

from the raw water and dampen particle loading to the rest of the treatment plant. Presedimentation is similar to conventional sedimentation, except that presedimentation may be operated at higher loading rates and may not involve use of chemical coagulants. Also, some systems operate the presedimentation process periodically and only in response to periods of high particle loading.

Because presedimentation reduces particle concentrations, it is expected to reduce *Cryptosporidium* levels. In addition, by dampening variability in source water quality, presedimentation may improve the performance of subsequent treatment processes. In general, the efficacy of presedimentation in lowering particle levels is influenced by a number of water quality and treatment parameters including surface loading rate, temperature, particle concentration, coagulation, and characteristics of the sedimentation basin.

The Stage 2–M–DBP Agreement in Principle recommends 0.5 log presumptive *Cryptosporidium* treatment credit for presedimentation with the use of coagulant. Today's proposal is consistent with this recommendation. However, the proposed requirement for demonstrated turbidity reduction as a condition for presedimentation credit represents a change from the November 2001 pre-proposal draft of the LT2ESWTR (USEPA 2001g). Rather than a requirement for turbidity removal, the 2001 pre-proposal draft included criteria for maximum overflow rate and minimum influent turbidity as conditions for the 0.5 log presedimentation credit.

The Science Advisory Board (SAB) reviewed the criteria and supporting information for presedimentation credit

in the November 2001 pre-proposal draft (see section VII.K). In written comments from a December 2001 meeting of the SAB Drinking Water Committee, the panel concluded that available data were minimal to support a 0.5 log presumptive credit and recommended that no credit be given for presedimentation. Additionally, the panel stated that performance criteria other than overflow rate need to be included if credit is to be given for presedimentation.

Due to this finding by the SAB, EPA further reviewed data on removal of aerobic spores (as an indicator of *Cryptosporidium* removal) and turbidity in full-scale presedimentation basins. As shown later in this section, these data indicate that presedimentation basins achieving a monthly mean reduction in turbidity of at least 0.5 log have a high likelihood of reducing mean *Cryptosporidium* levels by 0.5 log or more. Consequently, EPA has determined that it is appropriate to use turbidity reduction as a performance criterion for awarding *Cryptosporidium* treatment credit to presedimentation basins. The Agency believes this performance criterion addresses the concerns raised by the SAB.

The Agency has concluded that it is appropriate to limit eligibility for the 0.5 log presumptive *Cryptosporidium* treatment credit to systems that install presedimentation after LT2ESWTR monitoring. Systems with presedimentation in place prior to initiation of LT2ESWTR *Cryptosporidium* monitoring may sample after the presedimentation basin to determine their bin assignment. In this case, the effect of presedimentation in reducing *Cryptosporidium* levels will be reflected in the monitoring results

and bin assignment. Systems that monitor after presedimentation are not subject to the operational and performance requirements associated with the 0.5 log credit. The SAB agreed that a system should be able to sample after the presedimentation treatment process for appropriate bin placement.

In considering criteria for awarding *Cryptosporidium* removal credit to presedimentation, EPA has evaluated both published studies and data submitted by water systems using presedimentation. There is relatively little published data on the removal of *Cryptosporidium* by presedimentation. Consequently, EPA has reviewed studies that investigated *Cryptosporidium* removal by conventional sedimentation basins. These studies are informative regarding potential levels of performance, the influence of water quality parameters, and correlation of *Cryptosporidium* removal with removal of potential surrogates. However, removal efficiency in conventional sedimentation basins may be greater than in presedimentation due to lower surface loading rates, higher coagulant doses, and other factors. To supplement these studies, EPA has evaluated data provided by utilities on removal of other types of particles, primarily aerobic spores, in the presedimentation processes of full scale plants. Data indicate that aerobic spores may serve as a surrogate for *Cryptosporidium* removal by sedimentation (Dugan *et al.* 2001).

i. Published studies of *Cryptosporidium* removal by conventional sedimentation basins. Table IV–10 summarizes results from published studies of *Cryptosporidium* removal by conventional sedimentation basins.

TABLE IV–10.—SUMMARY OF PUBLISHED STUDIES OF *Cryptosporidium* REMOVAL BY CONVENTIONAL SEDIMENTATION BASINS

Author(s)	Plant/process type	<i>Cryptosporidium</i> removal by sedimentation
Dugan <i>et al.</i> (2001)	Pilot scale conventional	0.6 to 1.6 log (average 1.3 log).
States <i>et al.</i> (1997)	Full scale conventional with primary and secondary sedimentation.	0.41 log.
Edzwald and Kelly (1998)	Bench scale sedimentation	0.8 to 1.2 log.
Payment and Franco (1993)	Full scale conventional (2 plants)	3.8 log and 0.7 log.
Kelly <i>et al.</i> (1995)	Full scale conventional (two stage lime softening)	0.8 log.
	Full scale conventional (two stage sedimentation)	0.5 log.
Patania <i>et al.</i> (1995)	Pilot scale conventional (3 plants)	2.0 log (median).

Dugan *et al.* (2001) evaluated the ability of conventional treatment to control *Cryptosporidium* under different water quality and treatment conditions on a small pilot scale plant that had

been demonstrated to provide equivalent performance to a larger plant. Under optimal coagulation conditions, oocyst removal across the sedimentation basin ranged from 0.6 to 1.6 log,

averaging 1.3 log. Suboptimal coagulation conditions (underdosed relative to jar test predictions) significantly reduced plant performance with oocyst removal in the