

depends in part, or entirely, on the size of the organism. For example, a study by Goodrich and Lykins (1995) evaluating bag filters showed that any microbe or object greater than 4.5 microns in size (the average size of *Cryptosporidium*) would be subject to removal ranging from 0.5 to 2.0 logs.

Although not directly dependent on organism size, other treatment technologies identified in the LT2ESWTR should also provide additional control of co-occurring microbial pathogens. Membrane processes that remove *Cryptosporidium* are shown to achieve equivalent log removal of *Giardia* under worst-case and normal operating conditions (USEPA 2003c). Reduction in individual filter turbidities will reduce concentrations of other pathogens as well as *Cryptosporidium*. For example, in Dutch surface water, *Giardia* and *Cryptosporidium* occurrence appeared to correlate well with each other and for the Rhine River, with turbidity (Medema *et al.* 2001). Thus, improved control of *Cryptosporidium* should also result in improved control of *Giardia lamblia*.

Some membrane technologies that might be installed to comply with the LT2ESWTR can also reduce or eliminate chemical contaminants including arsenic, DBPs and atrazine. EPA has recently finalized a rule to further control arsenic levels in drinking water and is concurrently proposing the Stage 2 DBPR to address DBP control.

The extent to which the LT2ESWTR can reduce the overall risk from other contaminants has not been quantitatively evaluated because of the Agency's lack of data regarding the co-occurrence among *Cryptosporidium* and other microbial pathogens and contaminants. Because of the difficulties in establishing which systems would have multiple problems, such as microbial contamination, arsenic, and DBPs or any combination of the three, no estimate was made of the potential cost savings from addressing more than one contaminant simultaneously.

H. Are There Increased Risks From Other Contaminants?

It is unlikely that the LT2ESWTR will result in a significant increase in risk from other contaminants. Many of the options that systems will select to comply with the LT2ESWTR, such as UV, improved filtration performance, and watershed control, do not form DBPs. Other technologies that are effective against *Cryptosporidium*, such as ozone and chlorine dioxide, do form DBPs. However, these DBPs are currently regulated under the Stage 1

DBPR, and systems will have to comply with these regulations when implementing technologies to meet the LT2ESWTR.

I. What Are The Effects of the Contaminant on the General Population and Groups Within the General Populations That Are Identified as Likely To Be at Greater Risk of Adverse Health Effects?

Section II of this preamble discusses the health effects associated with *Cryptosporidium* on the general population as well as the effects on other sensitive sub-populations. In addition, health effects associated with children and pregnant women are discussed in greater detail in section VII.G of this preamble.

J. What Are the Uncertainties in the Baseline, Risk, Benefit, and Cost Estimates for the Proposed LT2ESWTR as Well as the Quality and Extent of the Information?

Today's proposal models the current baseline risk from *Cryptosporidium* exposure, as well as the reduction in risk and the cost for various rule options. There is uncertainty in the risk calculation, the benefit estimate, the cost estimates, and the interaction of other upcoming rules. Section IV of the proposed rule considers the uncertainty with the risk estimates; however, a brief summary of the major risk uncertainties as they relate to benefit estimation is provided next. In addition, the LT2ESWTR EA has a more extensive discussion of all of the uncertainties (USEPA 2003a).

In addition, the Agency conducted sensitivity analyses to address uncertainty. The sensitivity analyses focus on various occurrence, benefit and cost factors that may have a significant effect on the estimated impacts of the rule. All of these sensitivity analyses are explained in more detail in the EA for the LT2ESWTR (USEPA 2003a).

One area of uncertainty is associated with the estimate of *Cryptosporidium* occurrence on a national basis. The Information Collection Rule plant-mean data were higher than the ICRSS medium or large system plant-mean data at the 90th percentile. The reasons for these differing results are not well understood but may stem from differences in the populations sampled, year-to-year variation in occurrence, and systematic differences in the sampling and measurement methods employed. These data suggest that *Cryptosporidium* levels are relatively low in most water sources, but there is a subset of sources with significantly higher concentrations. Additional

uncertainty is associated with estimating finished water occurrence because the analysis is based on assumptions about treatment plant performance. To account for these uncertainties, the Agency used Monte Carlo simulation models that allow substantial variation in each estimate and computed finished water occurrence values based on statistical sampling of the variable estimates.

The risk associated with finished water occurrence is of lesser uncertainty than is typical for many contaminants because the health effects are measured based on *Cryptosporidium* challenge studies to human volunteer populations. Nevertheless, there is significant uncertainty about the dose-response associated with *Cryptosporidium* because there exists considerable differences in infectivity among the various tested *Cryptosporidium parvum* isolates. As described in section III.B, the Agency accounted for these differences using Monte Carlo simulations that randomly sampled from infectivity distributions for the three tested isolates. The different simulations were designed to account for the limited number of challenge studies and the variability in the infectivity of the isolates themselves. In addition, because the *Cryptosporidium* dosing levels in the human feeding studies were above typical drinking water exposure levels (e.g., one oocyst), there remains significant uncertainty that could not be quantified into the analysis.

While all of the significant costs of today's proposed rule have been identified by EPA, there are uncertainties about some of the estimates. However, the Agency explored the impact of the uncertainties that might have the greatest impact by conducting sensitivity analyses and using Monte Carlo techniques. For example, section VI.D.2.f of today's rule explores the impact of influent bromide levels on technology selection. As shown in the EA for this rule, the impact of higher influent bromide levels will not have a significant impact on the rule's costs. In addition, subsection 6.12 of the EA summarizes other cost uncertainties including the Agency's inability to include some lower cost toolbox options in the cost analysis (USEPA 2003a).

Last, EPA has recently finalized new regulations for arsenic, radon, *Cryptosporidium* in small surface water systems, and filter backwash in all system sizes (LT1ESWTR and Filter Backwash Rule); proposed a rule for microbials in ground water systems (Ground Water Rule); and is