



TCEQ REGULATORY GUIDANCE

Water Supply Division

RG-569 • Revised December 2020

Public Water System: Removal Credit for Reverse Osmosis and Nanofiltration Membranes

A Public Water System (PWS) that treats surface water, groundwater under the influence of surface water, or rain water must achieve at least a 2.0-log (99%) removal or inactivation of *Cryptosporidium parvum*, 3.0-log (99.9%) removal or inactivation of *Giardia lamblia*, and a 4.0-log (99.99%) removal or inactivation of viruses. This External Guidance document guides PWSs who would like to use Reverse Osmosis (RO) or Nanofiltration (NF) membranes as a means of removing the above pathogens.

Acronyms and Definitions

Term	Definition
Challenge Testing	A study conducted to determine the removal efficiency (log removal value) of a device for a particular organism, particulate, or surrogate.
Concentration-Time (CT) Study	A technical determination of disinfection performance based on the disinfectant concentrations and the effective contact time of each disinfectant.
<i>Cryptosporidium parvum</i> , <i>Giardia lamblia</i>	Waterborne pathogenic microorganisms.
Direct Integrity Testing (DIT)	A physical test applied to a membrane unit in order to identify and isolate integrity breaches/leaks that could result in contamination of the filtrate.
Nanofiltration (NF)	A pressure-driven membrane separation process that employs the principles of reverse osmosis to remove dissolved contaminants from water; typically applied for membrane softening or the removal of dissolved organic contaminants.
Reverse Osmosis (RO)	The reverse of the natural osmosis process – i.e., the passage of a solvent (e.g., water) through a semi-permeable membrane from a solution of higher concentration to a solution of lower concentration against the concentration gradient, achieved by applying pressure greater than the osmotic pressure to the more concentrated solution; also the pressure-driven membrane separation process that employs the principles of reverse osmosis to remove dissolved contaminants from water.
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality

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Membranes for Pathogen Removal Review

The TCEQ has determined that spiral wound membranes such as RO may be considered for pathogen removal credit on a case-by-case basis. To receive pathogen removal credit for RO/NF membranes, the following must be provided:

- Challenge testing of the membrane module that evaluated the removal efficiency of microbes, and documentation that the challenge test was conducted according to the criteria established by 40 Code of Federal regulations (CFR) 141.719(b)(2). (30 TAC 290.42(g)(3)(A))
- A direct integrity testing (DIT) method that demonstrates both the resolution and sensitivity sufficient to verify the pathogen removal is equal to or greater than the removal credits required by the TCEQ. (30 TAC 290.42(g)(3)(B))

Until DITs for spiral wound systems become commercially available to satisfy the above regulatory requirements, the TCEQ will be unable to assign pathogen removal credit for specific RO membrane systems. If a DIT method becomes available, credit will be considered on a case-by-case basis. Currently, marker-based methods are being developed for considerations of the DIT, but no credit has been given for pathogen removal for RO/NF membranes.

