

## **Chlorophenol Aquatic Life Water Standards**

Schedule 3.2 of the Contaminated Sites Regulation (the Regulation) provides aquatic life water standards for chlorophenols. These standards consist of a range of concentrations for chlorophenol isomers in the classes:

- monochlorophenols
- dichlorophenols
- trichlorophenols
- tetrachlorophenols
- pentachlorophenol

Footnote 26 of Schedule 3.2 in the Regulation indicates that chlorophenol standards vary with pH, temperature, and substance isomer and that a Director should be consulted for further advice.

This technical guidance document provides the Director's advice on how to select applicable aquatic life water standards for these substances.

### **Dependence on pH, temperature, and isomer**

Typically, chlorophenol aquatic toxicity increases with:

- decreasing pH,
- increasing water temperature, and
- increasing chlorination.

This has important implications for environmental protection, because water temperature is subject to seasonal variation and pH can change from location to location.

The Schedule 3.2 *minimum* standard for each discrete chlorophenol isomer was selected as the lowest concentration at a temperature of 20 °C and a pH < 6.2. The *maximum* standard for each chlorophenol isomer was selected as the highest concentration at a temperature of 0°C – 4.5°C and a pH > 9.1.

### **Director's advice**

The Schedule 3.2 chlorophenol isomer standards for the protection of aquatic life may be compared to contaminated site results in two ways.

### **Option 1. Direct comparison with minimum Schedule 3.2 chlorophenol isomer standards**

At sites for which the aquatic life water standards apply, if the concentration of a chlorophenol isomer does not exceed the minimum standard for that isomer listed in Schedule 3.2, the site would meet the standard for the substance.

Example:

Schedule 3.2 provides the following aquatic life standards for chlorophenol, 2- (CAS # 95-57-8): 19.5 – 6,500 µg/L. Thus, at any site where the chlorophenol, 2- aquatic life protective standards are applicable, the site is considered to have met numerical standards if the maximum concentration of chlorophenol, 2- in water does not exceed 19.5 µg/L.

**Option 2. Comparison with temperature, pH and isomer-specific standards for chlorophenols**

At sites for which the aquatic life water standards apply, Tables 1–5 (attached) may be consulted to establish the appropriate chlorophenol isomer aquatic life water standard(s) for the site. *Note:* if a person uses the attached tables, water pH and temperature must be measured at the site.

**Example:**

Groundwater adjacent to a former wood treatment site contains 138 µg/L of trichlorophenol, 2,4,5-. The summertime groundwater temperature was 8.0°C, and the pH was 6.8. The applicable standard is obtained from Table 2, which applies to temperatures of 5.0–9.5 °C. The fourth column from the left contains standards for a pH of 6.8, and the value for trichlorophenol, 2, 4, 5- is 18 µg/L. The observed concentration of 138 µg/L exceeds the 18 µg/L standard, thus the site is considered to be contaminated for the substance.

Since chlorophenol toxicity varies with water pH and temperature, chlorophenol isomer concentrations must be measured during the warmest season of the year and sufficient seasonal characterization should be undertaken to ensure worst case conditions are considered.

If aquatic life standards apply at a contaminated site, the practitioner may need to consider the transport of groundwater to nearby surface water, which is often a higher temperature than groundwater and thus a lower standard applies to protect biota, in accordance with [Technical Guidance 15, "Concentration Limits for the Protection of Aquatic Receiving Environments"](#).

*For more information, please direct inquiries to [site@gov.bc.ca](mailto:site@gov.bc.ca).*

**Revision history**

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October, 2005	October, 2005	1.0	Issued - new Technical Guidance 9
	November 1, 2017	2.0	Updated for CSR Stage 10 amendments

## **Isomer, pH, and Temperature-Specific Tables for Contaminated Sites Regulation Aquatic Life Water Standards for Chlorophenols**

In accordance with the Contaminated Sites Regulation, Schedule 3.2, footnote 26, aquatic life protective water standards for chlorophenols can vary with pH, temperature, and substance isomer. Tables 1–5 constitute the advice of the Director regarding the appropriate aquatic life protective water standards to use for chlorophenols.

### **Notes:**

1. The following tables may only be used if measured values of isomer concentrations, water pH, and temperature are known for the site.
2. Water temperature should be measured to the nearest 0.5 °C.
3. Water pH should be measured to the nearest 0.1 pH unit.
4. Chlorophenol isomer concentrations should be measured to the nearest 0.1 µg/L.

**Table 1. Chlorophenol isomer and pH specific aquatic life protective water standards (µg/L) for water temperatures within the range 0–4.5 °C**

Chlorophenol isomer	Chemical Abstract Service # (CAS)	pH							
		<6.2	6.2–6.6	6.7–7.1	7.2–7.6	7.7–8.1	8.2–8.6	8.7–9.1	>9.1
chlorophenol, 2-	95-57-8	78	128	220	340	580	960	1580	2600
chlorophenol, 3-	108-43-0	68	112	186	300	500	840	1400	2300
chlorophenol, 4-	106-48-9	34	58	96	156	260	440	720	1180
dichlorophenol, 2,3-	576-24-9	22	36	62	102	166	280	460	760
dichlorophenol, 2,4-	120-83-2	12	20	32	52	86	144	240	400
dichlorophenol, 2,5-	583-78-8	10	16	28	46	74	124	200	340
dichlorophenol, 2,6-	87-65-0	40	66	110	182	300	500	820	1360
dichlorophenol, 3,4-	95-77-2	12	20	32	54	88	148	240	400
dichlorophenol, 3,5-	591-35-5	10	14	24	40	68	112	184	300
trichlorophenol, 2,3,4-	15950-66-0	10	16	26	44	72	120	198	320
trichlorophenol, 2,3,5-	933-78-8	10	16	26	44	74	122	200	340
trichlorophenol, 2,3,6-	933-75-5	32	52	88	144	240	400	660	1080
trichlorophenol, 2,4,5-	95-95-4	10	14	24	40	66	112	184	300
trichlorophenol, 2,4,6-	88-06-02	24	38	64	106	176	300	480	800
trichlorophenol, 3,4,5-	609-19-8	4	6	10	18	28	48	78	128
tetrachlorophenol, 2,3,4,5-	4901-51-3	8	12	20	34	56	94	156	260
tetrachlorophenol, 2,3,4,6-	58-90-2	22	36	58	98	160	260	440	720
tetrachlorophenol, 2,3,5,6-	935-95-5	10	16	26	44	72	122	200	340
pentachlorophenol [PCP]	87-86-5	4	6	10	14	24	40	68	110

**Table 2. Chlorophenol isomer and pH specific aquatic life protective water standards (µg/L) for water temperatures within the range 5.0–9.5 °C**

Chlorophenol isomer	Chemical Abstract Service # (CAS)	pH							
		<6.2	6.2–6.6	6.7–7.1	7.2–7.6	7.7–8.1	8.2–8.6	8.7–9.1	>9.1
chlorophenol, 2-	95-57-8	58.5	96.0	165.0	255.0	435.0	720.0	1185.0	1950.0
chlorophenol, 3-	108-43-0	51.0	84.0	139.5	225.0	375.0	630.0	1050.0	1725.0
chlorophenol, 4-	106-48-9	25.5	43.5	72.0	117.0	195.0	330.0	540.0	885.0
dichlorophenol, 2,3-	576-24-9	16.5	27.0	46.5	76.5	124.5	210.0	345.0	570.0
dichlorophenol, 2,4-	120-83-2	9.0	15.0	24.0	39.0	64.5	108.0	180.0	300.0
dichlorophenol, 2,5-	583-78-8	7.5	12.0	21.0	34.5	55.5	93.0	150.0	255.0
dichlorophenol, 2,6-	87-65-0	30.0	49.5	82.5	136.5	225.0	375.0	615.0	1020.0
dichlorophenol, 3,4-	95-77-2	9.0	15.0	24.0	40.5	66.0	111.0	180.0	300.0
dichlorophenol, 3,5-	591-35-5	7.5	10.5	18.0	30.0	51.0	84.0	138.0	225.0
trichlorophenol, 2,3,4-	15950-66-0	7.5	12.0	19.5	33.0	54.0	90.0	148.5	240.0
trichlorophenol, 2,3,5-	933-78-8	7.5	12.0	19.5	33.0	55.5	91.5	150.0	255.0
trichlorophenol, 2,3,6-	933-75-5	24.0	39.0	66.0	108.0	180.0	300.0	495.0	810.0
trichlorophenol, 2,4,5-	95-95-4	7.5	10.5	18.0	30.0	49.5	84.0	138.0	225.0
trichlorophenol, 2,4,6-	88-06-02	18.0	28.5	48.0	79.5	132.0	225.0	360.0	600.0
trichlorophenol, 3,4,5-	609-19-8	3.0	4.5	7.5	13.5	21.0	36.0	58.5	96.0
tetrachlorophenol, 2,3,4,5-	4901-51-3	6.0	9.0	15.0	25.5	42.0	70.5	117.0	195.0
tetrachlorophenol, 2,3,4,6-	58-90-2	16.5	27.0	43.5	73.5	120.0	195.0	330.0	540.0
tetrachlorophenol, 2,3,5,6-	935-95-5	7.5	12.0	19.5	33.0	54.0	91.5	150.0	255.0
pentachlorophenol [PCP]	87-86-5	3.0	4.5	7.5	10.5	18.0	30.0	51.0	82.5

**Table 3. Chlorophenol isomer and pH specific aquatic life protective water standards (µg/L) for water temperatures within the range 10.0 to 14.5 °C .**

Temperature 10.0 to 14.5 °C		pH							
		<6.2	6.2–6.6	6.7–7.1	7.2–7.6	7.7–8.1	8.2–8.6	8.7–9.1	>9.1
Chlorophenol isomer	Chemical Abstract Service # (CAS)								
chlorophenol, 2-	95-57-8	39	64	110	170	290	480	790	1300
chlorophenol, 3-	108-43-0	34	56	93	150	250	420	700	1150
chlorophenol, 4-	106-48-9	17	29	48	78	130	220	360	590
dichlorophenol, 2,3-	576-24-9	11	18	31	51	83	140	230	380
dichlorophenol, 2,4-	120-83-2	6	10	16	26	43	72	120	200
dichlorophenol, 2,5-	583-78-8	5	8	14	23	37	62	100	170
dichlorophenol, 2,6-	87-65-0	20	33	55	91	150	250	410	680
dichlorophenol, 3,4-	95-77-2	6	10	16	27	44	74	120	200
dichlorophenol, 3,5-	591-35-5	5	7	12	20	34	56	92	150
trichlorophenol, 2,3,4-	15950-66-0	5	8	13	22	36	60	99	160
trichlorophenol, 2,3,5-	933-78-8	5	8	13	22	37	61	100	170
trichlorophenol, 2,3,6-	933-75-5	16	26	44	72	120	200	330	540
trichlorophenol, 2,4,5-	95-95-4	5	7	12	20	33	56	92	150
tTrichlorophenol, 2,4,6-	88-06-02	12	19	32	53	88	150	240	400
trichlorophenol, 3,4,5-	609-19-8	2	3	5	9	14	24	39	64
tetrachlorophenol, 2,3,4,5-	4901-51-3	4	6	10	17	28	47	78	130
tetrachlorophenol, 2,3,4,6-	58-90-2	11	18	29	49	80	130	220	360
tetrachlorophenol, 2,3,5,6-	935-95-5	5	8	13	22	36	61	100	170
pentachlorophenol [PCP]	87-86-5	2	3	5	7	12	20	34	55

**Table 4. Chlorophenol isomer and pH specific aquatic life protective water standards (µg/L) for water temperatures within the range 15.0 to 19.5 °C.**

Temperature 15.0 to 19.5 °C		pH							
		<6.2	6.2–6.6	6.7–7.1	7.2–7.6	7.7–8.1	8.2–8.6	8.7–9.1	>9.1
Chlorophenol isomer	Chemical Abstract Service # (CAS)								
chlorophenol, 2-	95-57-8	29.25	48	82.5	127.5	217.5	360	592.5	975
chlorophenol, 3-	108-43-0	25.5	42	69.75	112.5	187.5	315	525	862.5
chlorophenol, 4-	106-48-9	12.75	21.75	36	58.5	97.5	165	270	442.5
dichlorophenol, 2,3-	576-24-9	8.25	13.5	23.25	38.25	62.25	105	172.5	285
dichlorophenol, 2,4-	120-83-2	4.5	7.5	12	19.5	32.25	54	90	150
dichlorophenol, 2,5-	583-78-8	3.75	6	10.5	17.25	27.75	46.5	75	127.5
dichlorophenol, 2,6-	87-65-0	15	24.75	41.25	68.25	112.5	187.5	307.5	510
dichlorophenol, 3,4-	95-77-2	4.5	7.5	12	20.25	33	55.5	90	150
dichlorophenol, 3,5-	591-35-5	3.75	5.25	9	15	25.5	42	69	112.5
trichlorophenol, 2,3,4-	15950-66-0	3.75	6	9.75	16.5	27	45	74.25	120
trichlorophenol, 2,3,5-	933-78-8	3.75	6	9.75	16.5	27.75	45.75	75	127.5
trichlorophenol, 2,3,6-	933-75-5	12	19.5	33	54	90	150	247.5	405
trichlorophenol, 2,4,5-	95-95-4	3.75	5.25	9	15	24.75	42	69	112.5
trichlorophenol, 2,4,6-	88-06-02	9	14.25	24	39.75	66	112.5	180	300
trichlorophenol, 3,4,5-	609-19-8	1.5	2.25	3.75	6.75	10.5	18	29.25	48
tetrachlorophenol, 2,3,4,5-	4901-51-3	3	4.5	7.5	12.75	21	35.25	58.5	97.5
tetrachlorophenol, 2,3,4,6-	58-90-2	8.25	13.5	21.75	36.75	60	97.5	165	270
tetrachlorophenol, 2,3,5,6-	935-95-5	3.75	6	9.75	16.5	27	45.75	75	127.5
pentachlorophenol [PCP]	87-86-5	1.5	2.25	3.75	5.25	9	15	25.5	41.25

**Table 5. Chlorophenol isomer and pH specific aquatic life protective water standards (µg/L) for water temperatures within the range 20.0 to >20.0 °C.**

Temperature 20.0 to >20.0 °C		pH							
Chlorophenol isomer	Chemical Abstract Service # (CAS)	<6.2	6.2–6.6	6.7–7.1	7.2–7.6	7.7–8.1	8.2–8.6	8.7–9.1	>9.1
chlorophenol, 2-	95-57-8	19.5	32	55	85	145	240	395	650
chlorophenol, 3-	108-43-0	17	28	46.5	75	125	210	350	575
chlorophenol, 4-	106-48-9	8.5	14.5	24	39	65	110	180	295
dichlorophenol, 2,3-	576-24-9	5.5	9	15.5	25.5	41.5	70	115	190
dichlorophenol, 2,4-	120-83-2	3	5	8	13	21.5	36	60	100
dichlorophenol, 2,5-	583-78-8	2.5	4	7	11.5	18.5	31	50	85
dichlorophenol, 2,6-	87-65-0	10	16.5	27.5	45.5	75	125	205	340
dichlorophenol, 3,4-	95-77-2	3	5	8	13.5	22	37	60	100
dichlorophenol, 3,5-	591-35-5	2.5	3.5	6	10	17	28	46	75
trichlorophenol, 2,3,4-	15950-66-0	2.5	4	6.5	11	18	30	49.5	80
trichlorophenol, 2,3,5-	933-78-8	2.5	4	6.5	11	18.5	30.5	50	85
trichlorophenol, 2,3,6-	933-75-5	8	13	22	36	60	100	165	270
trichlorophenol, 2,4,5-	95-95-4	2.5	3.5	6	10	16.5	28	46	75
trichlorophenol, 2,4,6-	88-06-02	6	9.5	16	26.5	44	75	120	200
trichlorophenol, 3,4,5-	609-19-8	1	1.5	2.5	4.5	7	12	19.5	32
tetrachlorophenol, 2,3,4,5-	4901-51-3	2	3	5	8.5	14	23.5	39	65
tetrachlorophenol, 2,3,4,6-	58-90-2	5.5	9	14.5	24.5	40	65	110	180
tetrachlorophenol, 2,3,5,6-	935-95-5	2.5	4	6.5	11	18	30.5	50	85
pentachlorophenol [PCP]	87-86-5	1	1.5	2.5	3.5	6	10	17	27.5