

conducted to verify any repairs, and the membrane unit may be returned to service only if the direct integrity test is within the established control limit.

(vi) Direct integrity testing must be conducted on each membrane unit at a frequency of not less than once each day that the membrane unit is in operation.

(4) *Indirect integrity monitoring.*

Systems must conduct continuous indirect integrity monitoring on each membrane unit according to the criteria in paragraphs (b)(4)(i) through (b)(4)(v) of this section. A system that implements continuous direct integrity testing of membrane units in accordance with the criteria in paragraphs (b)(3)(i) through (b)(3)(v) of this section is not subject to the requirements for continuous indirect integrity monitoring.

(i) Unless the State approves an alternative parameter, continuous indirect integrity monitoring must include continuous filtrate turbidity monitoring.

(ii) Continuous monitoring must be conducted at a frequency of no less than once every 15 minutes.

(iii) Continuous monitoring must be separately conducted on each membrane unit.

(iv) If indirect integrity monitoring includes turbidity and if the filtrate turbidity readings are above 0.15 NTU

for a period greater than 15 minutes (*i.e.*, two consecutive 15-minute readings above 0.15 NTU), direct integrity testing must be performed on the associated membrane units as specified in paragraphs (b)(3)(i) through (b)(3)(v) of this section.

(v) If indirect integrity monitoring includes a State-approved alternative parameter and if the alternative parameter exceeds a State-approved control limit for a period greater than 15 minutes, direct integrity testing must be performed on the associated membrane units as specified in paragraphs (b)(3)(i) through (b)(3)(v) of this section.

(c) *Second stage filtration.* Systems are eligible for an additional 0.5 log *Cryptosporidium* removal credit if they have a separate second stage filtration process consisting of rapid sand, dual media, GAC, or other fine grain media in a separate stage following rapid sand or dual media filtration. To be eligible for this credit, the first stage of filtration must be preceded by a coagulation step and both filtration stages must treat 100% of the flow. A cap, such as GAC, on a single stage of filtration is not eligible for this credit.

(d) *Slow sand filtration.* Systems may claim a 2.5 log *Cryptosporidium* removal credit for a slow sand filtration process that follows another separate filtration process if all the flow is

treated by both processes and no disinfectant residual is present in the influent water to the slow sand filtration process.

§ 141.729 Inactivation toolbox components.

(a) *Calculation of CT values.* (1) CT is the product of the disinfectant contact time (T, in minutes) and disinfectant concentration (C, in milligrams per liter). Systems must calculate CT at least once each day, with both C and T measured during peak hourly flow as specified in §§ 141.74(a) and 141.74(b).

(2) Systems with several disinfection segments (a segment is defined as a treatment unit process with a measurable disinfectant residual level and a liquid volume) in sequence along the treatment train, may calculate the CT for each disinfection segment and use the sum of the *Cryptosporidium* log inactivation values achieved through the plant.

(b) *CT values for chlorine dioxide.* (1) Systems using chlorine dioxide must calculate CT in accordance with § 141.729(a).

(2) Unless the State approves alternative CT values for a system under paragraph (b)(3) of this section, systems must use the following table to determine *Cryptosporidium* log inactivation credit:

CT VALUES FOR *Cryptosporidium* INACTIVATION BY CHLORINE DIOXIDE

Log credit	Water Temperature, °C ¹									
	≤0.5	1	2	3	5	7	10	15	20	25
0.5	319	305	279	256	214	180	138	89	58	38
1.0	637	610	558	511	429	360	277	179	116	75
1.5	956	915	838	767	643	539	415	268	174	113
2.0	1275	1220	1117	1023	858	719	553	357	232	150
2.5	1594	1525	1396	1278	1072	899	691	447	289	188
3.0	1912	1830	1675	1534	1286	1079	830	536	347	226

¹ CT values between the indicated temperatures may be determined by interpolation.

(3) Systems may conduct a site-specific inactivation study to determine the CT values necessary to meet a specified *Cryptosporidium* log inactivation level, using a State-approved protocol. The alternative CT

values determined from the site-specific study and the method of calculation must be approved by the State.

(c) *CT values for ozone.* (1) Systems using ozone must calculate CT in accordance with § 141.729(a).

(2) Unless the State approves alternative CT values for a system under paragraph (c)(3) of this section, systems must use the following table to determine *Cryptosporidium* log inactivation credit:

CT VALUES FOR *Cryptosporidium* INACTIVATION BY OZONE

Log credit	Water Temperature, °C ¹									
	≤0.5	1	2	3	5	7	10	15	20	25
0.5	12	12	10	9.5	7.9	6.5	4.9	3.1	2.0	1.2
1.0	24	23	21	19	16	13	9.9	6.2	3.9	2.5
1.5	36	35	31	29	24	20	15	9.3	5.9	3.7
2.0	48	46	42	38	32	26	20	12	7.8	4.9
2.5	60	58	52	48	40	33	25	16	9.8	6.2