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To whom it may concern:

Ultraviolet (UV) disinfection involves a photochemical alteration of the structure of DNA; these are called lesions. If enough lesions are created this renders a microorganism incapable of replication. Such microorganisms, although technically metabolically alive, cannot cause disease because they cannot reproduce.

The extent of UV treatment is characterized by the term "UV inactivation", which is the logarithm of the ratio of the total number of microorganisms to the number of viable microorganisms. Often the log inactivation is found to be proportional to the UV dose applied. For example, if the log inactivation is 1.0 at a UV dose of 5 mJ/cm^2, then the log inactivation would be 2.0 at a UV dose of 10 mJ/cm^2, and so on. This means that no matter how high the UV dose, there will always be a few viable microorganisms. In fact, this first order kinetic response is common among all disinfection technologies. However, this is of no concern because for each pathogenic microorganism, there is a minimum number of pathogenic microorganisms that must be ingested before the patient can get sick. As long as the number of viable pathogenic microorganisms is much smaller that this critical number, there is no danger. Given the above explanation, the term "sterilization", which means total death of all microorganisms should not be used for UV and other (e.g., chlorination or ozonation)) disinfection processes.

Given the above explanation, grow out methods should be allowed by regulators, because the loss of the ability to reproduce is as-good-as-dead – a basic principle of disinfection. This is safe for protecting human health (non-reproductive organisms cannot multiply and cause an infection), and is also safe for protecting the environment (non-reproductive organisms cannot establish a new population and invade a new environment).

A good example is the story of *Cryptosporidium*, a protozoan parasite that caused a major public health problem in Milwaukee, WI in the early 1990's. Prior to 1998, it was thought that *Cryptosporidium* could not be treated effectively with UV because very high UV doses (hundreds of mJ/cm^2) were required to "kill" the *Cryptosporidium* oocysts. However, as a result of research conducted by myself and a large team of researchers,* it was found that if an infectivity assay was used, such as the infection of neonatal mice, *Cryptosporidium* oosysts are in fact very sensitive to UV. The problem with the earlier research was that the assay used was one that focused on damage to the oocyst membrane (excystation or vital dye assays) which has little to do with infection efficacy.

An important principle of all disinfection processes is that the assay should be consistent with the mode of inactivation for that treatment. Stain methods may be useful for some research, but grow-out methods (such as infectivity, culturing, and MPN) are suitable for measuring the response of all treatments because both inactivated and killed cells will not grow out.

In conclusion, the ability to reproduce is a fundamental property required for infection or invasion. Hence, it is important that regulations recognize this principle to provide adequate protection of human health and the environment.

Yours sincerely,

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* Bolton, J. R., Dussert, B., Bukhari, Z., Hargy, T. M., Clancy, J. L., (1998) Inactivation of Cryptosporidium parvum by Medium-Pressure Ultraviolet Light in Finished Drinking Water, Proc. AWWA 1998 Annual Conference, Dallas, TX, American Water Works Association, Denver, CO, Vol. A, pp 389–403.