Attachment A

http://water.epa.gov/drink/contaminants/index.cfm

Water: Drinking Water Contaminants

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Drinking Water Contaminants

National Primary Drinking Water Regulations

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National Primary Drinking Water Regulations (NPDWRs or primary standards) are legally enforceable standards that apply to public water systems. Primary standards protect public health by limiting the levels of contaminants in drinking water. Visit the list of regulated contaminants with links for more details.

- List of Contaminants & their Maximum Contaminant Level (MCLs)
- Regulation Development
- EPA's Regulated Contaminant Timeline (PDF) (1 pp, 86 K) (About PDF)
- National Primary Drinking Water Regulations- The complete regulations regarding these contaminants availible from the Code of Federal Regulations Website

List of Contaminants & their MCLs

Information on this section

- Alphabetical List (PDF) (6 pp, 924 K) (About PDF) EPA 816-F-09-0004, May 2009

An alphabetical listing with links to fact sheets on the primary drinking water regulations.

- Microorganisms
- Disinfectants
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- Inorganic Chemicals
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Microorganisms

Contaminant	MCLG[1] (mg/L)[2]	MCL or TT[1] (mg/L)[2]	Potential Health Effects from Long-Term Exposure Above the MCL (unless specified as short-term)	Sources of Contaminant in Drinking Water
Cryptosporidium	zero	TT [3]	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste
Giardia lamblia	zero	TT[3]	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste
Heterotrophic plate count	n/a	TT[3]	HPC has no health effects; it is an analytic method used to measure the variety of bacteria that are common in water. The lower the concentration of bacteria in drinking water, the better maintained the water system is.	HPC measures a range of bacteria that are naturally present in the environment
Legionella	zero	TT[3]	Legionnaire's Disease, a type of pneumonia	Found naturally in water; multiplies in heating systems
Total Coliforms (including fecal coliform and *E. Coli*)	zero	5.0%[4]	Not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present[5]	Coliforms are naturally present in the environment; as well as feces; fecal coliforms and *E. coli* only come from human and animal fecal waste.
Turbidity	n/a	TT[3]	Turbidity is a measure of the cloudiness of water. It is used to indicate water quality and filtration effectiveness (e.g., whether disease-causing organisms are present). Higher turbidity levels are often associated with higher levels of disease-causing microorganisms such as viruses, parasites and some bacteria. These organisms can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.	Soil runoff
Viruses (enteric)	zero	TT[3]	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste

Disinfection Byproducts

Contaminant	MCLG[1] (mg/L)[2]	MCL or TT[1] (mg/L)[2]	Potential Health Effects from Long-Term Exposure Above the MCL (unless specified as short-term)	Sources of Contaminant in Drinking Water

Contaminant	MCLG[1] (mg/L)[2]	MCL or TT[1] (mg/L)[2]	Potential Health Effects from Long-Term Exposure Above the MCL (unless specified as short-term)	Sources of Contaminant in Drinking Water
Bromate	zero	0.010	Increased risk of cancer	Byproduct of drinking water disinfection
Chlorite	0.8	1.0	Anemia; infants & young children: nervous system effects	Byproduct of drinking water disinfection
Haloacetic acids (HAA5)	n/a[6]	0.060[7]	Increased risk of cancer	Byproduct of drinking water disinfection
Total Trihalomethanes (TTHMs)	--> n/a[6]	--> 0.080[7]	Liver, kidney or central nervous system problems; increased risk of cancer	Byproduct of drinking water disinfection

Disinfectants

Contaminant	MCLG[1] (mg/L)[2]	MCL or TT[1] (mg/L)[2]	Potential Health Effects from Long-Term Exposure Above the MCL (unless specified as short-term)	Sources of Contaminant in Drinking Water
Chloramines (as Cl_2)	MRDLG=4[1]	MRDL=4.0[1]	Eye/nose irritation; stomach discomfort, anemia	Water additive used to control microbes
Chlorine (as Cl_2)	MRDLG=4[1]	MRDL=4.0[1]	Eye/nose irritation; stomach discomfort	Water additive used to control microbes
Chlorine dioxide (as ClO_2)	MRDLG=0.8[1]	MRDL=0.8[1]	Anemia; infants & young children: nervous system effects	Water additive used to control microbes

Inorganic Chemicals

Contaminant	MCLG[1] (mg/L)[2]	MCL or TT[1] (mg/L)[2]	Potential Health Effects from Long-Term Exposure Above the MCL (unless specified as short-term)	Sources of Contaminant in Drinking Water
Antimony	0.006	0.006	Increase in blood cholesterol; decrease in blood sugar	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder
Arsenic	0[7]	0.010 as of 01/23/06	Skin damage or problems with circulatory systems, and may have increased risk of getting cancer	Erosion of natural deposits; runoff from orchards, runoff from glass & electronicsproduction wastes
Asbestos (fiber >10 micrometers)	7 million fibers per liter	7 MFL	Increased risk of developing benign intestinal polyps	Decay of asbestos cement in water mains; erosion of natural deposits
Barium	2	2	Increase in blood pressure	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Beryllium	0.004	0.004	Intestinal lesions	Discharge from metal refineries and coal-burning factories; discharge from electrical, aerospace, and defense industries
Cadmium	0.005	0.005	Kidney damage	Corrosion of galvanized pipes; erosion of natural deposits; discharge from metal refineries; runoff from waste batteries and paints
Chromium (total)	0.1	0.1	Allergic dermatitis	Discharge from steel and pulp mills; erosion of natural deposits
Copper	1.3	TT[7]; Action Level=1.3	Short term exposure: Gastrointestinal distress Long term exposure: Liver or kidney damage People with Wilson's Disease should consult their personal doctor if the amount of copper in their water exceeds the action level	Corrosion of household plumbing systems; erosion of natural deposits
	0.2	0.2	Nerve damage or thyroid problems	

Contaminant	MCLG[1] (mg/L)[2]	MCL or TT[1] (mg/L)[2]	Potential Health Effects from Long-Term Exposure Above the MCL (unless specified as short-term)	Sources of Contaminant in Drinking Water
Cyanide (as free cyanide)				Discharge from steel/metal factories; discharge from plastic and fertilizer factories
Fluoride	4.0	4.0	Bone disease (pain and tenderness of the bones); Children may get mottled teeth	Water additive which promotes strong teeth; erosion of natural deposits; discharge from fertilizer and aluminum factories
Lead	zero	TT[7]; Action Level=0.015	Infants and children: Delays in physical or mental development; children could show slight deficits in attention span and learning abilities Adults: Kidney problems; high blood pressure	Corrosion of household plumbing systems; erosion of natural deposits
Mercury (inorganic)	0.002	0.002	Kidney damage	Erosion of natural deposits; discharge from refineries and factories; runoff from landfills and croplands
Nitrate (measured as Nitrogen)	10	10	Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue -baby syndrome.	Runoff from fertilizer use; leaking from septic tanks, sewage; erosion of natural deposits
Nitrite (measured as Nitrogen)	1	1	Infants below the age of six months who drink water containing nitrite in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue -baby syndrome.	Runoff from fertilizer use; leaking from septic tanks, sewage; erosion of natural deposits
Selenium	0.05	0.05	Hair or fingernail loss; numbness in fingers or toes; circulatory problems	Discharge from petroleum refineries; erosion of natural deposits; discharge from mines
Thallium	0.0005	0.002	Hair loss; changes in blood; kidney, intestine, or liver problems	Leaching from ore-processing sites; discharge from electronics, glass, and drug factories

Organic Chemicals

Contaminant	MCLG[1] (mg/L)[2]	MCL or TT[1] (mg/L)[2]	Potential Health Effects from Long-Term Exposure Above the MCL (unless specified as short-term)	Sources of Contaminant in Drinking Water
Acrylamide	zero	TT[8]	Nervous system or blood problems; increased risk of cancer	Added to water during sewage/wastewater treatment
Alachlor	zero	0.002	Eye, liver, kidney or spleen problems; anemia; increased risk of cancer	Runoff from herbicide used on row crops
Atrazine	0.003	0.003	Cardiovascular system or reproductive problems	Runoff from herbicide used on row crops
Benzene	zero	0.005	Anemia; decrease in blood platelets; increased risk of cancer	Discharge from factories; leaching from gas storage tanks and landfills
Benzo(a)pyrene (PAHs)	zero	0.0002	Reproductive difficulties; increased risk of cancer	Leaching from linings of water storage tanks and distribution lines
Carbofuran	0.04	0.04	Problems with blood, nervous system, or reproductive system	Leaching of soil fumigant used on rice and alfalfa
Carbon tetrachloride	zero	0.005	Liver problems; increased risk of cancer	Discharge from chemical plants and other industrial activities
Chlordane	zero	0.002	Liver or nervous system problems; increased risk of cancer	Residue of banned termiticide

Contaminant	MCLG[1] (mg/L)[2]	MCL or TT[1] (mg/L)[2]	Potential Health Effects from Long-Term Exposure Above the MCL (unless specified as short-term)	Sources of Contaminant in Drinking Water
Chlorobenzene	0.1	0.1	Liver or kidney problems	Discharge from chemical and agricultural chemical factories
2,4-D	0.07	0.07	Kidney, liver, or adrenal gland problems	Runoff from herbicide used on row crops
Dalapon	0.2	0.2	Minor kidney changes	Runoff from herbicide used on rights of way
1,2-Dibromo-3-chloropropane (DBCP)	zero	0.0002	Reproductive difficulties; increased risk of cancer	Runoff/leaching from soil fumigant used on soybeans, cotton, pineapples, and orchards
o-Dichlorobenzene	0.6	0.6	Liver, kidney, or circulatory system problems	Discharge from industrial chemical factories
p-Dichlorobenzene	0.075	0.075	Anemia; liver, kidney or spleen damage; changes in blood	Discharge from industrial chemical factories
1,2-Dichloroethane	zero	0.005	Increased risk of cancer	Discharge from industrial chemical factories
1,1-Dichloroethylene	0.007	0.007	Liver problems	Discharge from industrial chemical factories
cis-1,2-Dichloroethylene	0.07	0.07	Liver problems	Discharge from industrial chemical factories
trans-1,2-Dichloroethylene	0.1	0.1	Liver problems	Discharge from industrial chemical factories
Dichloromethane	zero	0.005	Liver problems; increased risk of cancer	Discharge from drug and chemical factories
1,2-Dichloropropane	zero	0.005	Increased risk of cancer	Discharge from industrial chemical factories
Di(2-ethylhexyl) adipate	0.4	0.4	Weight loss, liver problems, or possible reproductive difficulties.	Discharge from chemical factories
Di(2-ethylhexyl) phthalate	zero	0.006	Reproductive difficulties; liver problems; increased risk of cancer	Discharge from rubber and chemical factories
Dinoseb	0.007	0.007	Reproductive difficulties	Runoff from herbicide used on soybeans and vegetables
Dioxin (2,3,7,8-TCDD)	zero	0.00000003	Reproductive difficulties; increased risk of cancer	Emissions from waste incineration and other combustion; discharge from chemical factories
Diquat	0.02	0.02	Cataracts	Runoff from herbicide use
Endothall	0.1	0.1	Stomach and intestinal problems	Runoff from herbicide use
Endrin	0.002	0.002	Liver problems	Residue of banned insecticide
Epichlorohydrin	zero	TT[8]	Increased cancer risk, and over a long period of time, stomach problems	Discharge from industrial chemical factories; an impurity of some water treatment chemicals
Ethylbenzene	0.7	0.7	Liver or kidneys problems	Discharge from petroleum refineries
Ethylene dibromide	zero	0.00005	Problems with liver, stomach, reproductive system, or kidneys; increased risk of cancer	Discharge from petroleum refineries
Glyphosate	0.7	0.7	Kidney problems; reproductive difficulties	Runoff from herbicide use
Heptachlor	zero	0.0004	Liver damage; increased risk of cancer	Residue of banned termiticide

Contaminant	MCLG[1] (mg/L)[2]	MCL or TT[1] (mg/L)[2]	Potential Health Effects from Long-Term Exposure Above the MCL (unless specified as short-term)	Sources of Contaminant in Drinking Water
Heptachlor epoxide	zero	0.0002	Liver damage; increased risk of cancer	Breakdown of heptachlor
Hexachlorobenzene	zero	0.001	Liver or kidney problems; reproductive difficulties; increased risk of cancer	Discharge from metal refineries and agricultural chemical factories
Hexachlorocyclopentadiene	0.05	0.05	Kidney or stomach problems	Discharge from chemical factories
Lindane	0.0002	0.0002	Liver or kidney problems	Runoff/leaching from insecticide used on cattle, lumber, gardens
Methoxychlor	0.04	0.04	Reproductive difficulties	Runoff/leaching from insecticide used on fruits, vegetables, alfalfa, livestock
Oxamyl (Vydate)	0.2	0.2	Slight nervous system effects	Runoff/leaching from insecticide used on apples, potatoes, and tomatoes
Polychlorinated biphenyls (PCBs)	zero	0.0005	Skin changes; thymus gland problems; immune deficiencies; reproductive or nervous system difficulties; increased risk of cancer	Runoff from landfills; discharge of waste chemicals
Pentachlorophenol	zero	0.001	Liver or kidney problems; increased cancer risk	Discharge from wood preserving factories
Picloram	0.5	0.5	Liver problems	Herbicide runoff
Simazine	0.004	0.004	Problems with blood	Herbicide runoff
Styrene	0.1	0.1	Liver, kidney, or circulatory system problems	Discharge from rubber and plastic factories; leaching from landfills
Tetrachloroethylene	zero	0.005	Liver problems; increased risk of cancer	Discharge from factories and dry cleaners
Toluene	1	1	Nervous system, kidney, or liver problems	Discharge from petroleum factories
Toxaphene	zero	0.003	Kidney, liver, or thyroid problems; increased risk of cancer	Runoff/leaching from insecticide used on cotton and cattle
2,4,5-TP (Silvex)	0.05	0.05	Liver problems	Residue of banned herbicide
1,2,4-Trichlorobenzene	0.07	0.07	Changes in adrenal glands	Discharge from textile finishing factories
1,1,1-Trichloroethane	0.20	0.2	Liver, nervous system, or circulatory problems	Discharge from metal degreasing sites and other factories
1,1,2-Trichloroethane	0.003	0.005	Liver, kidney, or immune system problems	Discharge from industrial chemical factories
Trichloroethylene	zero	0.005	Liver problems; increased risk of cancer	Discharge from metal degreasing sites and other factories
Vinyl chloride	zero	0.002	Increased risk of cancer	Leaching from PVC pipes; discharge from plastic factories
Xylenes (total)	10	10	Nervous system damage	Discharge from petroleum factories; discharge from chemical factories

Radionuclides

Contaminant	MCLG[1] (mg/L)[2]	MCL or TT[1] (mg/L)[2]	Potential Health Effects from Long-Term Exposure Above the MCL (unless specified as short-term)	Sources of Contaminant in Drinking Water
Alpha particles	none[7] ---------- zero	15 picocuries per Liter (pCi/L)	Increased risk of cancer	Erosion of natural deposits of certain minerals that are radioactive and may emit a form of radiation known as alpha radiation
Beta particles and photon emitters	none[7] ---------- zero	4 millirems per year	Increased risk of cancer	Decay of natural and man-made deposits of certain minerals that are radioactive and may emit forms of radiation known as photons and beta radiation
Radium 226 and Radium 228 (combined)	none[7] ---------- zero	5 pCi/L	Increased risk of cancer	Erosion of natural deposits
Uranium	zero	30 ug/L as of 12/08/03	Increased risk of cancer, kidney toxicity	Erosion of natural deposits

Notes

[1] Definitions: Maximum Contaminant Level Goal (MCLG) - The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals. Maximum Contaminant Level (MCL) - The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards. Maximum Residual Disinfectant Level Goal (MRDLG) - The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants. (TT) Treatment Technique - A required process intended to reduce the level of a contaminant in drinking water. Maximum Residual Disinfectant Level (MRDL) - The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

[2] Units are in milligrams per liter (mg/L) unless otherwise noted. Milligrams per liter are equivalent to parts per million.

[3] EPA's surface water treatment rules require systems using surface water or ground water under the direct influence of surface water to (1) disinfect their water, and (2) filter their water or meet criteria for avoiding filtration so that the following contaminants are controlled at the following levels:

- *Cryptosporidium: Unfiltered systems are required to include Cryptosporidium in their existing watershed control provisions.*
- *Giardia lamblia: 99.9% removal/inactivation*
- Viruses: 99.99% removal/inactivation
- *Legionella: No limit, but EPA believes that if Giardia* and viruses are removed/inactivated, according to the treatment techniques in the Surface Water Treatment Rule, *Legionella* will also be controlled.
- Turbidity: For systems that use conventional or direct filtration, at no time can turbidity (cloudiness of water) go higher than 1 nephelolometric turbidity unit NTU), and samples for turbidity must be less than or equal to 0.3 NTU in at least 95 percent of the samples in any month. Systems that use filtration other than the conventional or direct filtration must follow state limits, which must include turbidity at no time exceeding 5 NTU.
- HPC: No more than 500 bacterial colonies per milliliter.
- Long Term 1 Enhanced Surface Water Treatment: Surface water systems or (GWUDI) systems serving fewer than 10,000 people must comply with the applicable Long Term 1 Enhanced Surface Water Treatment Rule provisions (e.g. turbidity standards, individual filter monitoring, *Cryptosporidium* removal requirements, updated watershed control requirements for unfiltered systems).
- *Long Term 2 Enhanced Surface Water Treatment Rule This rule applies to all surface water systems or ground water systems under the direct influence of surface water. The rule targets additional Cryptosporidium treatment requirements for higher risk systems and includes provisions to reduce risks from uncovered finished water storage facilities and to ensure that the systems maintain microbial protection as they take steps to reduce the formation of disinfection byproducts.*
- Filter Backwash Recycling; The Filter Backwash Recycling Rule requires systems that recycle to return specific recycle flows through all processes of the system's existing conventional or direct filtration system or at an alternate location approved by the state.

[4] *No more than 5.0% samples total coliform-positive in a month. (For water systems that collect fewer than 40 routine samples per month, no more than one sample can be total coliform-positive per month.) Every sample that has total coliform must be analyzed for either fecal coliforms or E. coli* if two consecutive TC-positive samples, and one is also positive for *E.coli fecal coliforms, system has an acute MCL violation.*

[5] Fecal coliform and E. coli are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Disease-causing microbes (pathogens) in these wastes can cause diarrhea, cramps, nausea, headaches, or other symptoms. These pathogens may pose a special health risk for infants, young children, and people with severely compromised immune systems.

[6] Although there is no collective MCLG for this contaminant group, there are individual MCLGs for some of the individual contaminants:

- Trihalomethanes: bromodichloromethane (zero); bromoform (zero); dibromochloromethane (0.06 mg/L): chloroform (0.07mg/L).
- Haloacetic acids: dichloroacetic acid (zero); trichloroacetic acid (0.02 mg/L); monochloroacetic acid (0.07 mg/L). Bromoacetic acid and dibromoacetic acid are regulated with this group but have no MCLGs.

[7] Lead and copper are regulated by a Treatment Technique that requires systems to control the corrosiveness of their water. If more than 10% of tap water samples exceed the action level, water systems must take additional steps. For copper, the action level is 1.3 mg/L, and for lead is 0.015 mg/L.

[8] Each water system must certify, in writing, to the state (using third-party or manufacturer's certification) that when acrylamide and epichlorohydrin are used to treat water, the combination (or product) of dose and monomer level does not exceed the levels specified, as follows:

- Acrylamide = 0.05% dosed at 1 mg/L (or equivalent)
- Epichlorohydrin = 0.01% dosed at 20 mg/L (or equivalent)

National Secondary Drinking Water Regulations

National Secondary Drinking Water Regulations (NSDWRs or secondary standards) are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. EPA recommends secondary standards to water systems but does not require systems to comply. However, states may choose to adopt them as enforceable standards.

- National Secondary Drinking Water Regulations - The complete regulations regarding these contaminants available from the Code of Federal Regulations Web Site.
- For more information, read Secondary Drinking Water Regulations: Guidance for Nuisance Chemicals.

List of National Secondary Drinking Water Regulations

Contaminant	Secondary Standard
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Color	15 (color units)
Copper	1.0 mg/L
Corrosivity	noncorrosive
Fluoride	2.0 mg/L
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 threshold odor number
pH	6.5-8.5
Silver	0.10 mg/L
Sulfate	250 mg/L
Total Dissolved Solids	500 mg/L
Zinc	5 mg/L

Unregulated Contaminants

This list of contaminants which, at the time of publication, are not subject to any proposed or promulgated national primary drinking water regulation (NPDWR), are known or anticipated to occur in public water systems, and may require regulations under SDWA. For more information check out the list, or vist the Drinking Water Contaminant Candidate List (CCL) web site.

- Drinking Water Contaminant Candidate List 2
- Drinking Water Contaminant Candidate List (CCL) Web Site
- Unregulated Contaminant Monitoring Program (UCM)
- **Information on specific unregulated contaminants**
  - MTBE (methyl-t-butyl ether) in drinking water

Last updated on Tuesday, June 05, 2012

WATER QUALITY
RULES AND REGULATIONS

Chapter 8

WATER QUALITY RULES AND REGULATIONS

CHAPTER 8

QUALITY STANDARDS FOR WYOMING GROUNDWATERS

CERTIFICATION PAGE FOR RULES

Adoption date: March 16, 2005
To guarantee review by the Secretary of State within the 60 day deadline, this package must be submitted to the Secretary of State by: May 15, 2005

GENERAL INFORMATION:

1. Agency: Department of Environmental Quality, Water Quality Division
   Address: 122 West 25th Street, Herschler Building, Cheyenne, WY 82002
   Agency Contact Person for these Rules: Kevin Frederick
   Work Telephone: 777-7781 (x5985)

2. Are these new rules? ("new" - means the first set of regular rules to be promulgated by this agency after the Legislature adopted a new statutory provision or significantly amended an existing statute.
   Yes ___ No _X_

3. Chapter # of rules being created, amended or repealed: _8_

4. Does this rule replace an existing rule? Yes _X_ No ___ If yes, which chapter(s)? _8_

5. Does this proposed rule change meet minimum substantive state statutory requirements?
   Yes _X_ No ___

6. Does this proposed rule change exceed minimum substantive state statutory requirements? Yes ___ No _X_

NOTICE OF INTENDED RULEMAKING TO THE AG, LSO, AND SECRETARY OF STATE:

7. Notice of intended rulemaking containing all of the information required by W.S. 16-3-103(a) was filed with the Secretary of State on: December 29, 2004.

8. Notice of intended rulemaking and proposed rules in strike and underscore format were provided to the Legislative Service Office and courtesy copies of the notice and proposed rules were provided to the Attorney General and the Governor on: December 29, 2004.

PUBLIC NOTICE OF INTENDED RULEMAKING:

9. Yes _X_ No__ (If applicable) Notice was mailed 45 days in advance to all persons who made a timely request for advance notice.

10. Yes _X_ No__ A public hearing was held on the proposed rules on: January 19 and 20, and February 17, 2005.

FINAL FILING OF RULES:

11. Yes _X_ No__ A disk with an exact copy of the attached rules is attached or the electronic copy was sent via electronic mail to the Secretary of State on March 24, 2005.

12. Final rules with original signatures were sent to the Attorney General's office for the Governor's signature and filing with the Secretary of State on March 24, 2005.

13. Final rules were sent to the Legislative Service Office the same date listed in number 10 above.

CERTIFICATION BY AGENCY:

The undersigned certifies that the foregoing information is correct.

3/25/05
Date

John V. Corra
Director

GOVERNOR'S CERTIFICATION

I have reviewed these rules and determined that they:

(1) are within the scope of the statutory authority delegated to the adopting agency; and

(2) appear to be within the scope of the legislative purpose of the statutory authority.

Therefore, I approve the same.

4/26/05
Date Approved

Dave Freudenthal
Governor

STATE OF WYOMING}
Office of the Secretary
Filed the 27th day of April
2005 at 2:00 P M.
Joseph B. Meyer
Secretary of State

RECEIVED
APR 27 2005
SECRETARY OF STATE
WYOMING

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CHAPTER 8

QUALITY STANDARDS FOR WYOMING GROUNDWATERS

Section 1. Authority. These regulations are promulgated pursuant to Sections 35-11-101 through 1104 of the Wyoming Statutes, specifically Section 35-11-302, and no person shall cause, threaten or allow violation of any water quality standard or provision contained herein.

Section 2. Definitions. The following definitions supplement those definitions contained in Section 35-11-103 of the Wyoming Environmental Quality Act.

(a) "Aquifer" means a zone, stratum or group of strata that can store and transmit water in sufficient quantities for a specific use.

(b) "Background" means the constituents or parameters and the concentrations or measurements which describe water quality and water quality variability prior to a subsurface discharge.

(c) "Below-Surface Receiver (Receiver)" means any zone, interval, formation or unit in the subsurface which can accept water or fluid from other sources.

(d) "Domestic Water" means a water which is suitable for uses, including but not limited to, drinking, gardening and other household uses, municipal uses and farmstead uses, including water used in the washing or hydro-cooling of farm products destined for human consumption on the farm, for sale on the fresh food market or for delivery to a processing plant for canning, freezing or other type of preparation prior to marketing. Classification of Domestic water does not mean that it meets the national drinking water standards.

(e) "Fluid" means any material which flows or moves whether semisolid liquid, sludge, gas or any other form or state.

(f) "Groundwater" means subsurface water that fills available openings in rock or soil materials such that they may be considered water saturated under hydrostatic pressure.

(g) "Groundwaters of the State" are all bodies of underground water which are wholly or partially within the boundaries of the State; Groundwaters of the State is synonymous with Groundwaters of Wyoming.

(h) "Hazardous Material (Substance)" means any matter of any description including petroleum related products and radioactive material (substance) which, when discharged into any waters of the State presents an imminent and substantial hazard to public health or welfare and shall include all materials (substances) so designated by the U.S. Environmental Protection Agency in the Federal Register for March 13, 1978 (Part III), Water Programs, Hazardous Substances.

(i) "Milliequivalents Per Liter", abbreviated meq/L, used to report the Residual Sodium Carbonate concentration in water used for irrigation, is defined as 0.001 of the equivalent weight of the ion per liter volume.

(j) "Milligrams Per Liter", abbreviated mg/L, means milligrams of solute per liter of solution -- equivalent to parts per million assuming unit density of water.

(k) "Parameter" means one of a set of physical or chemical properties whose measured values determine the characteristics of a fluid.

(l) "pH" is a term to express the intensity of the acid or basic condition. A pH value of 7.0 at 25 degrees C is neutral, with pH's of less than 7.0 progressively more acid and pH's of greater than 7.0 progressively more basic.

(m) "Picocuries Per Liter", abbreviated pCi/L, is a measure of radioactivity of waters or fluids. A picocurie is equal to 10^{-12} curie; a curie is defined as 3.7×10^{10} disintegrations per second.

(n) "Residual Sodium Carbonate", abbreviated RSC, is defined as twice the concentration of carbonate or bicarbonate a water would contain after subtracting an amount equivalent to the calcium plus the magnesium, and is a measure of potential hazard which exists when waters high in carbonate and bicarbonate and relatively low in calcium and magnesium are used for irrigation.

(o) "Sodium Adsorption Ratio", abbreviated SAR, of a water is defined by the U.S. Department of Agriculture Laboratory (1954) as:

$$SAR = Na^{+} / \sqrt{(Ca + Mg)^{++} / 2}$$

where ion concentrations are expressed in milliequivalents per liter. The SAR predicts reasonably well the degree to which irrigation water tends to enter into cation-exchange reactions in soil.

(p) "Standard Unit", abbreviated s.u., is the unit of measurement used to describe the numerical pH of a solution, fluid or pollutant.

(q) "Subsurface Discharge" means a discharge to a below-surface receiver.

(r) "Total Dissolved Solids", abbreviated TDS, is the sum of the dissolved mineral constituents in water, expressed as mg/L.

(s) "Toxic Materials (Substances)" are those materials (substances) or combinations of materials (substances), including disease causing agents, which, after discharge and upon exposure, ingestion, inhalation or assimilation into any environmentally significant organism, either directly from the environment or indirectly by ingestion through food chains, may cause death, disease, behavioral abnormalities, cancer, genetic malfunctions, physiological malfunctions (including malfunctions in reproduction of offspring) or physical deformations in such organisms or their offspring; and includes all materials (substances) so designated as toxic by the U.S. Environmental Protection Agency in the Federal Register for December 24, 1975 (Part IV), Water Programs, National Interim Primary Drinking Water Regulations.

(t) "Underground Water" means subsurface water, which is any body of water under the surface of the earth, including water in the vadose zone and groundwater.

(u) "Vadose Zone" means the unsaturated zone in the earth, between the land surface and the top of the first saturated aquifer which is not a perched water aquifer. The vadose zone characteristically contains liquid water under less than atmospheric pressure, and water vapor and air or other gases at atmospheric pressure. Perched water bodies exist within the vadose zone.

(v) "Virtually Free" means a concentration less than the concentration which is the lower limit of detection.

Section 3. Underground Water Protected.

(a) All waters, including groundwaters of the State, within the boundaries of the State of Wyoming are the property of the State; and control of the beneficial use of waters of the State resides with the Wyoming State Engineer.

(b) Nothing herein contained shall be construed so as to interfere with the right of any person to use water from any underground water source for any purpose identified in W.S. 35-11-102 and 35-11-103(c)(i); or to limit or interfere with the jurisdiction, duties or authorities of other Wyoming State agencies or officials.

(c) Protection shall be afforded all underground water bodies (including water in the vadose zone). Water being used for a purpose identified in W.S. 35-11-102 and 103(c)(i) shall be protected for its intended use and uses for which it is suitable. Water not being put to use shall be protected for all uses for which it is suitable.

Section 4. Quality Standards Prescribed; Groundwaters of the State Classified.

(a) Standards are prescribed to protect the natural quality of underground water:

(i) Receiving pollution or wastes directly from a subsurface discharge or by migrating water or fluid of a discharge;

(ii) Invaded by underground water of inferior quality as a result of well or exploration hole drilling or completion practices;

(iii) From pollution which may result from above-ground facilities capable of causing or contributing to pollution;

(iv) From pollution which may result from surface mining operations.

(b) Groundwaters of the State are classified in order to apply standards to protect water quality. Groundwaters of the State are classified by use, and by ambient water quality.

(c) Waters which are known sources of supply and appropriated for uses identified in W.S. 35-11-102 and 103(c)(i) are classified herein as: Domestic water; Water for fish and aquatic life; Water for agriculture; Water for livestock; and, Water for industry.

A discharge or activity that impacts an underground source of water for existing uses identified in W.S. 35-11-102 and 103(c)(i) shall not make the affected water unsuitable for its intended use or uses, at any place or places of withdrawal or natural flow to the surface.

(d) Unappropriated waters are classified by ambient water quality.

(i) Class I Groundwater of the State - This water is suitable for domestic use. The ambient quality of underground water of this suitability does not have a concentration in excess of any of the standards for Class I Groundwater of the State (see Table I, page 9).

(ii) Class II Groundwater of the State - This water is suitable for agricultural use where soil conditions and other factors are adequate. The ambient quality of underground water of this suitability does not have a concentration in excess of any of the standards for Class II Groundwater of the State (see Table I, page 9).

(iii) Class III Groundwater of the State - This water is suitable for livestock. The ambient quality of underground water of this suitability does not have a concentration in excess of any of the standards for Class III Groundwater of the State (see Table I, page 9).

(iv) Class Special (A) Groundwater of the State - This water is suitable for fish and aquatic life. The ambient quality of underground water of this suitability does not have a concentration in excess of any of the standards for Class Special (A) Groundwater of the State (see Table I, page 10).

(v) Underground water of Class I, II, III or Special (A) shall not contain biological, hazardous, toxic or potentially toxic materials or substances in concentrations or amounts which exceed maximum allowable concentrations based upon information of the EPA in the Federal Register for December 24, 1975 (Part IV), Water Programs, National Interim Primary Drinking Water Regulations; and in the Federal Register for March 13, 1978 (Part II), Water Programs, Hazardous Substances.

In addition, underground water of Class I, II, III or Special (A) shall not contain any biological, hazardous, toxic or potentially toxic materials or substances in concentrations or amounts which, based upon the latest available scientific information and as determined by the Administrator, will impair this water for its use suitability or which may contribute to a condition in contravention of groundwater

quality standards or to any toxic or hazardous effect on natural biota.

(vi) A discharge into an aquifer containing Class I, II, III or Special (A) Groundwater of the State shall not result in variations in the range of any parameter, or concentrations of constituents in excess of the standards of these regulations at any place or places of withdrawal or natural flow to the surface. A discharge which results in concentrations in excess of standards shall be permitted if post-discharge water quality can be returned to a quality of use equal to, or better than, and consistent with the uses for which the water was suitable prior to the operation.

(vii) Class IV Groundwater of the State - This water is suitable for industry. The quality requirements for industrial water supplies range widely and almost every industrial application has its own standards.

(A) Class IV (A) Groundwater of the State has a total dissolved solids concentration not in excess of 10,000 mg/L.

(B) Class IV (B) Groundwater of the State has a total dissolved solids concentration in excess of 10,000 mg/L.

(C) A discharge into an aquifer containing Class IV (A) or IV (B) Groundwater of the State shall not result in the water being unfit for its intended use.

(D) A discharge into an aquifer with Class IV (A) or IV (B) Groundwater of the State shall not result in oil and grease concentrations in excess of 10 mg/L or a lesser amount if a concentration in excess of the lesser amount is determined to be toxic; or oil and grease in excess of background concentrations of the underground water, whichever is greater, at any place or places of withdrawal or natural flow to the surface.

(E) A discharge into an aquifer with Class IV (A) or IV (B) Groundwater of the State shall not result in radioactivity concentrations or amounts which exceed the standards for Class I through III and Special (A) Groundwaters of the State; or in concentrations or amounts which exceed background concentrations of the underground water, whichever is greater, at any place or places of withdrawal or natural flow to the surface.

(F) A discharge into an aquifer with Class IV (A) or IV (B) Groundwater of the State shall not result in biological, hazardous, toxic or potentially toxic materials or substances including pesticides, insecticides or herbicides in concentrations or amounts which exceed maximum allowable concentrations, based upon information of the EPA in the Federal Register for December 24, 1975 (Part IV), Water Programs, National Interim Primary Drinking Water Regulations, and in the Federal Register for March 13, 1978 (Part II), Water Programs, Hazardous Substances; or which exceed background concentrations of the underground water, whichever is greater, at any place or places of withdrawal or natural flow to the surface.

In addition, a discharge shall not result in any biological, hazardous, toxic or potentially toxic materials or substances, in concentrations or amounts which, based on the latest available scientific information and as determined by the Administrator, will impair the quality of ambient groundwaters of the State of this Class; or which may contribute to a condition in contravention of groundwater quality standards or cause, allow or permit any deleterious effect on natural biota.

(viii) Groundwater of the State found closely associated with commercial deposits of hydrocarbons and/or other minerals, or which is considered a geothermal resource, is Class V (Hydrocarbon Commercial), Class V (Mineral Commercial) or Class V (Geothermal) Groundwater of the State.

(A) A discharge into a Class V (Hydrocarbon Commercial) Groundwater of the State shall be for the purpose of the production of oil and gas and shall not result in the degradation or pollution or waste of other water resources.

(B) A discharge into a Class V (Mineral Commercial) Groundwater of the State shall be for the purpose of mineral production and shall not result in the degradation or pollution of the associated or other groundwater and, at a minimum, be returned to a condition and quality consistent with the pre-discharge use suitability of the water.

(C) A discharge into a Class V (Geothermal) Groundwater of the State shall be for the purpose of the production of geothermal resources and shall not result in the degradation or pollution or waste of other water resources.

(ix) Class VI Groundwater of the State may be unusable or unsuitable for use:

(A) Due to excessive concentration of total dissolved solids or specific constituents; or

(B) Is so contaminated that it would be economically or technologically impractical to make the water useable; or

(C) Is located in such a way, including depth below the surface, so as to make use economically and technologically impractical.

Section 5. Classification for Groundwater of the State Affected by a Discharge; Classification by Aquifer and Area.

(a) Classification of groundwaters of the State shall be based on the water quality standards of this chapter; excepting, a Class I Groundwater of the State shall be classified by ambient water quality and the technical practicability and economic reasonableness of treating ambient water quality to meet use suitability standards.

(b) Underground water quality shall be classified for an aquifer which is or may be affected by a subsurface discharge or other activity identified in Section 4.a. of these regulations.

(c) Classification shall be made:

(i) Whenever there is pollution or the threat of pollution to a groundwater of the State; or

(ii) The physical, chemical, radiological or biological properties of any groundwater of the State are or may be altered by man's action.

(d) Classification shall be for a water in a specified locally defined area by named and described aquifer or receiver. Any aquifer or receiver in its regional setting may have one or more classifications by defined area or areas.

(i) The name shall be a recognized geologic name whenever possible;

(ii) The description shall include a lithologic description.

(e) The lateral and vertical limits of an aquifer or receiver, for purposes of classification, shall be based on existing water use, ambient water quality and geologic and hydrologic characteristics of the aquifer or of the receiver.

(f) An underground water may be reclassified if new or additional data warrant reclassification.

TABLE I

UNDERGROUND WATER CLASS	I	II	III
Use Suitability	Domestic*	Agriculture	Livestock
Constituent or Parameter	Concentration**	Concent.**	Concent.**
Aluminum (Al)	---	5.0	5.0
Ammonia (NH_3-N)	0.5[7]	---	---
Arsenic (AS)	0.05	0.1	0.2
Barium (Ba)	2.0	---	---
Beryllium (Be)	---	0.1	---
Boron (B)	0.75	0.75	5.0
Cadmium (Cd)	.005	0.01	0.05
Chloride (Cl)	250.0	100.0	2000.0
Chromium (Cr)	.10	0.1	0.05
Cobalt (Co)	---	0.05	1.0
Copper (Cu)	1.0	0.2	0.5
Cyanide (CN)	0.2	---	---
Fluoride (F)	4.0	---	---
Hydrogen Sulfide(H_2S)	0.05	---	---
Iron (Fe)	0.3	5.0	---
Lead (Pb)	.015	5.0	0.1
Lithium (Li)	---	2.5	---
Manganese (Mn)	0.05	0.2	---
Mercury (Hg)	0.002	---	0.00005
Nickel (Ni)	---	0.2	---
Nitrate (NO_3-N)	10.0	---	---
Nitrite (NO_2-N)	1.0	---	10.0
(NO_3+NO_2)-N	---	---	100.0
Oil & Grease	Virtually Free	10.0	10.0
Phenol	0.001	---	---
Selenium (Se)	.05	0.02	0.05
Silver (Ag)	.10	---	---
Sulfate (SO_4)	250.0	200.0	3000.0
Total Dissolved Solids (TDS)	500.0	2000.0	5000.0
Vanadium (V)	---	0.1	0.1
Zinc (Zn)	5.0	2.0	25.0
pH	6.5-8.5	4.5-9.0s.u.	6.5-8.5s.u
SAR	---	8	---
RSC	---	1.25 meq/L	---
CombinedTotal Radium 226 and Radium 228[8]	5pCi/L	5pCi/L	5pCi/L
Total Strontium 90	8pCi/L	8pCi/L	8pCi/L
Gross alpha particle radioactivity (including Radium 226 but excluding Radon and Uranium[8]	15pCi/L	15pCi/L	15pCi/L

* This list does not include all constituents in the national drinking water standards.

** mg/L, unless other wise indicated

TABLE I

UNDERGROUND WATER CLASS Use Suitability Constituent or Parameter	Special (A) Fish/Aquatic Life Concentration*
Aluminum (Al)	0.1
Ammonia (NH_3)	0.02[1]
Arsenic (As)	0.05
Barium (Ba)	5.0
Beryllium (Be)	0.011-1.3[3]
Boron (B)	---
Cadmium(Cd)	0.0004-0.015[3]
Chloride (Cl)	---
Chromium (Cr)	0.05
Cobalt (Co)	---
Copper (Cu)	0.01-0.04[3]
Cyanide (CN)	0.005
Fluoride (F)	---
Hydrogen Sulfide (H_2S)	0.002[2]
Iron (Fe)	0.5
Lead (Pb)	0.004-0.15[3]
Lithium (Li)	---
Manganese (Mn)	1.0
Mercury (Hg)	0.00005
Nickel (Ni)	0.05-0.4[3]
Nitrate (NO_3-N)	---
Nitrite (NO_2-N)	---
(NO_3+NO_2-N	---
Oil & Grease	Virtually free
Phenol	0.001
Selenium(Se)	0.05
Silver(Ag)	0.0001-0.00025[3]
Sulfate (SO_4)	---
TotalDissolvedSolids(TDS)	500.0[4]-1000.0[5]-2000.0[6]
Uranium (U)	0.03-1.4[3]
Vanadium (V)	---
Zinc (Zn)	0.05-0.6[3]
pH	6.5s.u.-9.0s.u.
Combined Total Radium 226 and Radium 228[8]	5pCi/L
Total Strontium 90	8pCi/L
Gross alpha particle radioactivity (including Radium 226 but excluding Radon and Uranium[8]	15pCi/L

*mg/L, unless other wise indicated

TABLE I

Explanation for Superscripts Used in Table I

[1]Unionized ammonia: When ammonia dissolves in water, some of the ammonia reacts with water to form ammonium ions. A chemical equilibrium is established which contains unionized ammonia (NH_3), ionized ammonia (NH_4+) and hydroxide ions (OH^-). The toxicity of aqueous solutions of ammonia is attributed to NH_3; therefore, the standard is for unionized ammonia. (Note: 0.02 mg/L NH_3 is equivalent to 0.016 NH_3 as N.)

[2]Undissociated H_2S: The toxicity of sulfides derives primarily from H_2S, rather than from the dissociated (HS) or (S) ions; therefore, the standard is for the toxic undissociated H_2S.

[3]Dependent on hardness: The toxicity of metals in natural waters varies with the hardness of the water; generally, the limiting concentration is higher in hard water than in soft water.

[4]Egg hatching

[5]Fish rearing

[6]Fish and aquatic life

[7]Total ammonia nitrogen

[8]Requirements and procedures for the measurement and analysis of gross alpha particle activity, Radium 226 and Radium 228 shall be the same as requirements and procedures of the U.S. Environmental Protection Agency, National Interim Primary Drinking Water Regulations, EPA-570/9-76-003, effective June 24, 1977.

Section 6. Standards for the Underground Management of Hazardous or Toxic Wastes. The underground management of wastes includes the temporary storage and the ultimate disposal of all hazardous or toxic wastes in below-surface receivers. The following standards apply to any underground storage or disposal of hazardous or toxic wastes.

(a) The below-surface receiver:

(i) Is an extensive sedimentary rock stratum or strata free of complex faulting and folding and distant from any underground water recharge area;

(ii) Is adequately separated from aquifers both above and below;

(iii) Has normal or low formation pressure and is capable of accepting the discharge without necessitating excessive discharge or injection pressure;

(iv) Has slow movement of ambient formation fluid under the natural horizontal gradient and is not in an area of underground water discharge for the receiver;

(v) Is located areally and stratigraphically so that an escape of waste to useable water resources would not be anticipated due to:

(A) Seismic risk;

(B) Abandoned holes; or

(C) Mineral exploration or other drilling, or mineral development.

(b) The underground water in the receiver;

(i) Is not an economically available source of water or is unusable;

(ii) Is confined by strata overlying and underlying the receiver; and

(iii) Is classified as class IV groundwater by this chapter.

(c) The discharge or waste:

(i) Will not create or result in a hazard to health or impair existing rights, and is not prohibited from subsurface disposal by Federal or State law or regulation;

(ii) Will not degrade or decrease the availability of mineral resources, including oil and gas;

(iii) Is compatible with the receiver and ambient water; and

(iv) Can be controlled at all times.

Section 7. Testing Procedures.

(a) For determination of the parameters involved in the standards, analysis will be in accord with test procedures as defined pursuant to: Title 40, Code of Federal Regulations, Part 136, or any modifications thereto. For test procedures not listed in the Code of Federal Regulations, test procedures outlined in EPA Methods for Chemical Analysis of Water and Wastes (March, 1979); or Standard Methods for the Examination of Water and Wastewaters (1975); or, A.S.T.M. Standards, Part 31 (1979), Water shall be used.

(b) The analytical technique for total uranium (as U) shall be the fluorometric method as referenced in Methods for Determination of Radioactive Substances in Water and Fluvial Sediments, Techniques of Water - Resource Investigations of the U.S. Geological Survey, Book 5, Chapter A-5 (1977).

(c) Where standard methods of testing have not been established, the suitability of testing procedures shall be determined by the Department.

Section 8. Limit of Detection. Where the standard is below the lower limit of detection given in EPA Methods for Chemical Analysis of Water and Wastes (March, 1979), or Standard Methods for the Examination of Water and Wastewaters (1975), or, A.S.T.M. Standards, Part 31 (1979), Water, the standard shall be the lower limit of detection, unless otherwise provided by the Council.

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Wyoming Department of Environmental Quality
Water Quality Division

Guideline for Sampling and Testing Well Water Quality

The Wyoming Department of Environmental Quality (WDEQ) has developed this Guideline to provide basic information to well owners interested in evaluating water well quality for domestic use. Well owners may find the information in this guideline useful in understanding how and when to collect water well samples, what to sample for, and laboratories that perform water quality analyses. The information presented in this guideline is intended to assist well owners in making informed decisions, but well owners are also encouraged to seek professional advice and assistance related to their specific situation or concern.

Potential Sources of Groundwater Contamination

Virtually all types of land use activities have the potential to impact water supplies. Common land use activities that are known to have impacted water supplies include: agricultural, residential, government, commercial, and industrial (including mining and oil and gas development). Water wells can also be impacted by naturally occurring sources of contamination (e.g. arsenic, selenium, fluoride, radium, etc.) at levels that may cause health concerns. Well owners should become familiar with the various types of land use activities within their area in order to understand the types of chemical constituents that are often associated with them and that may impact groundwater. Please refer to the table of potential sources and contaminants available on DEQ's website at http://deq.state.wy.us/wqd/groundwater/index.asp that further describes potential sources of contamination and the types of materials and chemical constituents that are commonly associated with them.

Establishing 'Baseline' Quality of Well Water

DEQ recommends that all domestic wells be initially sampled and analyzed for **Tier 1** (with the exception of disinfection by-products and disinfectants), **Tier 2 and Tier 3** constituents as described below:

Tier 1 (Safe Drinking Water) constituents include those potential drinking water contaminants for which the US EPA has established safe drinking water levels (*National Primary Drinking Water Standards*), and levels that ensure the aesthetic (taste, odor, etc.) quality of drinking water (Secondary Drinking Water Standards). These include certain microorganisms, metals, inorganic minerals and chemical compounds, organic chemicals, and radionuclides known to be potentially harmful or otherwise affect the aesthetic quality of drinking water. A copy is available on DEQ's website at http://deq.state.wy.us/wqd/groundwater/index.asp. A Tier 1 analysis is very expensive and may cost upwards of a few thousand dollars to complete.

Tier 2 and Tier 3 ('Indicators') constituents are a limited set of potential contaminants that can be used to indicate changes in well water quality, and possibly detect the presence of water well contamination. They typically consist of several minerals and metals that occur naturally in ground water, physical parameters (e.g. pH), and one or more chemical constituents usually associated with potential sources of contamination in the area of the well. Different 'indicators' recommended by other agencies and laboratories may be equally suitable for establishing baseline water well quality and monitoring for potential contamination over time. The more comprehensive the list of constituents, the better, when determining whether well water is suitable for domestic use or has been impacted by a potential source of contamination.

Tier 2 constituents include: conductivity, pH, Total Dissolved Solids (TDS), alkalinity, barium, calcium, magnesium, sodium, chloride, sulfate, fluoride, nitrate, lead, arsenic, iron, and total organic carbon. A Tier 2 analysis is relatively inexpensive and will likely cost less than a couple hundred dollars to complete.

Tier 3 constituents are 'indicator' chemical compounds often associated with a potential source of contamination. A Tier 3 analysis can cost between a couple hundred to several thousand dollars to complete, depending upon the type and number of constituents to be analyzed by the laboratory.

Sampling Frequency

Upon completion of **Tier 1, Tier 2 and Tier 3** analyses to establish 'baseline' conditions, it is important to continue to periodically collect samples from the well in order to evaluate whether well water quality has changed over time, or not. Ideally, follow up samples should be analyzed for **Tier 1** constituents on a schedule similar to that required for public water systems, or more frequently if there is a noticeable change in the taste, color, or odor of well water. Generally, for groundwater-supplied public water systems EPA requires sampling and analyses for inorganic and synthetic organic contaminants and radionuclides every three years; volatile organic contaminants every 5 years (or annually if detected in prior samples); and nitrate and nitrite annually. Well owners may consider eliminating the need to analyze for constituents associated with sources of contamination which they believe pose little, if any threat to their water supply.

Unfortunately, the cost for Tier 1 analysis can be very expensive. Alternatively, less expensive sampling and lab analyses can be a useful way to periodically screen for changes in water well quality provided that the well owner understands the limitations of not completing a Tier 1 analyses on schedule. One alternative may be to rotate the sampling schedule by completing a Tier 1 analysis as scheduled in order to evaluate the safety of the well water for drinking water purposes, then complete less expensive Tier 2 and Ties 3 'indicator' sampling during Year 2 and annually or bi-annually thereafter in order to evaluate 'indicators' of potential contamination.

Well owners may wish to consider negotiating water well testing, both pre-and post-drilling, as a condition to their mineral lease, or surface use agreement. Obtaining baseline water well quality and periodic sampling and analysis may be beneficial to both parties.

Sample Collection and Laboratory Analysis

Water well testing should be arranged through a certified water testing laboratory and water well samples should be collected by an unbiased professional. This could be an employee of the water testing laboratory. Doing so can add significantly to the cost of water well testing but may be vital to the admissibility of the sample results if a legal action related to pollution of the water well ensues. It is unlikely that test results from water samples collected by the water well owner will be recognized in legal proceedings, however, well owners are encouraged to consult their own attorneys for professional advice.

It is also important to request laboratory methods that achieve a low detection limit in order to detect the presence of contaminants at low levels. Generally, the lower the detection limit, the more expensive the water quality analysis.

Before selecting a lab it may be prudent to check the laboratory's certifications. Preferred labs are certified by US EPA. Consult the 'Environmental' or 'Water Testing' sections of your local Yellow Pages for a list of laboratories within your area.

The Wyoming Department of Agriculture laboratory in Laramie also provides some analytical services and is EPA certified. For more information, contact the lab at 307-742-2984 or visit them online at: http://wyagric.state.wy.us/images/stories/pdf/forms/aslab/labfees.pdf.

Evaluating Sample Results

Tier 1 sample results should be compared to the safe drinking water levels listed on US EPA's Primary Drinking Water Standards table available on DEQ's website at http://deq.state.wy.us/wqd/groundwater/index.asp. If a sample result for any "primary" constituent exceeds its safe drinking water level (Maximum Contaminant Level (MCL)) listed on the table, the US EPA considers the water not safe for drinking water purposes. In these situations, well owners should discontinue use of the well until an assessment of water treatment alternatives has been completed. The cause may, or may not be associated with man-made contamination. For instance, some areas in Wyoming have naturally occurring constituents in ground water (e.g. arsenic, selenium, fluoride, radium, etc.) that exceed the safe drinking water level. If the cause of contamination is suspected to be a result of some type of human activity, well owners are encouraged to contact DEQ's Spill and Complaint hotline at 307-777-7781 or provide information online at DEQ's website (http://deq.state.wy.us/) by clicking on the link *"Got a Spill?"*.

Tier 1 sample results should also be compared to the aesthetic drinking water levels listed on US EPA's Secondary Drinking Water Standards table available on DEQ's website at http://deq.state.wy.us/wqd/groundwater/index.asp. If a sample result for any "secondary" constituent exceeds its aesthetic drinking water level (Secondary Standard) listed on the table, the water may be safe for drinking water purposes, but may have problems with taste, appearance, or odor. Again, the cause may, or may not be associated with manmade contamination. Well owners should contact their local health department or county conservation district office, or visit DEQ's website at http://deq.state.wy.us/wqd/groundwater/index.asp for further information on water treatment.

Usually one sees only minor fluctuations in **Tier 2** water quality results over time. Tier 2 sample results should also be compared to US EPA's Primary and Secondary Drinking Water Standards table as described above. If Tier 2 sample results illustrate an increasing trend in constituent concentration over time (i.e. over several sampling periods) the well owner is encouraged to consult with the local DEQ Water Quality Division office in Cheyenne, Sheridan, Lander, or Casper.

Tier 3 sample results should be compared to US EPA's latest edition of "*Drinking Water Standards and Health Advisories*" available on DEQ's website at http://deq.state.wy.us/wqd/groundwater/index.asp. If a sample result for any constituent exceeds its safe drinking water level (Maximum Contaminant Level (MCL)) or its drinking water equivalent level (DWEL) listed on the table, the US EPA considers the water to be not safe for drinking water purposes. In these situations, well owners should discontinue use of the well until an assessment of water treatment alternatives has been completed. The cause may, or may not be associated with man-made contamination. If the cause of contamination is suspected to be a result of some type of human activity, well owners are encouraged to contact DEQ's Spill and Complaint hotline at 307-777-7781 or provide information online at DEQ's website (http://deq.state.wy.us/) by clicking on the link *"Got a Spill?"*.

For Further Information:

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