

3745-81-77 Treatment techniques for control of disinfection byproduct (DBP) precursors.

- (A) Surface water community and nontransient noncommunity public water systems using conventional filtration treatment shall operate with enhanced coagulation or enhanced softening to achieve the TOC per cent removal levels specified in paragraph (F) of this rule unless the system meets at least one of the alternative compliance criteria listed in paragraph (D) or (E) of this rule.
- (B) Surface water systems using conventional filtration treatment shall comply with the following monitoring requirements for disinfection byproduct precursors (DBPP).
- (1) Routine monthly monitoring: public water systems using surface water as a source which use conventional filtration treatment shall monitor each treatment plant for TOC no later than the point of combined filter effluent turbidity monitoring and representative of the treated water. All public water systems required to monitor under this paragraph shall also monitor for TOC in the source water prior to any treatment at the same time as monitoring for TOC in the treated water. These samples (source water and treated water) are referred to as paired samples. At the same time as the source water sample is taken, all systems shall monitor for alkalinity in the source water prior to any treatment. Public water systems shall take one paired sample and one source water alkalinity sample every thirty days per plant at a time representative of normal operating conditions and influent water quality. The thirty day monitoring frequency may be extended or reduced by three days to allow for unplanned circumstances that prevent monitoring precisely thirty days apart, as long as the samples are collected during each calendar month.
- (2) Reduced quarterly monitoring: public water systems using surface water as a source with an average treated water TOC of less than 2.0 mg/l for two consecutive years, or less than 1.0 mg/l for one year, may reduce monitoring for both TOC and alkalinity to one paired sample and one source water alkalinity sample per plant every ninety days. The ninety day monitoring frequency may be extended or reduced by five days to allow for unplanned circumstances that prevent monitoring precisely ninety days apart, as long as the samples are collected during each calendar quarter. The public water system must revert to routine monitoring in the month following the quarter when the running annual average treated water TOC \geq 2.0 mg/l.
- (C) Public water systems may begin monitoring twelve months prior to the

compliance date for the system, to determine whether step 1 TOC removals can be met. This monitoring is not required and failure to monitor during this period is not a violation. However, any public water system that does not monitor during this period, and then determines in the first twelve months after the compliance date that it is not able to meet the step 1 requirements in paragraph (F)(2) of this rule and must apply for alternate minimum TOC removal (step 2) requirements, is not eligible for retroactive approval of alternate minimum TOC removal (step 2) requirements as allowed by paragraph (F)(3) of this rule and is in violation of the treatment technique for TOC removal of this rule. Public water systems may apply for alternate minimum TOC removal (step 2) requirements any time after the compliance date.

- (D) Alternative compliance criteria for enhanced coagulation and enhanced softening systems. Surface water systems using conventional filtration treatment may use one or more of the alternative compliance criteria in paragraphs (D)(1) to (D)(7) of this rule to comply with this rule in lieu of complying with paragraph (F) of this rule. Public water systems must still comply with the monitoring requirements of paragraph (B) of this rule.
- (1) The system's source water TOC level, measured according to rule 3745-81-27 of the Administrative Code, is less than 2.0 mg/l, calculated quarterly as a running annual average.
 - (2) The system's treated water TOC level, measured according to rule 3745-81-27 of the Administrative Code, is less than 2.0 mg/l, calculated quarterly as a running annual average.
 - (3) The system's source water TOC level, measured according to rule 3745-81-27 of the Administrative Code, is less than 4.0 mg/l, calculated quarterly as a running annual average; the source water alkalinity, measured according to rule 3745-81-27 of the Administrative Code, is greater than 60.0 mg/l (as CaCO₃), calculated quarterly as a running annual average and the TTHM and HAA5 running annual averages are no greater than 0.040 mg/l and 0.030 mg/l, respectively.
 - (4) The system's source water TOC level, measured according to rule 3745-81-27 of the Administrative Code, is less than 4.0 mg/l, calculated quarterly as a running annual average; the source water alkalinity, measured according to rule 3745-81-27 of the Administrative Code, is greater than 60.0 mg/l (as CaCO₃), calculated quarterly as a running annual average and the system has made a clear and irrevocable financial commitment to use technologies that will limit the levels of

TTHMs and HAA5 to no more than 0.040 mg/l and 0.030 mg/l, respectively. Systems must submit evidence of a clear and irrevocable financial commitment, in addition to a schedule containing milestones and periodic progress reports for installation and operation of appropriate technologies, to the director for approval. Failure to install and operate these technologies by the date in the approved schedule will constitute a violation of the Administrative Code primary drinking water regulations for control of disinfection byproduct precursors.

- (5) The TTHM and HAA5 running annual averages are no greater than 0.040 mg/l and 0.030 mg/l, respectively, and the system uses only chlorine for primary disinfection and maintenance of a residual in the distribution system.
 - (6) The system's source water SUVA, prior to any treatment and measured monthly according to ~~of~~ rule 3745-81-27 of the Administrative Code, is less than or equal to 2.0 l/mg-m, calculated quarterly as a running annual average.
 - (7) The system's finished water SUVA, measured monthly according to rule 3745-81-27 of the Administrative Code, is less than or equal to 2.0 l/mg-m, calculated quarterly as a running annual average.
- (E) Additional alternative compliance criteria for softening systems. Systems practicing enhanced softening that cannot achieve the TOC removals required by paragraph (F)(2) of this rule may use the alternative compliance criteria in paragraph (E)(1) or (E)(2) of this rule in lieu of complying with paragraph (F) of this rule. Systems must still comply with monitoring requirements in paragraph (B) of this rule.
- (1) Softening that results in lowering the treated water alkalinity to less than 60.0 mg/l (as CaCO₃), measured monthly according to rule 3745-81-27 of the Administrative Code and calculated quarterly as a running annual average.
 - (2) Softening that results in removing at least 10.0 mg/l of magnesium hardness (as CaCO₃), measured monthly according to paragraph (C)(4)(c) of rule 3745-81-27 of the Administrative Code and calculated quarterly as an annual running average.
- (F) Enhanced coagulation and enhanced softening performance requirements.

- (1) Public water systems must achieve the per cent reduction of TOC specified in paragraph (F)(2) of this rule between the source water and the combined filter effluent, unless the director approves a system's request for alternate minimum TOC removal (step 2) requirements under paragraph (F)(3) of this rule.
- (2) Required step 1 TOC reductions, indicated in the following table, are based upon specified source water parameters measured according to rule 3745-81-27 of the Administrative Code. Systems practicing softening are required to meet the step 1 TOC reductions in the far-right column (source water alkalinity >120 mg/l) for the specified source water TOC:

Step 1 required removal of TOC by enhanced coagulation and enhanced softening for surface water systems using conventional treatment^{1,2}

Source-water TOC, mg/l	Source-water alkalinity, mg/l as CaCO ₃		
	0 - 60 (Per cent)	>60 - 120 (Per cent)	>120 ³ (Per cent)
>2.0 - 4.0	35.0	25.0	15.0
>4.0 - 8.0	45.0	35.0	25.0
>8.0	50.0	40.0	30.0

- ¹ Systems meeting at least one of the conditions in paragraphs (D)(1) to (D)(7) of this rule are not required to operate with enhanced coagulation.
- ² Softening systems meeting one of the alternative compliance criteria in paragraphs (E)(1) and (E)(2) of this rule are not required to operate with enhanced softening.
- ³ Systems practicing softening must meet the TOC removal requirements in this column.

- (3) Surface water conventional treatment systems that cannot achieve the step 1 TOC removals required by paragraph (F)(2) of this rule due to water quality parameters or operational constraints shall apply to the director, within three months of failure to achieve the TOC removals required by paragraph (F)(2) of this rule, for approval of alternative minimum TOC removal (step 2) requirements submitted by the system. If the director approves the alternative minimum TOC removal (step 2) requirements, the director may make those requirements retroactive for the purposes of determining compliance. Until the director approves the alternate minimum TOC removal (step 2) requirements, the system must

meet the step 1 TOC removals contained in paragraph (F)(2) of this rule.

- (4) Alternate minimum TOC removal (step 2) requirements. Applications made to the director by enhanced coagulation systems for approval of alternative minimum TOC removal (step 2) requirements under paragraph (F)(3) of this rule shall include, at a minimum, results of bench- or pilot-scale testing conducted under paragraphs (F)(6) to (F)(9) of this rule. The submitted bench- or pilot-scale testing shall be used to determine the alternate enhanced coagulation level.
- (5) Alternate enhanced coagulation level is defined as coagulation at a coagulant dose and pH as determined by the method described in paragraphs (F)(6) to (F)(9) of this rule such that an incremental addition of 10.0 mg/l of alum (or equivalent amount of ferric salt) results in a TOC removal of ≤ 0.3 mg/l. The per cent removal of TOC at this point on the "TOC removal versus coagulant dose" curve is then defined as the minimum TOC removal required for the system. Once approved by the director, this minimum requirement supersedes the minimum TOC removal required by the table in paragraph (F)(2) of this rule. This requirement will be effective until such time as the director approves a new value based on the results of a new bench- or pilot-scale test. Failure to achieve alternative minimum TOC removal levels as set by the director is a violation of the Administrative Code primary drinking water regulations for control of disinfection byproduct precursors.
- (6) Bench- or pilot-scale testing of enhanced coagulation must be conducted by using representative water samples and adding 10.0 mg/l increments of alum (or equivalent amounts of ferric salt) until the pH is reduced to a level less than or equal to the enhanced coagulation step 2 target pH shown in the following table:

Enhanced coagulation step 2 target pH

Alkalinity (mg/l as CaCO ₃)	Target pH
0 - 60	5.5
>60 - 120	6.3
>120 - 240	7.0
>240	7.5

- (7) For waters with alkalinities of less than 60.0 mg/l for which addition of small amounts of alum or equivalent addition of iron coagulant drives the pH below 5.5 before significant TOC removal occurs, the system must add necessary chemicals to maintain the pH between 5.3 and 5.7 in samples until the TOC removal of 0.3 mg/l per 10.0 mg/l alum added (or equivalent addition of iron coagulant) is reached.
 - (8) The system may operate at any coagulant dose or pH necessary (consistent with other state primary drinking water regulations) to achieve the minimum TOC per cent removal approved under paragraph (F)(3) of this rule.
 - (9) If the TOC removal is consistently less than 0.3 mg/l of TOC per 10.0 mg/l of incremental alum dose at all dosages of alum (or equivalent addition of iron coagulant), the water is deemed to contain TOC not amenable to enhanced coagulation. The system may then apply to the director for a waiver of enhanced coagulation requirements.
- (G) Compliance calculations: surface water systems other than those identified in paragraph (D) or (E) of this rule shall comply with requirements contained in paragraph (F)(2) or (F)(3) of this rule. Systems shall calculate compliance quarterly, beginning after the system has collected twelve months of data, by determining a running annual average using the following method:
- (1) Determine actual monthly TOC per cent removal. This is equal to: $(1.0 - (\text{treated water TOC} / \text{source water TOC})) \times 100.0$.
 - (2) Determine the required monthly TOC per cent removal (from either the table in paragraph (F)(2) of this rule or from paragraph (F)(3) of this rule).
 - (3) Divide the value determined according to paragraph (G)(1) of this rule by the value determined according to paragraph (G)(2) of this rule.
 - (4) Add together the results of paragraph (G)(3) of this rule for the last twelve months and divide by twelve.
 - (5) If the value calculated in paragraph (G)(4) of this rule is less than 1.00, the system is not in compliance with the TOC per cent removal requirements.
 - (6) Systems may use the provisions in paragraphs (G)(7) to (G)(11) of this rule in lieu of the calculations in paragraphs (G)(1) to (G)(5) of this rule to

determine compliance with TOC per cent removal requirements.

- (7) In any month that the system's treated or source water TOC level, measured according to rule 3745-81-27 of the Administrative Code, is less than 2.0 mg/l, the system may assign a monthly value of 1.0 (in lieu of the value calculated in paragraph (G)(3) of this rule).
 - (8) In any month that a system practicing softening removes at least 10.0 mg/l of magnesium hardness (as CaCO₃), the system may assign a monthly value of 1.0 (in lieu of the value calculated in paragraph (G)(3) of this rule).
 - (9) In any month that the system's source water SUVA, prior to any treatment and measured according to rule 3745-81-27 of the Administrative Code, is ≤ 2.0 l/mg-m, the system may assign a monthly value of 1.0 (in lieu of the value calculated in paragraph (G)(3) of this rule).
 - (10) In any month that the system's finished water SUVA, measured according to rule 3745-81-27 of the Administrative Code, is ≤ 2.0 l/mg-m, the system may assign a monthly value of 1.0 (in lieu of the value calculated in paragraph (G)(3) of this rule).
 - (11) In any month that a system practicing enhanced softening lowers alkalinity below 60.0 mg/l (as CaCO₃), the system may assign a monthly value of 1.0 (in lieu of the value calculated in paragraph (G)(3) of this rule).
 - (12) Surface water systems using conventional treatment may also comply with the requirements of this rule by meeting the criteria in paragraph (D) or (E) of this rule.
- (H) Treatment technique requirements for DBP precursors. The director identifies the following as treatment techniques to control the level of disinfection byproduct precursors in drinking water treatment and distribution systems: for surface water systems using conventional treatment, enhanced coagulation or enhanced softening.
- (I) Each public water system required to monitor under this rule shall develop and implement a monitoring plan. The public water system shall maintain the plan and make it available for inspection by the director and the general public no later than thirty days following the applicable compliance dates in this rule. All surface water systems serving more than three thousand three hundred people

shall submit a copy of the monitoring plan to the director no later than the date of the first report required under paragraph (G) of rule 3745-81-75 of the Administrative Code. The director may also require any other public water system to submit such a plan. After review, the director may require changes in any plan elements to ensure monitoring will be adequate for required compliance determinations. The public water system shall modify the plan as required by the director. The plan shall include how the public water system will calculate compliance with the treatment technique for disinfection byproduct precursors. Failure to sample according to the monitoring plans is monitoring violation.

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Certification

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Attachment A**Cost of Compliance, OAC Rules 3745-81-23 and 3745-81-77**

This cost estimate is based on an economic analysis conducted by USEPA as it applies to public water systems in Ohio. The federal economic analysis was published with the final Stage 2 Disinfectants/Disinfection Byproducts Rule (DBPR) on January 4, 2006 in Volume 71, Number 388 of the Federal Register. That cost estimate represented total annualized capital and operational costs to comply with all requirements of the Stage 2 DBPR. These costs include non-treatment costs of rule implementation, Initial Distribution System Evaluations (IDSEs), Stage 2 DBPR monitoring plans, additional routine monitoring, and operational evaluations. Systems required to install treatment to comply with the MCLs will accrue the additional costs of treatment installation as well as operation and maintenance.

Because the requirements associated with the Stage 2 DBPR are distributed among multiple rules, this cost estimate represents costs associated with OAC rules 3745-81-12, 3745-81-22, 3745-81-23, 3745-81-24, 3745-81-70 and 3745-81-77.

Table 1 provides a summary of the federal analysis broken down according to system size and type of source water (i.e., surface water or ground water).

Table 1 (D/DBP). USEPA Economic Analysis Summary

System Type, Source Water and Population Served	Number of Systems	Total Cost * (in \$ Millions/Year)	Cost per System *
Community surface water >10,000	2406	\$ 39.98	\$ 16,617
Community ground water >10,000	1424	\$ 11.60	\$ 8,146
Community surface water <10,000	9397	\$ 11.89	\$ 1,265
Community ground water <10,000	28806	\$ 17.05	\$ 592
Nontransient noncommunity surface water >10,000	6	\$ 0.09	\$ 15,000
Nontransient noncommunity ground water >10,000	3	\$ 0.02	\$ 6,666

Nontransient noncommunity surface water <10,000	771	\$ 0.84	\$ 1,089
Nontransient noncommunity ground water <10,000	5479	\$ 1.80	\$ 329

* U.S. Department of Labor, Bureau of Labor Statistics Inflation Calendar used to account for inflation from 2009 - 2014.

Ohio EPA determined how many public water systems in Ohio fall into the above categories and broke the categories down further by type of ownership. This breakdown is presented in Table 2 below.

Table 2 (D/DBP). Summary of Affected Ohio Water Systems

System Ownership	Source Water and Population Served			
	Surface Water >10,000	Ground Water >10,000	Surface Water <10,000	Ground Water <10,000
School Districts	0	0	0	128
Counties	11	17	17	46
Townships	1	1	1	7
Municipalities	54	45	74	306
All Systems ¹	66	65	96	1040

¹ Includes government and non-government owned systems.

Ohio EPA then applied the USEPA cost estimate to the different categories of water systems identified in Table 2 to arrive at a very approximate cost estimate for Ohio. A summary is provided in Table 3 below.

Table 3 (D/DBP). Summary of Costs to Affected Ohio Water Systems

System Ownership	Source Water and Population Served				Totals
	Surface Water >10,000	Ground Water	Surface Water	Ground Water <10,000	

School Districts	0	0	0	128 systems X \$328/system = \$41,984	\$41,984
Counties	11 systems X \$16,616/system = \$182,776	17 systems X \$8,143/system = \$138,431	17 systems X \$1,264/system = \$21,488	46 systems X \$592/system = \$27,232	\$369,927
Townships	1 system X \$16,616/system = \$16,616	1 system X \$8,143/system = \$8,143	1 system X \$1,264/system = \$1,264	7 systems X \$592/system = \$4,144	\$30,167
Municipalities	54 systems X \$16,616/system = \$897,264	45 systems X \$8,143/system = \$366,435	74 systems X \$1,264/system = \$93,563	306 systems X \$592/system = \$181,152	\$1,538,414
All systems ¹	66 systems X \$16,616/system = \$1,096,656	65 systems X \$8,143/system = \$529,295	96 systems X \$1,264/system = \$121,344	1,040 systems X \$592/system = \$615,680	\$2,362,975

¹ Includes government and non-government owned systems

* U.S. Department of Labor, Bureau of Labor Statistics Inflation Calendar used to account for inflation from 2009 - 2014.

It should be noted that USEPA assigned an uncertainty factor of ± 30 per cent to their cost estimate. The uncertainty is associated with the anticipated number of affected systems, the unit costs estimates for different technologies as they are applied to individual systems, and monitoring costs. The cost per water system can only be considered a numerical average and not an accurate estimate of the actual cost per system. The actual costs per system will vary widely depending on technologies employed by each system and monitoring costs.