

**TABLE B-1  
CT VALUES\* FOR 3-LOG INACTIVATION  
OF GIARDIA CYSTS BY FREE CHLORINE**

Chlorine Concentration (mg/L)	Temperature <=0.5°C										Temperature =5°C										Temperature = 10°C									
	pH										pH										pH									
	<=6.0	6.5	7.0	7.5	8.0	8.5	9.0	<=6.0	6.5	7.0	7.5	8.0	8.5	9.0	<=6.0	6.5	7.0	7.5	8.0	8.5	9.0	<=6.0	6.5	7.0	7.5	8.0	8.5	9.0		
<=0.4	137	163	195	237	277	329	390	97	117	139	166	198	236	279	73	88	104	125	149	177	209	73	88	104	125	149	177	209		
0.6	141	168	200	239	286	342	407	100	120	143	171	204	244	291	75	90	107	128	153	183	218	75	90	107	128	153	183	218		
0.8	145	172	205	246	295	354	422	103	122	146	175	210	252	301	78	92	110	131	158	189	226	78	92	110	131	158	189	226		
1.0	148	176	210	253	304	365	437	105	125	149	179	216	260	312	79	94	112	134	162	195	234	79	94	112	134	162	195	234		
1.2	152	180	215	259	313	376	451	107	127	152	183	221	267	320	80	95	114	137	166	200	240	80	95	114	137	166	200	240		
1.4	155	184	221	266	321	387	464	109	130	155	187	227	274	329	82	98	116	140	170	206	247	82	98	116	140	170	206	247		
1.6	157	189	226	273	329	397	477	111	132	158	192	232	281	337	83	99	119	144	174	211	253	83	99	119	144	174	211	253		
1.8	162	193	231	279	338	407	489	114	135	162	196	238	287	345	86	101	122	147	179	215	259	86	101	122	147	179	215	259		
2.0	165	197	236	286	346	417	500	116	138	165	200	243	294	353	87	104	124	150	182	221	265	87	104	124	150	182	221	265		
2.2	169	201	242	297	353	426	511	118	140	169	204	248	300	361	89	105	127	153	186	225	271	89	105	127	153	186	225	271		
2.4	172	205	247	298	361	435	522	120	143	172	209	253	306	368	90	107	129	157	190	230	276	90	107	129	157	190	230	276		
2.6	175	209	252	304	368	444	533	122	146	175	213	258	312	375	92	110	131	160	194	234	281	92	110	131	160	194	234	281		
2.8	178	213	257	310	375	452	543	124	148	178	217	263	318	382	93	111	134	163	197	239	287	93	111	134	163	197	239	287		
3.0	181	217	261	316	382	460	552	126	151	182	221	268	324	389	95	113	137	166	201	243	292	95	113	137	166	201	243	292		
Chlorine Concentration (mg/L)	Temperature = 15°C										Temperature = 20°C										Temperature = 25°C									
	pH										pH										pH									
	<=6.0	6.5	7.0	7.5	8.0	8.5	9.0	<=6.0	6.5	7.0	7.5	8.0	8.5	9.0	<=6.0	6.5	7.0	7.5	8.0	8.5	9.0	<=6.0	6.5	7.0	7.5	8.0	8.5	9.0		
<=0.4	49	59	70	83	99	118	140	36	44	52	62	74	89	105	24	29	35	42	50	59	70	24	29	35	42	50	59	70		
0.6	50	60	72	86	102	122	146	38	45	54	64	77	92	109	25	30	36	43	51	61	73	25	30	36	43	51	61	73		
0.8	52	61	73	88	105	126	151	39	46	55	66	79	95	113	26	31	37	44	53	63	75	26	31	37	44	53	63	75		
1.0	53	63	75	90	108	130	156	39	47	56	67	81	98	117	26	31	37	45	54	65	78	26	31	37	45	54	65	78		
1.2	54	64	76	92	111	134	160	40	48	57	69	83	100	120	27	32	38	46	55	67	80	27	32	38	46	55	67	80		
1.4	55	65	78	94	114	137	165	41	49	58	70	85	103	123	27	33	39	47	57	69	82	27	33	39	47	57	69	82		
1.6	56	66	79	96	116	141	169	42	50	59	72	87	105	126	28	33	40	48	58	70	84	28	33	40	48	58	70	84		
1.8	57	68	81	98	119	144	173	43	51	61	74	89	108	129	29	34	41	49	60	72	86	29	34	41	49	60	72	86		
2.0	58	69	83	100	122	147	177	44	52	62	75	91	110	132	29	35	41	50	61	74	88	29	35	41	50	61	74	88		
2.2	59	70	85	102	124	150	181	44	53	63	77	93	113	135	30	35	42	51	62	75	90	30	35	42	51	62	75	90		
2.4	60	72	86	105	127	153	184	45	54	65	78	95	115	138	30	36	43	52	63	77	92	30	36	43	52	63	77	92		
2.6	61	73	88	107	129	156	188	46	55	66	80	97	117	141	31	37	44	53	65	78	94	31	37	44	53	65	78	94		
2.8	62	74	89	109	132	159	191	47	56	67	81	99	119	143	31	37	45	54	66	80	96	31	37	45	54	66	80	96		
3.0	63	76	91	111	134	162	195	47	57	68	83	101	122	146	32	38	46	55	67	81	97	32	38	46	55	67	81	97		

\*Although units did not appear in the original tables, units are min-mg/L.

Table D-7. CT Values for Inactivation of Viruses by Free Chlorine

pH	Log Inactivation					
	2.0		3.0		4.0	
Temperature (C)	6-9	10	6-9	10	6-9	10
0.5	6	45	9	66	12	90
5	4	30	6	44	8	60
10	3	22	4	33	6	45
15	2	15	3	22	4	30
20	1	11	2	16	3	22
25	1	7	1	11	2	15

Table D-8. CT Values for Inactivation of *Giardia* Cysts by Chlorine Dioxide

	Temperature (C)					
	< = 1	5	10	15	20	25
0.5-log	10	4.3	4	3.2	2.5	2
1-log	21	8.7	7.7	6.3	5	3.7
1.5-log	32	13	12	10	7.5	5.5
2-log	42	17	15	13	10	7.3
2.5-log	52	22	19	16	13	9
3-log	63	26	23	19	15	11

Table D-9. CT Values for Inactivation of Viruses by Chlorine Dioxide pH 6-9

	Temperature (C)					
	< = 1	5	10	15	20	25
2-log	8.4	5.6	4.2	2.8	2.1	1.4
3-log	25.6	17.1	12.8	8.6	6.4	4.3
4-log	50.1	33.4	25.1	16.7	12.5	8.4

Table D-10. C . Values for Inactivation of *Giardia* Cysts by Ozone

	Temperature (C)					
	< = 1	5	10	15	20	25
0.5-log	0.48	0.32	0.23	0.16	0.1	0.08
1-log	0.97	0.63	0.48	0.32	0.2	0.16
1.5-log	1.5	0.95	0.72	0.48	0.36	0.24
2-log	1.9	1.3	0.95	0.63	0.48	0.32
2.5-log	2.4	1.6	1.2	0.79	0.6	0.4
3-log	2.9	1.9	1.43	0.95	0.72	0.48

Table D-3. CT Values for Inactivation of *Giardia* Cysts by Free Chlorine at 10 °C

Chlorine concentration (mg/L)	pH < 6.0					pH = 6.5					pH = 7.0					pH = 7.5								
	0.5	1	1.5	2	2.5	3.0	0.5	1	1.5	2	2.5	3.0	0.5	1	1.5	2	2.5	3.0	0.5	1	1.5	2	2.5	3.0
c - 0.4	12	24	37	49	81	73	15	20	44	50	73	88	17	35	52	69	87	104	21	42	63	83	104	125
0.8	13	25	38	50	63	75	15	30	45	80	75	90	18	36	54	71	89	107	21	43	64	85	107	128
0.9	13	28	39	52	85	78	15	31	48	61	77	92	18	37	55	73	92	110	22	44	68	87	109	131
1	13	26	40	53	66	79	16	31	47	83	78	94	10	37	58	75	93	112	22	45	67	89	112	134
1.2	13	27	40	53	67	80	16	32	48	63	79	95	19	38	57	76	95	114	23	48	70	91	114	137
1.4	14	27	41	55	88	82	18	33	49	85	82	98	19	39	58	77	97	118	23	47	70	93	117	140
1.8	14	26	42	55	69	83	17	33	50	66	93	99	20	40	60	79	99	119	24	46	72	96	120	144
1.6	14	29	43	57	72	88	17	34	51	67	84	101	20	41	61	81	102	122	25	47	74	98	123	147
2	15	20	44	58	73	87	17	35	52	69	87	104	21	41	62	83	103	124	25	50	75	100	125	150
2.2	15	30	45	59	74	89	18	35	53	70	88	105	21	42	64	85	106	127	26	51	77	102	128	153
2.4	15	30	45	60	75	90	18	36	54	71	89	107	22	43	65	88	108	129	28	52	79	105	131	157
2.6	15	31	48	61	77	92	10	37	55	73	92	110	22	44	66	87	109	131	27	53	80	107	133	160
2.8	18	31	47	62	78	93	10	37	56	74	93	111	22	45	67	89	112	134	27	54	82	109	136	163
3	16	32	49	63	79	95	19	38	57	75	94	113	23	46	69	91	114	137	29	55	83	111	138	168
Chlorine concentration (mg/L)	pH = a.0					pH = 6.5					pH < 9.0													
	0.5	1	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0						
C - 0.4	25	50	75	100	124	149	30	59	89	119	148	177	35	70	105	139	174	209						
0.8	28	51	77	102	128	153	31	61	92	122	153	183	38	73	109	145	182	218						
0.8	28	53	79	105	132	158	32	63	95	126	158	180	38	75	113	151	188	228						
1	27	54	81	108	135	162	33	65	98	130	163	195	39	78	117	156	195	234						
1.2	28	55	83	111	136	168	33	67	100	133	167	200	40	80	120	160	200	240						
1.4	28	57	85	113	142	170	34	69	103	137	172	208	41	82	124	165	208	247						
1.8	20	58	87	116	145	174	35	70	106	141	178	211	42	84	127	168	211	243						
1.8	30	80	110	149	179	215	36	72	108	143	179	215	43	86	130	173	218	250						
2	30	81	111	150	180	216	37	74	111	147	184	221	44	88	133	177	221	285						
2.2	31	82	112	151	181	217	38	75	113	150	188	225	45	90	136	181	228	271						
2.4	32	83	113	152	182	218	38	77	115	153	192	230	46	92	138	184	230	278						
2.8	32	85	115	154	184	220	39	79	117	158	195	234	47	94	141	187	234	281						
2.8	33	86	116	155	185	221	40	80	120	160	198	238	48	96	144	191	238	287						
3	34	87	117	156	186	222	41	81	122	162	203	243	40	97	148	195	243	202						

NOTE: CT 99.9 = CT for 3-log inactivation.