental Technology Verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

July 31, 2019
Vancouver, BC, Canada

Verification Body
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Performance claim(s)

The efficacy of the Ozonator NG-1000 for treating bio-hazardous and regulated medical wastes has been tested employing a surrogate bacterium, *Bacillus subtilus* (*B. atrophaeus*), and a surrogate waste composed of 10% glass/sharp, 30% plastic, 20% paper, 20% cloth/woven materials, and 20% liquids/organics. The waste was shredded, loaded into the treatment chamber and ozonated for 900 seconds (or 15 minutes).The ozone concentration in the treatment chamber ranged from 4000 to 8000 ppm; temperature ranged between 17 to 24 °C; and humidity was between 70 and 100%.Test results show the Ozonator NG-1000 was able to kill *B. subtilus* and reduce its viability by at least 6 orders of magnitude or 6 $\log_{10}$ with 95% confidence.

Performance conditions

The performance claim evaluation is based on data and information provided by Ozonator Industries regarding the efficacy of Ozonator NG-1000 for inactivation of a surrogate bacterium, *Bacillus subtilus* (*B. atrophaeus*). Clifton Associates Ltd., an independent third party engineering and scientific firm, conducted tests to determine the effectiveness of the Ozonator NG-1000 for sterilization of bio-hazardous and regulated medical wastes. Ten test strips each containing at least 1x106 spores were placed in the treatment chamber; eight on eight corners and two in locations along the central axis of the chamber. The chamber was then filled with shredded medical waste that covered all test strips and ozonated with a minimum of 2000 and typically 4000 to 8000 ppm of ozone. The relative humidity of the treatment chamber was between 70 and 100% and humidity was supplied by a water vapour generating system. The tests were conducted with and without ozone in the treatment chamber. The disinfection of *B. subtilus* was calculated using the following relation.

$$X_{uc} - X_t = X_r$$

Where X_{uc} and X_t are $\log_{10}$ concentrations of untreated control (uc) and treated (t) spores and X_r is $\log_{10}$ reduction in concentration of spores.

The systems was operated in a batch mode. Test strips were located in specific locations inside the Ozonator NG-1000 treatment chamber covered with shredded waste comprising 10% glass/sharp, 30% plastic, 20% paper, 20% cloth/woven materials, and 20% liquids/organics and ozonated between 2000 and 8000 ppm of ozone for 900 seconds.

Technology description and application

The Ozonator NG-1000 is designed to treat bio-hazardous and regulated medical wastes employing ozone. The treatment can be carried out on-site as well as off-site. It comprises a lift, an intake hopper, a shredding chamber, a treatment chamber, and a disposal tank. There are independently movable sealing interfaces on the top of the intake hopper, between the intake hopper and shredding chamber, and between the treatment chamber and the disposal tank.

In typical operation, hospital waste is brought to the device and placed on the cart lift by the operator. After confirming the load is within the weight (200 kg) and volume limits (1 cubic yard), the operator places the cart on the lift, pushes the START button, and the waste processing begins. From this point on, the entire process is computer controlled and the operator has no direct contact with the waste. After the contents of the cart are emptied into the hopper, the ozone generator will be activated, and ozone will be injected into the treatment chamber. Waste then falls onto shredder blades, becomes shredded, and shredded material falls down into the treatment chamber. A water vapour system ensures that the relative humidity within the system is maintained between 75 and 100%. The automated system opens the sealing interface and an exhaust fan draws external air into the hopper, forcing any residual ozone that may

remain in the hopper through a Carulite® canister situated in the hopper wall.

Hospitals and health clinics generate bio-medical wastes that have to be managed and disposed of properly in order to protect the general public from pathogens and infectious diseases. Hospital waste can be managed by separating hazardous wastes and placing them in a specially designed container or by treating hazardous wastes and making them non-hazardous.

Treatment processes available for hospital wastes include incineration, steam sterilization, heat treatment, micro- and macro-wave processes, chemical treatment, ozonation, etc. The Ozonator Industries' NG-1000 employs ozone for inactivation of pathogens and infectious disease-causing agents after shredding the waste and reducing its volume by about 90%. The Ozonator NG-1000 is designed to treat bio-hazardous and regulated medical wastes either on-site or off-site.

Verification

This verification was first completed in July 2010 and has been considered valid for subsequent renewal periods every three (3) years thereafter. The original verification was conducted by Amiri Clean Water Technologies of Oakville, Ontario, using the Canadian ETV Program's General Verification Protocol (February 2007). The verification was based on testing results generated by Clifton Associates Ltd. of Regina, Saskatchewan, and bacterial analysis by SunWest Food Laboratory Ltd., Saskatchewan. The ETV renewal of this verification is issued by GLOBE Performance Solutions and is considered to meet the equivalency of an ETV verification completed using the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***.

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV) and was developed and published by the International Organization for Standardization (ISO). The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

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