TITLE 179 PUBLIC WATER SYSTEMS

CHAPTER 2 PUBLIC WATER SUPPLY SYSTEMS

SECTION 002 DRINKING WATER STANDARDS AND TREATMENT TECHNIQUES

2-002.01 SCOPE AND AUTHORITY: These regulations establish drinking water standards, treatment techniques, best available technologies (BATs) and compliance technologies for public water systems. The authority is found in Neb. Rev. Stat. §§ 71-5301 to 71-5313.

2-002.02 DEFINITIONS

Best Available Technology or BAT means the best technology, treatment techniques, or other means which the U.S. Environmental Protection Agency finds, after examination for efficacy under field conditions and not solely under laboratory conditions, are available (taking cost into consideration). For the purposes of setting MCLs for synthetic organic chemicals, any BAT must be at least as effective as granular activated carbon.

GAC10 means granular activated carbon filter beds with an empty-bed contact time of 10 minutes based on average daily flow and a carbon reactivation frequency of every 180 days, except that the reactivation frequency for GAC10 used as a best available technology for compliance with Title 179 NAC 24 (upon its effective date) MCLs under 179 NAC 2-002.04E2a(1) is 120 days.

GAC20 means granular activated carbon filter beds with an empty-bed contact time of 20 minutes based on average daily flow and a carbon reactivation frequency of every 240 days.

Maximum Contaminant Level (MCL) means the maximum permissible level of a contaminant in water which is delivered to any user of a public water system.

2-002.03 DRINKING WATER STANDARDS AND TREATMENT TECHNIQUES: ~~2-002.01 03 Applicability:~~ The basis for the establishment of maximum contaminant levels is based either upon potential acute health effects over a short length of time of exposure or chronic health effects over a long length of time of exposure.

2-002.~~01A~~ 03A Standards Based upon Acute Health Effects: Standards based upon acute health effects over a short length of time of exposure shall apply to all public water systems. Contaminants governed by these standards are:

1. Nitrates;
2. Turbidity;
3. Microbiological; and
4. Chlorine dioxide

2-002.~~01B~~ 03B Standards Based upon Chronic Health Effects: Standards based upon chronic health effects over a long length of time of exposure apply to community and/or non-transient, non-community water systems as specified in Title 179. Contaminants governed by these standards are:

1. Inorganic chemicals except for nitrate;
2. Organic chemicals; and
3. Radioactive contaminants.

2-002.~~02~~ 04 Maximum Contaminant Levels

2-002.~~02A~~ 04A Maximum Contaminant Levels for Inorganic Chemicals: All the following maximum contaminant levels (MCLs) for inorganic chemical contaminants apply to community water systems. All the following maximum contaminant levels for inorganic chemicals, except the MCL for fluoride, apply to non-transient, non-community water systems. Only the maximum contaminant levels for nitrate, nitrite, and total nitrate and nitrite apply to transient, non-community systems.

CONTAMINANT	**MCL (mg/L)**
(1) Antimony	0.006
(2) Asbestos (fibers >10 µm)	7 million fibers/Liter
(3) ~~Arsenic~~	~~0.05 (Through January 22, 2006)~~
Arsenic	0.010 ~~(Effective January 23, 2006)~~
(4) Barium	2
(5) Beryllium	0.004
(6) Cadmium	0.005
(7) Chromium total	0.10
(8) Cyanide (as free cyanide)	0.2
(9) Fluoride*	4.0
(10) Mercury	0.002
(11) Nickel	0.1
(12) Nitrate (as Nitrogen)	10
(13) Nitrite (as Nitrogen)	1
(14) Total Nitrate and Nitrite (as Nitrogen)	10
(15) Selenium	0.05
(16) Sodium	500.0
(17) Thallium	0.002

*Community water systems experiencing fluoride levels above 2.0 milligrams per liter must notify the public as required in 179 NAC 4-010.

2-002.~~02A1~~ 04A1 At the discretion of the Director, nitrate levels not to exceed 20 mg/L may be allowed in a non-community water system if the supplier of water demonstrates to the satisfaction of the Director that:

2-002.~~02A1a~~ 04A1a Such water will not be available to children under six months of age, pregnant women, or mothers nursing children under six months of age; and

2-002.~~02A1b~~ 04A1b The non-community water system is meeting the public notification requirements under 179 NAC 4-011, including continuous posting of the fact that nitrate levels exceed 10 mg/L and the potential health effects of exposure; and

2-002.~~02A1c~~ 04A1c Local and State public health authorities will be notified annually of nitrate levels that exceed 10 mg/L; and

2-002.~~02A1d~~ 04A1d No adverse health effects shall result.

2-002.~~02B~~ 04B Maximum Contaminant Levels for Synthetic Organic Chemicals: The following maximum contaminant levels for organic chemical contaminants apply to community and non-transient, non-community water systems.

2-002.~~02B1~~ 04B1 Volatile Organic Chemicals (VOCs):

CONTAMINANT	**MCL (mg/L)**
(1) Vinyl chloride	0.002
(2) Benzene	0.005
(3) Carbon tetrachloride	0.005
(4) 1,2-Dichloroethane	0.005
(5) Trichloroethylene	0.005
(6) para-Dichlorobenzene	0.075
(7) 1,1-Dichloroethylene	0.007
(8) 1,1,1-Trichloroethane	0.2
(9) cis-1,2-Dichloroethylene	0.07
10) 1,2-Dichloropropane	0.005
(11) Ethylbenzene	0.7
(12) Monochlorobenzene	0.1
(13) o-Dichlorobenzene	0.6
(14) Styrene	0.1
(15) Tetrachloroethylene	0.005
(16) Toluene	1
(17) trans-1,2-Dichloroethylene	0.1
(18) Xylenes (total)	10
(19) Dichloromethane	0.005
(20) 1,2,4-Trichlorobenzene	0.07
(21) 1,1,2-Trichloroethane	0.005

2-002.~~02B2~~ 04B2 Non-Volatile Synthetic Organic Chemicals

CONTAMINANT	**MCL (mg/L)**
(1) Alachlor	0.002
(2) reserved	
(3) reserved	
(4) reserved	
(5) Atrazine	0.003
(6) Carbofuran	0.04
(7) Chlordane	0.002
(8) Dibromochloropropane	0.0002
(9) 2,4-D	0.07
(10) Ethylene dibromide	0.00005
(11) Heptachlor	0.0004
(12) Heptachlor epoxide	0.0002
(13) Lindane	0.0002
(14) Methoxychlor	0.04
(15) Polychlorinated biphenyls	0.0005
(16) Pentachlorophenol	0.001
(17) Toxaphene	0.003
(18) 2,4,5-TP	0.05
(19) Benzo[a]pyrene	0.0002
(20) Dalapon	0.2
(21) Di(2-ethylhexyl)adipate	0.4
(22) Di(2-ethylhexyl)phthalate	0.006
(23) Dinoseb	0.007
(24) Diquat	0.02
(25) Endothall	0.1
(26) Endrin	0.002
(27) Glyphosate	0.7
(28) Hexachlorobenzene	0.001
(29) Hexachlorocyclopentadiene	0.05
(30) Oxamyl (Vydate)	0.2
(31) Picloram	0.5
(32) Simazine	0.004
(33) 2,3,7,8-TCDD (Dioxin)	3×10^{-8}

2-002.~~02C~~ 04C Microbiological: The maximum contaminant levels for coliform bacteria, applicable to all public water systems, are as follows:

2-002.~~02C1~~ 04C1 The MCL is based on the presence or absence of total coliforms in a sample, rather than coliform density.

2-002.~~02C1a~~ 04C1a For a system which collects at least 40 samples per month, if no more than 5.0% of the samples collected during a month are total coliform-positive, the system is in compliance with the MCL for total coliforms.

2-002.~~02C1b~~ 04C1b For a system which collects fewer than 40 samples per month, if no more than one sample collected during a month is total coliform-positive, the system is in compliance with the MCL for total coliforms.

2-002.~~02C1c~~ 04C1c Results of all routine samples and repeat samples (when required by 179 NAC 3-004.02) which are not invalidated must be included in determining compliance with 179 NAC 2-002.~~02C1a~~ 04C1a and 2-002.~~02C1b~~04C1b.

2-002.~~02C2~~ 04C2 Any fecal coliform-positive repeat sample or *E. coli*-positive repeat sample, or any total coliform-positive repeat sample following a fecal coliform-positive or *E. coli*-positive routine sample constitutes a violation of the MCL for total coliforms. For purposes of the public notification requirements in 179 NAC 4 this is a violation that may pose an acute risk to health.

2-002.~~02C3~~ 04C3 Compliance with the MCL for total coliforms in 179 NAC 2-002.~~02C1~~ 04C1 and 2-002.~~02C2~~ 04C2 will be determined each month for systems which are required to monitor monthly for total coliforms, and each quarter for systems which are required to monitor once per quarter for total coliforms.

2-002.~~02D~~ 04D Maximum contaminant levels for radionuclides

2-002.~~02D1~~ 04D1 MCL for combined radium-226 and -228: The MCL for combined radium-226 and radium-228 is 5 pCi per liter. The combined radium-226 and radium-228 value is determined by the addition of the results of the analysis for radium-226 and the analysis for radium-228.

2-002.~~02D2~~ 04D2 MCL for gross alpha particle activity (excluding radon and uranium): The MCL for gross alpha particle activity (including radium-226 but excluding radon and uranium) is15 pCi per liter.

2-002.~~02D3~~ 04D3 MCL for Beta Particle and Photon Radioactivity

1. The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water must not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem per year (mrem/year).

2. Except for the radionuclides listed in the following table, the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalents must be calculated on the basis of a two liter per day drinking water intake using the 168

hour data listed in "Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure", NBS Handbook 69, as amended August 1963, U.S. Department of Commerce, which is incorporated by reference. A copy may be inspected at the Department of Health and Human Services Regulation and Licensure, Public Health Assurance Division, 301 Centennial Mall South, Lincoln, NE 68509 or copies are available from the National Technical Information Service, NTIS, ADA 280 282, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia, 22161, phone 800-553-6847. If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ must not exceed 4 millirem per year.

AVERAGE ANNUAL CONCENTRATIONS ASSUMED TO PRODUCE A TOTAL BODY OR ORGAN DOSE OF 4 MILLIREM PER YEAR

Radionuclide	**Critical Organ**	**pCi per liter**
Tritium	Total Body	20,000
Strontium-90	Bone Marrow	8

2-002.~~02D4~~ 04D4 MCL for Uranium: The maximum contaminant level for uranium is 30 µg/L.

2-002.~~02D5~~ 04D5 Compliance Dates for Combined Radium-226 and -228, Gross Alpha Particle Activity, Gross Beta Particle and Photon Radioactivity, and Uranium: Community water systems must comply with the MCLs listed in 179 NAC 2-002.~~02D1~~ 04D1 through 2-002.~~02D4~~ 04D4 beginning December 8, 2003 and compliance will be determined in accordance with the requirements of 179 NAC 3-008.01 and 3-008.02.

2-002.~~02E~~ 04E Maximum Contaminant Levels for Disinfection Byproducts

2-002.~~02E1~~ 04E1 Bromate and chlorite: The maximum contaminant levels (MCLs) for ~~disinfection byproducts~~bromate and chlorite are as follows:

Disinfection Byproduct	**MCL (mg/L)**
~~Total trihalomethanes (TTHMs)~~	~~0.080~~
~~Haloacetic acids (five) (HAA5)~~	~~0.060~~
Bromate ……..	0.010
Chlorite ……...	1.0

2-002.~~02E1a~~ 04E1a Compliance Dates for ~~2-002.02E2a~~ Community Water Systems (CWSs) and Non-Transient Non-Community Water Systems (NTNCWSs): Public water systems using surface water or ground water under the direct influence of surface water serving 10,000 or more ~~persons~~ individuals must comply with 179 NAC 2-002.~~02E~~ 04E1 beginning January 1, 2002. Public water systems using surface water or ground water under the direct influence of

surface water serving fewer than 10,000 ~~persons~~ individuals and systems using only ground water not under the direct influence of surface water must comply with 179 NAC 2-002.~~02E~~ 04E1 beginning January 1, 2004.

~~2-002.02E2b A system that is installing granular activated carbon (GAC) or membrane technology to comply with 179 NAC 2-002.02F may apply to the Department for an extension of up to 24 months past the dates in 179 NAC 2-002.02F2a, but not beyond December 31, 2003. In granting the extension, the Department must set a schedule for compliance and may specify any interim measures that the system must take. Failure to meet the schedule or interim treatment requirements constitutes a violation of the Nebraska Safe Drinking Water Act.~~

2-002.~~02E3~~ 04E1b The Department identifies the following as the best technology, treatment techniques, or other means available for achieving compliance with the maximum contaminant levels for bromate and chlorite ~~disinfection byproducts~~ identified in 179 NAC 2-002.~~02E1~~04E1.

BATs FOR BROMATE AND CHLORITE ~~DBPs~~

Disinfection Byproduct	Best Available Technology
~~TTHM~~	~~Enhanced coagulation or enhanced softening or GAC10, with chlorine as the primary and residual disinfectant.~~
~~HAA5~~	~~Enhanced coagulation or enhanced softening or GAC10, with chlorine as the primary and residual disinfectant.~~
Bromate	Control of ozone treatment process to reduce production of bromate.
Chlorite	Control of treatment processes to reduce disinfectant demand and control of disinfection treatment processes to reduce disinfectant levels.

2-002.04E2 TTHMs and HAA5s

2-002.04E2a Running Annual Average (RAA) Compliance for 179 NAC 16

2-002.04E2a(1) Compliance Dates: All systems must comply with these MCLs until the date specified for compliance in 179 NAC 24-003.01 (upon its effective date).

Disinfection byproduct	MCL (mg/L)
Total trihalomethanes (TTHMs)	0.080
Haloacetic acids (five) (HAA5)	0.060

2-002.04E2a(2) The Department identifies the following as the best technology, treatment techniques, or other means available for achieving compliance with the maximum contaminant levels for TTHMs and HAA5s identified in 2-002.04E2a(1).

Disinfection byproduct	Best available technology
Total trihalomethanes (TTHMs) and Haloacetic acids (five) (HAA5s)	Enhanced coagulation or enhanced softening or GAC10, with chlorine as the primary and residual disinfectant

2-002.04E2b LRAA Compliance for 179 NAC 24 (upon its effective date)

2-002.04E2b(1) Compliance Dates: The 179 NAC 24 MCLs for TTHMs and HAA5 must be complied with as a locational running annual average at each monitoring location beginning the date specified for compliance in 179 NAC 24-003.01.

Disinfection byproduct	MCL (mg/L)
Total trihalomethanes (TTHMs)	0.080
Haloacetic acids (five) (HAA5)	0.060

2-002.04E2b(2) The Department identifies the following as the best technology, treatment techniques, or other means available for achieving compliance with the maximum contaminant levels for TTHMs and HAA5 identified in 179 NAC 2-002.04E2b for all systems that disinfect their source water:

Disinfection byproduct	Best available technology
Total trihalomethanes (TTHMs) and Haloacetic acids (five) (HAA5s)	Enhanced coagulation or enhanced softening plus GAC10, or nanofiltration with a molecular weight cutoff <1000 Daltons; or GAC20

2-002.04E2b(3) The Department identifies the following as the best technology, treatment techniques, or other means available for achieving compliance with the maximum contaminant levels for TTHMs and HAA5s identified in 179 NAC 2-002.04E2b for consecutive systems and applies only to disinfected water that consecutive systems buy or otherwise receive:

Disinfection byproduct	Best available technology
Total trihalomethanes (TTHMs) and Haloacetic acids (five) (HAA5s)	Systems serving >10,000: Improved distribution system and storage tank management to reduce residence time, plus the use of chloramines for disinfectant residual maintenance Systems serving <10,000: Improved distribution system and storage tank management to reduce residence time

2-002.~~02F~~ 04F Maximum Residual Disinfectant Levels

2-002.~~02F1~~ 04F1 Maximum residual disinfectant levels (with compliance determined in accordance with 179 NAC 16-006) are as follows:

MRDLs

DISINFECTANT RESIDUAL	MRDL (MG/L)
Chlorine	4.0 (as Cl_2).
Chloramines	4.0 (as Cl_2).
Chlorine dioxide	0.8 (as ClO_2).

2-002.~~02F2~~ 04F2 Compliance dates

2-002.~~02F2a~~ 04F2a CWSs and NTNCWSs: Surface water systems and ground water systems under the direct influence of surface water serving 10,000 or more ~~persons~~ individuals must comply with 179 NAC 2-002.~~02F~~ 04F beginning January 1, 2002. Surface water systems and ground water systems serving fewer than 10,000 ~~persons~~ individuals and systems using only ground water not under the direct influence of surface water must comply with these maximum residual disinfectant levels beginning January 1, 2004.

2-002.~~02F2b~~ 04F2b Transient NCWSs: Surface water systems and ground water systems under the direct influence of surface water serving 10,000 or more ~~persons~~ individuals and using chlorine dioxide as a disinfectant or oxidant must comply with the chlorine dioxide MRDL beginning January 1, 2002. Surface water systems and ground water systems serving fewer than 10,000 ~~persons~~ individuals and using chlorine dioxide as a disinfectant or oxidant and systems using only ground water not under the direct influence of surface water and using chlorine dioxide as a disinfectant or oxidant must comply with the chlorine dioxide MRDL beginning January 1, 2004.

2-002.~~02F3~~ 04F3 The Department hereby identifies the following as the best technology, treatment techniques, or other means available for achieving compliance with the maximum residual disinfectant levels identified in 179 NAC 2-002.~~02F1~~04F1: control of treatment processes to reduce disinfectant demand and control of disinfection treatment processes to reduce disinfectant levels.

2-002.~~03~~ 05 Treatment Techniques

2-002.~~03A~~ 05A The requirements of 179 NAC 2-002.~~03~~ 05 establish treatment techniques in lieu of maximum contaminant levels for specified contaminants.

2-002.~~03B~~ 05B Treatment Techniques for Acrylamide and Epichlorohydrin: Each public water system owner must certify annually in writing to the Director (using third party or manufacturer's certification) that when acrylamide and epichlorohydrin are used in drinking water systems, the combination (or product) of dose and monomer level does not exceed the

levels specified as follows. Certifications can rely on manufacturers or third parties, as approved by the Director.

2-002.~~03B1~~05B1 Acrylamide = 0.05% dosed at 1 ppm (or equivalent)

2-002.~~03B2~~ 05B2 Epichlorohydrin = 0.01% dosed at 20 ppm (or equivalent)

2-002.~~04~~ 06 BAT (Best Available Technology): The Director hereby identifies as indicated in the table below granular activated carbon (GAC), packed tower aeration (PTA), or oxidation (OX) as the best technology treatment technique, or other means available for achieving compliance with the maximum contaminant level for organic contaminants identified in 179 NAC 2-002.~~02B1~~ 04B1 and 2-002.~~02B2~~04B2.

BAT FOR CONTAMINANTS LISTED IN 179 NAC 2-002.~~02B1~~ 04B1 and 2-002.~~02B2~~04B2

CAS NO.	Contaminant	GAC	PTA	OX
15972-60-8	Alachlor	X	--	--
116-06-3	Aldicarb	X	--	--
1646-88-4	Aldicarb sulfone	X	--	--
1646-87-3	Aldicarb sulfoxide	X	--	--
1912-24-9	Atrazine	X	--	--
71-43-2	Benzene	X	X	--
1563-66-2	Carbofuran	X	--	--
56-23-5	Carbon tetrachloride	X	X	--
57-74-9	Chlordane	X	--	--
75-99-0	Dalapon	X	--	--
94-75-7	2,4-D	X	--	--
103-23-1	Di(2-ethylhexyl)adipate	X	X	--
117-81-7	Di(2-ethylhexyl)phthalate	X	--	--
96-12-8	Dibromochloropropane (DBCP)	X	X	--
95-50-1	o-Dichlorobenzene	X	X	--
106-46-7	para-Dichlorobenzene	X	X	--

CAS NO.	Contaminant	GAC	PTA	OX
107-06-2	1,2-Dichloroethane	X	X	--
75-35-4	1,1-Dichloroethylene	X	X	--
156-59-2	cis-1,2-Dichloroethylene	X	X	--
156-60-5	trans-1,2-Dichloroethylene	X	X	--
75-09-2	Dichloromethane	--	X	--
78-87-5	1,2-Dichloropropane	X	X	--
88-85-7	Dinoseb	X	--	--
72-20-8	Endrin	X	--	--
100-41-4	Ethylbenzene	X	X	--
106-93-4	Ethylene Dibromide (EDB)	X	X	--
1071-83-6	Glyphosate	--	--	X
76-44-8	Heptachlor	X	--	--
1024-57-3	Heptachlor epoxide	X	--	--
118-74-1	Hexachlorobenzene	X	--	--
77-47-3	Hexachlorocyclopentadiene	X	X	--
58-89-9	Lindane	X	--	--
72-43-5	Methoxychlor	X	--	--
108-90-7	Monochlorobenzene	X	X	--
23135-22-0	Oxamyl (Vydate)	X	--	--
87-86-5	Pentachlorophenol	X	--	--
1918-02-1	Picloram	X	--	--
1336-36-3	Polychlorinated biphenyls (PCB)	X	--	--
122-34-9	Simazine	X	--	--
100-42-5	Styrene	X	X	--
1746-01-6	2,3,7,8-TCDD (Dioxin)	X	--	--
127-18-4	Tetrachloroethylene	X	X	--

CAS NO.	Contaminant	GAC	PTA	OX
108-88-3	Toluene	X	X	--
8001-35-2	Toxaphene	X	--	--
93-72-1	2,4,5-TP (Silvex)	X	--	--
120-82-1	1,2,4-Trichlorobenzene	X	X	--
71-55-6	1,1,1-Trichloroethane	X	X	--
79-00-5	1,1,2-Trichloroethane	X	X	--
79-01-6	Trichloroethylene	X	X	--
75-01-4	Vinyl chloride	--	X	--
1330-20-7	Xylene	X	X	--

2-002.~~05~~ 07 BAT FOR INORGANIC COMPOUNDS LISTED IN 179 NAC 2-002.~~02A~~ 04A (EXCEPT FLUORIDE)

BATs FOR INORGANIC COMPOUNDS

Chemical Name	BAT(s)
Antimony	2,7
Asbestos	2,3,8
Arsenic[4]	1,2,5,6,7,9,12[5,6]
Barium	5,6,7,9
Beryllium	1,2,5,6,7
Cadmium	2,5,6,7
Chromium	2,5,6[2],7
Cyanide	5,7,13
Mercury	2[1],4,6[1],7[1]
Nickel	5,6,7
Nitrate	5,7,9
Nitrite	5,7
Selenium	1,2[3],6,7,9
Thallium	1,5

[1] BAT only if influent Hg concentrations $\leq$ 10μg/L.
[2] BAT for Chromium III only.
[3] BAT for Selenium IV only.
[4] BAT for Arsenic V. Pre-oxidation may be required to convert Arsenic III to Arsenic V.
[5] To obtain high removals, iron to arsenic ratio must be at least 20:1.
[6] Effective for the purpose of compliance on January 23, 2006.

Key to BATS in Table

1 = Activated Alumina
2 = Coagulation/Filtration (not BAT for systems <500 service connections)
3 = Direct and Diatomite Filtration
4 - Granular Activated Carbon
5 = Ion Exchange
6 = Lime Softening (not BAT for systems <500 service connections)
7 = Reverse Osmosis
8 = Corrosion Control
9 = Electrodialysis
10 = Chlorine
11 = Ultraviolet
12 = Oxidation/Filtration
13 = Alkaline Chlorination (pH≥ 8.5)

2-002.~~06~~ 08 Best Available Technologies (BATs) for Radionuclides: The Director hereby identifies as indicated in the following table the best technology available for achieving compliance with the maximum contaminant levels for combined radium-226 and -228, uranium, gross alpha particle activity, and beta particle and photon radioactivity.

BAT FOR COMBINED RADIUM-226 AND RADIUM-228, URANIUM, GROSS ALPHA PARTICLE ACTIVITY, AND BETA PARTICLE AND PHOTON RADIOACTIVITY

Contaminant	BAT
1. Combined radium-226 and radium-228	Ion exchange, reverse osmosis, lime softening
2. Uranium	Ion exchange, reverse osmosis, lime softening, coagulation/filtration
3. Gross alpha particle activity (excluding radon and uranium)	Reverse osmosis
4. Beta particle and photon radioactivity	Ion exchange, reverse osmosis

2-002.~~07~~ 09 Small Systems Compliance Technologies List for Radionuclides

LIST OF SMALL SYSTEMS COMPLIANCE TECHNOLOGIES FOR RADIONUCLIDES AND LIMITATIONS TO USE

Unit Technologies	Limitations (See Footnotes)	Operator Skill Level Required[1]	Raw Water Quality Range and Considerations[1]
1. Ion exchange (IE)	a	Intermediate	All ground waters
2. Point of use (POU[2]) IE	b	Basic	All ground waters
3. Reverse osmosis	c	Advanced	Surface waters usually

Unit Technologies	Limitations (See Footnotes)	Operator Skill Level Required[1]	Raw Water Quality Range and Considerations[1]
(RO)			require pre-filtration
4. POU[2] RO	b	Basic	Surface waters usually require pre-filtration
5. Lime softening	d	Advanced	All waters
6. Green sand filtration	e	Basic	
7. Co-precipitation with barium sulfate	f	Intermediate to Advanced	Ground waters with suitable water quality
8. Electrodialysis/ electrodialysis reversal	---	Basic to Intermediate	All ground waters
9. Pre-formed hydrous manganese oxide filtration	g	Intermediate	All ground waters
10. Activated alumina	a, h	Advanced	All ground waters; competing anion concentrations may affect regeneration frequency
11. Enhanced coagulation/filtration	i	Advanced	Can treat a wide range of water qualities

[1] National Research Council (NRC), Safe Water from Every Tap: Improving Water Service to Small Communities. National Academy Press. Washington, D.C. 1997.
[2] A POU, or "point-of-use" technology is a treatment device installed at a single tap used for the purpose of reducing contaminants in drinking water at that one tap. POU devices are typically installed at the kitchen tap. See the April 21, 2000 Federal Register Notice of Data Availability (NODA) at http://www.epa.gov/safewater/radws/frnoda.pdf for more details.

Limitations Footnotes: Technologies for Radionuclides
a The regeneration solution contains high concentrations of the contaminant ions. Disposal options should be carefully considered before choosing this technology.
b When POU devices are used for compliance, programs for long-term operation, maintenance, and monitoring must be provided by water utility to ensure proper performance.
c Reject water disposal options should be carefully considered before choosing this technology. See other RO limitations described in the SWTR compliance technologies table.
d The combination of variable source water quality and the complexity of the water chemistry involved may make this technology too complex for small surface water systems.
e Removal efficiencies can vary depending on water quality.
f This technology may be very limited in application to small systems. Since the process requires static mixing, detention basins, and filtration, it is most applicable to systems with sufficiently high sulfate levels that already have a suitable filtration treatment train in place.
g This technology is most applicable to small systems that already have filtration in place.
h Handling of chemicals required during regeneration and pH adjustment may be too difficult for small systems without an adequately trained operator.
i Assumes modification to a coagulation/filtration process already in place.

2-002.~~08~~ 10 Small System Compliance Technologies (SSCTs) for Arsenic: The Director identifies in the following table the affordable technology, treatment technique, or other means available to systems serving 10,000 ~~persons~~ individuals or fewer for achieving compliance with the maximum contaminant level for arsenic effective for the purpose of compliance as of January 23, 2006:

SMALL SYSTEM COMPLIANCE TECHNOLOGIES (SSCTs)[1] FOR ARSENIC[2]

Small system compliance technology	**Affordable for listed small system categories[3]**
Activated Alumina (centralized)	All size categories
Activated Alumina (Point-of-use)[4]	All size categories
Coagulation/Filtration[5]	501-3,300, 3,301-10,000
Coagulation-assisted Microfiltration	501-3,300, 3,301-10,000
Electrodialysis reversal[6]	501-3,300, 3,301-10,000
Enhanced coagulation/filtration	All size categories
Enhanced lime softening (pH>10.5)	All size categories
Ion Exchange	All size categories
Lime Softening[5]	501-3,300, 3,301-10,000
Oxidation/Filtration[7]	All size categories
Reverse Osmosis (centralized)[6]	501-3,300, 3,301-10,000
Reverse Osmosis (Point-of-Use)[4]	All size categories

[1] Section 1412(b)(4)(E)(ii) of the federal Safe Drinking Water Act (SDWA) specifies that SSCTs must be affordable and technically feasible for small systems.
[2]SSCTs for Arsenic V. Pre-oxidation may be required to convert Arsenic III to Arsenic V.
[3]The federal SDWA specifies three categories of small systems: (i) those serving 25 or more, but fewer than 501, (ii) those serving more than 500, but fewer than 3,301, and (iii) those serving more than 3,300, but fewer than 10,001.
[4]When POU or POE devices are used for compliance, programs to ensure proper long-term operation, maintenance, and monitoring must be provided by the water system to ensure adequate performance.
[5]Unlikely to be installed solely for arsenic removal. May require pH adjustment to optimal range if high removals are needed.
[6]Technologies to reject a large volume of water—may not be appropriate for areas where water quantity may be an issue.
[7]To obtain high removals, iron to arsenic ratio must be at least 20:1.

2-002.~~09~~ 11 Compliance Technologies by System Size Category for Radionuclide Drinking Water Standards

COMPLIANCE TECHNOLOGIES BY SYSTEM SIZE CATEGORY FOR RADIONUCLIDE DRINKING WATER STANDARDS

Contaminant	**Compliance technologies[1] for system size categories (population served)**		
	25-500	**501-3,300**	**3,300-10,000**
Combined radium-226 and radium-228	1,2,3,4,5,6,7,8,9	1,2,3,4,5,6,7,8,9	1,2,3,4,5,6,7,8,9
Gross alpha particle activity	3,4	3,4	3,4

Beta particle activity and photon activity	1,2,3,4	1,2,3,4	1,2,3,4
Uranium	1,2,4,10,11	1,2,3,4,5,10,11	1,2,3,4,5,10,11

[1] **Note**: Numbers correspond to those technologies found listed in the unit technologies column in the table in 179 NAC 2-002.~~07~~09.