NAVIGATING
CHALLENGING WATERS

HDR's 7 STRATEGIES to DELIVER MORE VALUE from SOURCE to TAP

integrated WATER PLANNING
Establish a system-wide vision and goals to maximize value and minimize risk.

proactive SUPPLY DEVELOPMENT
Protect water resources now to ensure reliable supply and promote public health.

forward-looking REGULATORY COMPLIANCE
Plan for the future to cost-effectively meet conflicting requirements.

customized INFRASTRUCTURE MANAGEMENT
Apply capital planning and condition assessment tools to pinpoint and fund highest value projects.

21st century WATER TREATMENT
Think ahead and consider new technologies and tactics to deliver a sustainable facility.

alternative DELIVERY METHODS
Employ new processes to enhance project delivery and maximize your investments.

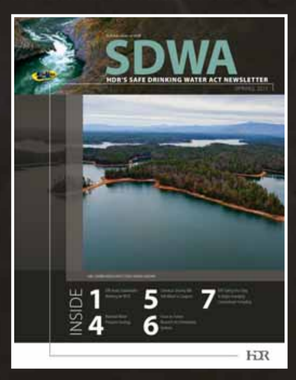
system-wide OPTIMIZATION
Identify and execute improvements to increase efficiencies and lower operating costs.

SAFE DRINKING WATER ACT

1974 2011

HDR's 13th Edition
FEBRUARY 2011

Additional HDR Resources:



Quarterly SDWA Newsletter
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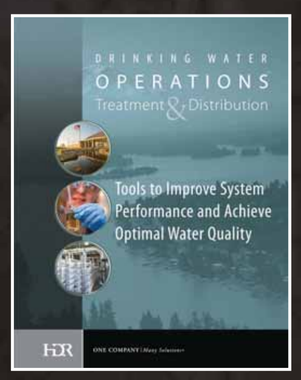

Drinking Water Operations Chart
www.hdrinc.com/OpChart

EXISTING NATIONAL PRIMARY DRINKING WATER REGULATIONS

Regulations	Name of Contaminant	MCL / MCLG (mg/L unless noted)	Health Effects of Contaminant	Monitoring Requirements / Comments
Inorganic Chemicals (IOCs)	Antimony	0.006 / 0.006	Increase in blood cholesterol; decrease in blood sugar	For IOCs: Once a year for surface water; once every 3 years for ground water (not including Asbestos, Lead and Copper, Nitrate, Nitrite and Radionuclides). Minimize monitoring costs by using historical data, waivers, susceptibility waivers, and/or making composite samples.
	Asbestos (fiber length > 10µm)	7 MFL / 7 MFL	Increased risk of developing benign intestinal polyps	Once every 9 years.
	Barium	2 / 2	Increase in blood pressure	For IOCs: Once a year for surface water; once every 3 years for ground water (not including Asbestos, Lead and Copper, Nitrate, Nitrite and Radionuclides). Minimize monitoring costs by using historical data, waivers, susceptibility waivers, and/or making composite samples.
	Beryllium	0.004 / 0.004	Intestinal lesions	
	Cadmium	0.005 / 0.005	Kidney damage	
	Chromium (total)	0.1 / 0.1	Allergic dermatitis	
	Copper (revisions & clarifications)	TT (AL = 1.3) / 1.3	Gastrointestinal/liver/kidney problems	Copper: Same as Lead.
	Cyanide (as free cyanide)	0.2 / 0.2	Thyroid/neurological effects	For IOCs: Once a year for surface water; once every 3 years for ground water (not including Asbestos, Lead and Copper, Nitrate, Nitrite and Radionuclides). Minimize monitoring costs by using historical data, waivers, susceptibility waivers, and/or making composite samples.
	Fluoride	4.0 / 4.0	Bone disease; children may get mottled teeth	
	Lead (revisions & clarifications)	TT (AL = 0.015) / 0	Kidney problems; high blood pressure; infants and children – delays in physical or mental development	Residential sample taken at the kitchen or bathroom sink tap. ALs must be met in 90% of the samples. Follow-up monitoring every 6 months after corrosion controls initiated or optimized. Reduced monitoring for systems consistently meeting AL. An AL exceedance is not a violation but can trigger other requirements that include water quality parameter monitoring, corrosion control treatment, source water monitoring/treatment, public education, and lead service line replacement.
	Mercury (inorganic)	0.002 / 0.002	Kidney damage	For IOCs: Once a year for surface water; once every 3 years for ground water (not including Asbestos, Lead and Copper, Nitrate, Nitrite and Radionuclides). Minimize monitoring costs by using historical data, waivers, susceptibility waivers, and/or making composite samples.
	Nitrate (as N)	10 / 10	Methemoglobinemia (blue baby syndrome)/diuresis	Ground water annually; surface water quarterly initially, then annually.
	Nitrite (as N)	1 / 1	Methemoglobinemia (blue baby syndrome)/diuresis	One sample during first 3-year compliance period. Repeat frequency determined by state.
	Selenium	0.05 / 0.05	Hair or fingernail loss; numbness of fingers or toes; circulatory problems	For IOCs: Once a year for surface water; once every 3 years for ground water (not including Asbestos, Lead and Copper, Nitrate, Nitrite and Radionuclides). Minimize monitoring costs by using historical data, waivers, susceptibility waivers, and/or making composite samples.
	Thallium	0.002 / 0.0005	Hair loss; changes in blood; kidney/liver/intestinal problems	
	Arsenic Rule Arsenic	0.010 / 0	Cancer risk/cardiovascular and dermal problems	Same as IOCs. Applies to CWS and NTNCWS.
	Radionuclides Combined Radium-226 and Radium-228	5 pCi/L / 0	Cancer risk	Sample point is the distribution system entry point that is representative of all sources being used. Four consecutive quarterly samples must be taken at all sample points. Rule applies to CWS only.
	Gross Alpha (excluding radon and uranium)	15 pCi/L / 0	Cancer risk	
	Beta Particles and Photon Emitters	4 mrem/year / 0	Cancer risk	Primacy agency must designate vulnerable systems. Once deemed vulnerable, quarterly samples required for beta emitters and annual samples for Tritium and Strontium-90 at entry to distribution system. Compliance is based on the running annual average of four quarterly samples taken at each sample point.
	Uranium	0.030 / 0	Kidney problems; cancer risk	Same as Combined Radium and Gross Alpha.
Organic Chemicals	**Synthetic Organic Chemicals (SOCs)** 2,3,7,8-TCDD (Dioxin)	0.00000003 / 0	Cancer risk; reproductive system problems	For SOCs: Four consecutive quarterly samples during first compliance period. Compliance is based on annual average of quarterly samples. If no detections are found during initial round, two quarterly samples are required each year for systems serving > 3,300; one sample is required every 3 years for smaller systems. With the completion of source water assessments, primacy agencies are allowed to develop alternative monitoring requirements. Contact your local primacy agency for further information. Applies to CWS and NTNCWS.
	2,4,5-TP (Silvex)	0.05 / 0.05	Liver problems	
	2,4-D	0.07 / 0.07	Adrenal gland/liver/kidney problems	
	Acrylamide	TT / 0	Cancer risk; nervous system/blood problems	
	Alachlor	0.002 / 0	Cancer risk; eye/liver/kidney/spleen problems	
	Atrazine	0.003 / 0.003	Cardio problems/reproductive system problems	
	Benzo(a)pyrene (PAHs)	0.0002 / 0	Cancer risk; reproductive system problems	
	Carbofuran	0.04 / 0.04	Blood/nervous/reproductive system problems	
	Chlordane	0.002 / 0	Cancer risk; liver/nervous system problems	
	Dalapon	0.2 / 0.2	Kidney problems	
	Di(2-ethylhexyl) adipate	0.4 / 0.4	Liver/weight loss/reproductive system problems	
	1,2-Dibromo-3-chloropropane (DBCP)	0.0002 / 0	Cancer risk; reproductive system problems	
	Di(2-ethylhexyl) phthalate (DEHP)	0.006 / 0	Cancer risk; liver/reproductive system problems	
	Dinoseb	0.007 / 0.007	Reproductive system problems	
	Diquat	0.02 / 0.02	Ocular problems	
	Endothall	0.1 / 0.1	Stomach/intestinal problems	
	Endrin	0.002 / 0.002	Liver problems	
	Epichlorohydrin	TT / 0	Cancer risk; stomach problems	
	Ethylene Dibromide (EDB)	0.00005 / 0	Cancer risk; liver/kidney/stomach/reproductive system problems	
	Glyphosate	0.7 / 0.7	Kidney/reproductive system problems	
	Heptachlor	0.0004 / 0	Cancer risk; liver problems	
	Heptachlor Epoxide	0.0002 / 0	Cancer risk; liver problems	
	Hexachlorobenzene	0.001 / 0	Cancer risk; liver/reproductive system problems	
	Hexachlorocyclopentadiene (HEX)	0.05 / 0.05	Kidney/stomach problems	
	Lindane	0.0002 / 0.0002	Kidney/liver problems	
	Methoxychlor	0.04 / 0.04	Reproductive system problems	
	Oxamyl (Vydate)	0.2 / 0.2	Nervous system problems	
	Polychlorinated Biphenyls (PCBs)	0.0005 / 0	Cancer risk; thymus gland/immune deficiencies/reproductive or nervous system problems	
	Pentachlorophenol	0.001 / 0	Cancer risk; liver/kidney problems	
	Picloram	0.5 / 0.5	Liver problems	
	Simazine	0.004 / 0.004	Problems with blood	
	Toxaphene	0.003 / 0	Cancer risk; liver/kidney/thyroid problems	
	Volatile Organic Chemicals (VOCs) 1,1,1-Trichloroethane	0.2 / 0.20	Liver/circulatory/nervous system problems	For VOCs: Four consecutive quarterly samples during first compliance period. Compliance is based on annual average of quarterly samples. If no detections are found during initial round, two quarterly samples are required each year for systems serving > 3,300; one sample is required every 3 years for smaller systems. With the completion of source water assessments, primacy agencies are allowed to develop alternative monitoring requirements. Contact your local primacy agency for further information. Applies to CWS and NTNCWS.
	1,1,2-Trichloroethane	0.005 / 0.003	Kidney/liver/immune system problems	
	1,1-Dichloroethylene	0.007 / 0.007	Liver problems	
	1,2,4-Trichlorobenzene	0.07 / 0.07	Adrenal gland problems	
	1,2-Dichloroethane	0.005 / 0	Cancer risk	
	1,2-Dichloropropane	0.005 / 0	Cancer risk	
	Benzene	0.005 / 0	Cancer risk; anemia/blood problems	
	Carbon Tetrachloride	0.005 / 0	Cancer risk; liver problems	
	Chlorobenzene	0.1 / 0.1	Kidney/liver problems	
	cis-1,2-Dichloroethylene	0.07 / 0.07	Liver problems	
	Dichloromethane	0.005 / 0	Cancer risk; liver problems	
	Ethylbenzene	0.7 / 0.7	Kidney/liver problems	
	Ortho-Dichlorobenzene	0.6 / 0.6	Kidney/liver/circulatory system problems	
	Para-Dichlorobenzene	0.075 / 0.075	Kidney/liver/spleen/circulatory system problems	
	Styrene	0.1 / 0.1	Liver/kidney/circulatory system problems	
	Tetrachloroethylene (PCE)	0.005 / 0	Cancer risk; liver problems	
	Toluene	1 / 1	Kidney/liver/nervous system problems	
	Trans-1,2-Dichloroethylene	0.1 / 0.1	Liver problems	
	Trichloroethylene (TCE)	0.005 / 0	Cancer risk; liver problems	
	Vinyl Chloride	0.002 / 0	Cancer risk	
	Xylenes (total)	10 / 10	Nervous system problems	
Disinfectants and Disinfection Byproducts	**Stage 1 Disinfectants/Disinfection Byproducts Rule (D/DBPR) Disinfectants**			Applies to all CWS and NTNCWS that treat water with a chemical disinfectant for primary or residual treatment.
	Chlorine	4.0 (as Cl_2) MRDL / 4 MRDLG	Eye/nose irritation; stomach discomfort	Monitor at the same sample locations as the Total Coliform Rule. Compliance based on running annual arithmetic average of monthly averages. Daily sample at distribution system entry point.
	Chloramines	4.0 (as Cl_2) MRDL / 4 MRDLG	Eye/nose irritation; stomach discomfort; anemia	
	Chlorine Dioxide	0.8 (as ClO_2) MRDL / 0.8 MRDLG	Anemia; nervous system problems	Daily sample at distribution system entry points. Four quarterly distribution samples. Compliance based on running annual average of quarterly average.
	Disinfection Byproducts Total Trihalomethanes (TTHMs)	0.080	Cancer risk; potential reproductive system effects; liver/kidney/nervous system problems	Running annual average of quarterly samples at four distribution system sites per plant or entry point.
	Haloacetic Acids (HAA5)	0.060	Cancer risk	
	Chlorite	1.0 / 0.8	Anemia; nervous system problems	Systems that add chlorine dioxide required to take daily sample at distribution system entry point.
	Bromate	0.010 / 0	Cancer risk	One sample per month (ozone systems only). Compliance based on running annual average.
	Total Organic Carbon (TOC)	TT		Source and treated water TOC sampled once a month. Compliance based on running annual average of TOC removal ratios.
	Stage 2 Disinfectants/Disinfection Byproducts Rule (D/DBPR) Disinfection Byproducts			Applies to all CWS and NTNCWS that add a primary or residual disinfectant other than UV or deliver water that has been disinfected.
	Total Trihalomethanes (TTHMs) Chloroform Bromodichloromethane (BDCM) Bromoform Dibromochloromethane (DBCM)	0.080 / 0.07 / 0 / 0 / 0.06	Cancer risk; potential reproductive system effects; liver/kidney/nervous system problems	Compliance Monitoring: Locational Running Annual Average (LRAA) of quarterly samples (yearly for very small surface water and small ground water systems) taken at locations determined by Initial Distribution System Evaluation (IDSE). The number of sites is based on the type of source water and population served. Compliance based on LRAAs is required by 2012-2013, depending on system size.
	Haloacetic Acids (HAA5) Monochloroacetic Acid (MCAA) Dichloroacetic Acid (DCAA) Trichloroacetic Acid (TCAA)	0.060 / 0.07 / 0 / 0.02	Nervous system/liver effects	
Microbiological Contaminants	**Total Coliform Rule (TCR)** Total Coliforms Fecal Coliforms *E. coli*	MCL = See comments MCLG = 0 for all 3 indicators	Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other, potentially harmful bacteria may be present. The presence of fecal coliform or *E. coli* may indicate potential contamination that can cause diarrhea, cramps, nausea, headaches or other symptoms.	Applies to all surface water and ground water systems. The total number and location of samples is based on the population served and a system-specific sampling plan. If 40 samples or more/month, no more than 5.0% positive; < 40 samples/month, no more than one positive for total coliforms.
	Surface Water Treatment Rule (SWTR) Turbidity	TT	None. Interferes with disinfection.	Applies to all public water systems using surface water or ground water under the direct influence of surface water. Grab samples every four hours or continuous monitoring for turbidity. Continuous chlorine residual required for systems > 3,300; one to four grab samples per day for systems ≤ 3,300. Must maintain disinfectant residual ≥ 0.2 mg/L at distribution system entry. Performance requirements demonstrated through combination of removal (filtration) and inactivation (disinfection). See IESWTR and LT1ESWTR for turbidity TT requirements.
	Giardia lamblia	TT / 0	Gastrointestinal illness; Giardiasis	Minimum three-log removal/inactivation of *Giardia* (99.9%).
	Enteric Viruses	TT / 0	Gastrointestinal and other viral infections	Minimum four-log removal/inactivation of viruses (99.99%).
	Legionella	TT / 0	Legionnaire's disease	No limit. Rule assumes if virus and *Giardia* limits are met, *Legionella* will be controlled.
	Heterotrophic Plate Count (HPC)	TT	None. Used to measure variety of bacteria common in water.	Filtration avoidance is allowed under certain circumstances (see Regulation). Lower bacteria concentration indicates better maintained water system.
	Interim Enhanced Surface Water Treatment Rule (IESWTR) Turbidity	TT	None. Interferes with disinfection.	Applies to plants using surface water or ground water under the direct influence of surface water. Must continue to comply with SWTR. Treatment effectiveness is demonstrated by combined effluent turbidity ≤ 0.3 NTU in 95% of measurements taken each month. Conventional and direct filtration systems must measure combined filter effluent turbidity at least every four hours and continuously monitor turbidity of each individual filter. The maximum turbidity limit is 1 NTU. If the PWS meets filtered water turbidity criteria, it is assumed to achieve the required 2-log *Cryptosporidium* removal. Performance triggers for individual filter turbidities lead to additional reporting and assessments if exceeded. IESWTR applies to systems ≥ 10,000; LT1ESWTR applies to systems <10,000 people.
	Cryptosporidium	TT / 0	Gastrointestinal illness; Cryptosporidiosis	
	Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) Turbidity	TT	None. Interferes with disinfection.	
	Cryptosporidium	TT / 0	Gastrointestinal illness; Cryptosporidiosis	
	Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) *Cryptosporidium*	TT / 0	Gastrointestinal illness; Cryptosporidiosis	Applies to all public water systems using surface water or ground water under the direct influence of surface water. Monthly monitoring for *Cryptosporidium* for 2 years is required to characterize the source water. Small systems monitor for *E. coli* in lieu of *Cryptosporidium*, unless *E. coli* is high - then monitor for *Cryptosporidium*. First round of monitoring complete for all system sizes by 2010. Second round of *Cryptosporidium* monitoring due 2015-2019, depending on system size. Calculated *Cryptosporidium* concentration defines required level of additional treatment. Treatment bins differ for filtered and unfiltered systems. Additional treatment options selected from the Microbial Toolbox. Additional treatment must be in place by 2012 for systems > 50,000 and by 2013 or 2014 for smaller systems, depending on size.
	Filter Backwash Rule *Cryptosporidium*	TT / 0	Gastrointestinal illness; Cryptosporidiosis	No monitoring is required, but systems must collect and retain information on recycle flows for review by the primacy agency. Applies to all systems using conventional or direct filtration treatment that recycle spent filter backwash water (excluding membrane plants), thickener supernatant or liquids from dewatering processes. TT Requirement - All recycle flows must be returned at the head of the plant so that complete treatment of the recycle stream is provided. Treatment of recycle streams prior to recycle is not required.
	Ground Water Rule (GWR) Viruses	TT	Gastrointestinal illness	Applies to all ground water systems. Sanitary surveys required every 3 years for CWS and every 5 years for NCWS. Source water monitoring is required for systems that do not treat to 4-log viral inactivation and is triggered by a total coliform (TC)-positive sample in the distribution system. Samples must be taken within 24 hours of TC-positive at all sources on line at the time the TC sample was taken. Special notification requirements for wholesalers and consecutive systems for TC-positive. If your state identifies significant deficiencies in sanitary survey, corrective action is required and can consist of correcting deficiencies, providing alternative source of water, eliminating source of contamination or providing treatment for 4-log inactivation of viruses. Implementation of rule varies widely among states – consult with your primacy agency regarding requirements.
Additional Rules	**Consumer Confidence Report Rule (CCR)**	None (data reporting only)		PWS to prepare and distribute annual CCR to their customers every July.

FUTURE REGULATIONS

Regulations	Name of Contaminant	MCL / MCLG (mg/L unless noted)	Health Effects of Contaminant	Monitoring Requirements / Comments
Revisions to TCR (RTCR)	**Total Coliforms** *E. coli*	TT (See Comments) MCLG = 0	Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other, potentially harmful bacteria may be present. The presence of *E. coli* may indicate potential contamination that can cause diarrhea, cramps, nausea, headaches or other symptoms.	Proposed RTCR published on July 14, 2010. *E. coli* MCL violation when i) both routine and associated repeat TC samples are TC-positive and either is also *E. coli*-positive, or ii) when system fails to take required repeat samples after routine sample is TC- and *E. coli*-positive. Monitoring for systems >1,000 remains the same except for changes to repeat and additional routine monitoring. TC-positives used as an indicator to start evaluation process to identify and correct sanitary defects. Level 1 assessment triggered by exceeding 5.0% TC-positives per month (systems taking ≥ 40 samples), by two or more TC-positives per month (systems taking < 40 samples), or by failing to take repeat samples. Level 2 assessment triggered by *E. coli* MCL violation, *E. coli* monitoring violation or second Level 1 trigger within a 12 month rolling period. Final RTCR is scheduled for promulgation in 2012.
Perchlorate	**Perchlorate**	To be determined	Prevents the thyroid gland from absorbing iodide from the bloodstream, a process known as "inhibiting iodide uptake."	Regulatory determination not to regulate (2008) has been reopened after the EPA published a supplemental request for comment on the breakdown of the Health Reference Levels (HRLs) by age category and EPA's finding of substantial likelihood that perchlorate will occur in public water systems with a frequency and at levels of public health concern. HRLs of various life stages range from 2 ppb to 23 ppb, so this is the likely range for the proposed MCLG. The EPA's final regulatory determination is expected by early 2011.
Lead and Copper Revisions	**Lead and Copper**	Lead: TT (AL = 0.015) / 0; Copper: TT (AL = 1.3) / 0	Lead: Kidney problems; high blood pressure; infants and children – delays in physical or mental development; Copper: Gastrointestinal/liver/kidney problems	Revisions planned for 2012. Potential changes: Flushing guidance and sample collection after service line replacement, lead service line replacement programs, sample site criteria, corrosion control guidance, tap sampling issues, consecutive water systems.
Groups of Contaminants	**Numerous potential groups of contaminants**			EPA's new drinking water strategy includes regulating contaminants as groups. Groups for consideration include carcinogenic volatile organic chemicals (VOCs), nitrosamines, disinfection byproducts from chlorination, perfluoronated compounds (PFCs), organophosphates, carbamates, triazines, chloracetanilides and cyanotoxins. The EPA is expected to select one group for regulation by early 2011. The EPA believes it has enough information to make a decision for the first three groups listed, but needs more data for the other groups.
Inorganic Chemicals	**Fluoride**	To be determined	Bone disease; children may get mottled teeth	The US Department of Health and Human Services has requested comment on lowering the recommended level of fluoride to 0.7 mg/L. The EPA intends to consider tightening the MCL but no schedule has been established.

SECONDARY STANDARDS

Guidelines

National Secondary Drinking Water Standards are non-enforceable guidelines regulating contaminants that may cause cosmetic effects or aesthetic effects in drinking water. The EPA recommends secondary standards but does not require systems to comply with secondary MCLs. States may establish or enforce standards that differ from these recommendations.

Contaminant	Secondary MCL (mg/L unless noted)	Noticeable Effects Above Secondary MCL
Aluminum	0.05 to 0.2	Colored water
Chloride	250	Salty taste
Color	15 (color units)	Visible tint
Copper	1.0	Metallic taste; blue-green staining
Corrosivity	Noncorrosive	Metallic taste; corroded pipes/fixtures; staining
Fluoride	2.0	Tooth discoloration
Foaming Agents	0.5	Frothy, cloudy; bitter taste; odor
Iron	0.3	Rusty color; sediment; metallic taste; reddish or orange staining
Manganese	0.05	Black to brown color; black staining; bitter metallic taste
Odor	3 TON (threshold odor number)	"Rotten-egg", musty or chemical smell
pH	6.5 - 8.5 su	Low pH: bitter metallic taste; corrosion. High pH: slippery feel; soda taste; deposits
Silver	0.10	Skin discoloration; graying of the white part of the eye
Sulfate	250	Salty taste
Total Dissolved Solids	500	Hardness; deposits; colored water; staining; salty taste
Zinc	5	Metallic taste

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KEY

AL – Action Level
CWS – Community Water System
GAC – Granular Activated Carbon
GW – Ground Water
HPC – Heterotrophic Plate Count
MCL – Maximum Contaminant Level
MCLG – Maximum Contaminant Level Goal
MFL – Million Fibers per Liter
mg/L – Milligrams per Liter
MRDL – Maximum Residual Disinfectant Level
MRDLG – Maximum Residual Disinfectant Level Goal
mrem – millirem
NCWS – Non-Community Water System
NTNCWS – Nontransient Non-Community Water System
NTU – Nephelometric Turbidity Unit
pCi/L – Picocuries per Liter
ppb – Parts per Billion
PWS – Public Water Systems
SDWA – Safe Drinking Water Act
TC – Total Coliform
TT – Treatment Technique