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September 22, 2007

California Environmental Protection Agency
1001 I Street
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95812-2815

RE: Proposed Regulation to Limit Ozone Emissions from Indoor Air Cleaning Devices

To: California Air Resource Board:

My name is Dr. James Marsden. I am the Regent's Distinguished Professor in the area of food safety and security as Kansas State University. I support the establishment of the 0.05 ppm standard for indoor ozone levels in occupied spaces. However, after evaluating the ARB staff report, there are a few areas that should be addressed before a regulation is finalized. These include recognition of the public health benefits associated with very low ozone levels and the methods for measuring indoor ozone levels.

For the past several years, I have been conducting research evaluating the effect of low levels of ozone for the inactivation of microbiological pathogens, including the following:

- *Staphylococcus aureus*
- Methicillin Resistant *Staphylococcus aureus*
- *Listeria monocytogenes*
- *E. coli* O157:H7
- *Streptococcus* spp.
- *Pseudomonas aeruginosa*
- *Bacillus* spp.
- Candida *albicans*
- *E coli*
- *Stachybotrys chartarum*
- Low Pathogen Avian Influenza
- Viral Surrogates for Hepatitis A.

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In all cases, very low levels of ozone -- 0.02 ppm (well below the standard proposed in the California regulation) have proved effective in controlling these microbiological hazards on inoculated surfaces. A copy of a peer reviewed journal article which I co-authored titled: *Efficacy of EcoQuest Radiant Catalytic Ionization and Breeze AT Ozone Generator in Reducing Microbial Populations on Stainless Steel Surfaces* has been provided for your information. Additional research conducted at the University of Cincinnati also supports the value of low levels of ozone in indoor environments.

The public health implications of this research should be strongly considered by the California ARB, before finalizing a regulation. Every year, the microbiological hazards identified above are responsible for hundreds of thousands of serious infections in the United States. In many cases, especially in susceptible individuals, these infections lead to death. A technology that systematically reduces the presence of biological hazards in indoor environments has applications in homes, schools, office buildings and hospitals and related health care facilities. The technologies produced by EcoQuest International are currently either being used or evaluated in each of these applications.

The California ARB through this regulation should establish a safe level for indoor ozone that supports the public health benefits associated with these technologies. Clearly, the 0.05 ppm limit will accomplish that objective. However, it is extremely important that the testing system used to measure indoor ozone levels is properly defined. The UL procedure identified in the staff report will not accomplish this objective. In the UL testing protocol, ozone is created in a chamber that represents an atypical, sterile environment. There are no natural biological materials in the chamber and as result ozone simply accumulated in an unnatural manner.

Under actual indoor room conditions, there are numerous biological material (i.e. fabric, carpet, furniture, dust and microbes). As the staff points out in its report, ozone is a highly reactive molecule. Under natural conditions, it readily reacts with biological substances. This reaction results in the oxidation of the biological substance and the conversion of ozone to oxygen. Therefore, the levels of ozone in the indoor environment remain very low. Under natural conditions, the indoor ozone levels present even when advanced oxidation cells like the EcoQuest system are continuously producing low levels of ozone, are maintained well below the 0.05 ppm limit and are usually below the natural outdoor ozone levels (even in areas with very low levels of outdoor air pollution).

The test for measuring indoor ozone levels should be conducted in a room environment that is controlled, but that includes natural biological materials. A recommended protocol has been submitted for your consideration. A protocol could be developed in cooperation with UL and other recognized organizations that set US and international standards.