

earlier studies (Schuler and Gosh 1990, Ongerth and Hutton 1997) in showing that a well designed and operated DE plant can achieve *Cryptosporidium* removal equivalent to a conventional treatment plant (*i.e.*, average of 3 log).

d. *Other filtration technologies.* In today's proposal, information about bag filters, cartridge filters, and membranes, including criteria for awarding *Cryptosporidium* treatment credit, is presented in section IV.C as part of the microbial toolbox. Section IV.C also addresses credit for pretreatment options like presedimentation basins and bank filtration.

e. *Inactivation.* Substantial advances in understanding of *Cryptosporidium* inactivation by ozone, chlorine dioxide, and UV have been made following the IESWTR and LT1ESWTR. These advances have allowed EPA to develop criteria to award *Cryptosporidium* treatment credit for these disinfectants. Relevant information is summarized next, with additional information sources noted.

i. Ozone and chlorine dioxide. With the completion of several major studies, EPA has acquired sufficient information to develop standards for the inactivation of *Cryptosporidium* by ozone and chlorine dioxide. For both of these disinfectants, today's proposal includes CT tables that specify a level of *Cryptosporidium* treatment credit based on the product of disinfectant concentration and contact time.

For ozone, the CT tables in today's proposal were developed through considering four sets of experimental data: Li *et al.* (2001), Owens *et al.* (2000), Oppenheimer *et al.* (2000), and Rennecker *et al.* (1999). Chlorine dioxide CT tables are based on three experimental data sets: Li *et al.* (2001), Owens *et al.* (1999), and Ruffell *et al.* (2000). Together these studies provide a large body of data that covers a range of water matrices, both laboratory and natural. While the data exhibit variability, EPA believes that collectively they are sufficient to determine appropriate levels of

treatment credit as a function of disinfection conditions. CT tables for ozone and chlorine dioxide inactivation of *Cryptosporidium* are presented in Section IV.C.14 of this preamble.

ii. Ultraviolet light. A major recent development is the finding that UV light is highly effective for inactivating *Cryptosporidium* and *Giardia* at low doses. Research prior to 1998 had indicated that very high doses of UV light were required to achieve substantial disinfection of protozoa. However, as noted previously, these results were largely based on the use of *in vitro* assays, which were later shown to substantially overestimate the UV doses required to prevent infection (Clancy *et al.* 1998, Bukhari *et al.* 1999, Craik *et al.* 2000). Recent research using *in vivo* assays (*e.g.*, neonatal mouse infectivity) and cell culture techniques to measure infectivity has provided strong evidence that both *Cryptosporidium* and *Giardia* are highly sensitive to low doses of UV.

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