

6.0 Lime Softening

6.1 Introduction

Lime softening is a drinking water treatment process that uses chemical precipitation with lime and other chemicals to reduce hardness and to enhance clarification prior to filtration. Lime softening can be categorized into two general types: (1) single stage softening that is used to remove calcium hardness and (2) two-stage softening that is used to remove magnesium hardness and high levels of calcium hardness. A single stage softening plant includes a primary clarifier and filtration components. A two stage softening plant has an additional clarifier located between the primary clarifier and filter. Within these general categories there are several possible treatment schemes; however, describing each is beyond the scope of this chapter.

This toolbox option is practical for lime softening plants that either have a two stage process or could upgrade to a two stage process. The advantage of using this toolbox option to achieve compliance with the LT2ESWTR is that systems will have the treatment process in place or if an upgrade or modification is needed, it could benefit the treatment of other contaminants. A disadvantage for softening plants is a potential reduced flexibility in the treatment train since all water must be treated by both stages.

Since the water systems considering this toolbox option will most likely have a lime softening process in place, this section does not provide design or operational information. Instead, this section focuses on the requirements that lime softening systems must meet to receive *Cryptosporidium* removal credit and how those requirements can be met with general process modifications. The chapter is organized into two sections:

- 6.2 LT2ESWTR Compliance Requirements - describes the criteria that plants must meet in order to receive additional credit for *Cryptosporidium* removal, and reporting requirements to maintain compliance.

- 6.3 Split Flow Processes - addresses compliance issues for split flow processes.

6.2 LT2ESWTR Compliance Requirements

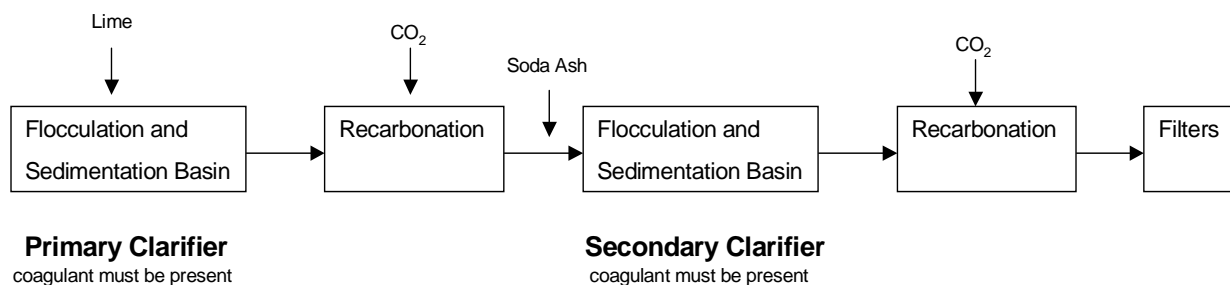
6.2.1 Credit for *Cryptosporidium* Removal

The LT2ESWTR requires plants to meet the following criteria in order to receive 0.5 log credit towards additional *Cryptosporidium* treatment requirements (40 CFR 141.726(b)):

- The plant must have a second clarification step between the primary clarifier¹ and filter which is operated continuously. For split treatment processes, only the portion of flow going through two clarification stages can receive credit. If a portion of flow bypasses one stage, additional treatment must be provided to the bypassed portion (see section 6.3).
- A coagulant must be present in both clarifiers. Precipitation of metal salts (e.g., magnesium hydroxide or excess lime) could be considered a coagulant for the second clarifier.

Figure 6.1 shows a typical two stage lime softening process. Lime or lime and soda ash are added at the first stage. To receive treatment credit for this type of process, both stages of clarification must have a coagulant present.

Figure 6.1 Typical Two-Stage Lime Softening Process



¹ For purposes of compliance with the lime-softening toolbox option, “clarifier” is used as a general term for processes with settling.

6.2.2 Reporting Requirements

The LT2ESWTR requires monthly verification and reporting of the following conditions for systems using the lime softening option (40 CFR 141.730):

- Continuous operation of a second clarification step between the primary clarifier and filter
- Continuous presence of coagulant in the first and second stage clarifiers
- Both clarifiers treat 100 percent of the plant flow

In addition, EPA recommends submitting a schematic of the treatment process to the State, clearly identifying the two stages of clarification. EPA also recommends that systems monitor the coagulant dosages (or concentration) in the secondary clarifier on a daily basis, for the first year, and record the average and minimum coagulant concentrations. This data can assist the State in assessing whether the system operates in compliance at all times.

6.3 Spilt-Flow Processes

Split-flow processes divert a portion of the flow from either the first or second stage of the process and then blend the two streams together further downstream. Only the portion of flow that receives the two stages of treatment would be eligible for the 0.5 log credit. In these situations, systems would either have to: 1) eliminate the bypass and direct the entire flow through both stages, or 2) treat the bypassed portion with another toolbox option, such as chlorine dioxide, membranes, or ozone to receive 0.5 log credit for that stream.