# ( IOUSE COMMITTEE REPO

(9)
**Date Referred to Committee: January 13, 2006** **FURTHER REFERRALS: Finance**

**Date of Committee Action:** 02/06/06

**The RESOUKCES Committee considered:** **HB 360**

**HOUSE BILL NO. 360** **REGULATION OF PUBLIC DRINKING WATER**

**"An Act relating to the regulation of public accommodation water supply systems."**

**Recommends it be replaced with [ ] HCS *or* [ ] CS *for* ____________ (________)**
***For Senate Bills with new title: [ ] Technical Title [ ] New Title: HCR_______*** **[ ] Same Title [ ] New Title**

[ ] attach amendments
[ ] add new referral to ___________Committee
[ ] Letter of Intent__________Committee

*List of Abbrev for Depts.:*
ADM
CED
COR
CRT
EED
DEC
DFG
GOV
HSS
LEG
LAW
LWF
MVA
DNR
DPS
REV
DOT
UA

***NEW* FISCAL NOTES**
*Assigned by Chief Clerk's Office

| List by Dept(s): | *FN# | Fiscal | Indet. | Zero |
|---|---|---|---|---|
| DEC | | 535.1 | | |
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***PREVIOUS* FISCAL NOTES**

| List by Dept(s): | FN# | Fiscal | Indet. | Zero |
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| **Signing with recommendations** | Printed Last Name | DP | DNP | NR | AM |
|---|---|---|---|---|---|
| | Gatto | | | X | |
| | Olson | | | X | |
| | Elkins | ✓ | | | |
| | | | | ✓ | |
| Harry J Crawford Jr | CRAWFORD | | | ✓ | |
| | | | | | |
| | | | | | |
| | | | | | |
| Chair: | SAMUELS | | | X | |
| Chair: | RAMRAS | X | | | |

# REPRESENTATIVE KEVIN MEYER

HOUSE DISTRICT 30


## SPONSOR STATEMENT

## HB 360

***"An Act relating to the regulation of public accommodation water supply systems."***

House Bill 360 directs the Department of Environmental Conservation to regulate small public water systems to ensure that the public's water supply is safe and clean.

Approximately 100,000 Alaskans get their water from small public water systems. These public water systems are too small to be regulated by EPA but are bigger than a private well. Approximately 3,000 of these small public water systems serve public facilities like day care or residential care facilities and office buildings.

According to the Center for Disease Control (CDC), the number of water borne outbreaks related to water sources not covered under the National Safe Drinking Water Act has increased 50% since 1993. The increase is attributed to rapid community growth, on-site waste disposal systems and faulty well design.
A national study of 5,000 small water systems showed 42% contaminated with fecal colifrom. Drinking Water can be contaminated with a variety of things that potentially are fatal including fecal coliforms, nitrates, E. Coli and Cryptosporidium.

While Alaskans may assume that the water they drink is safe and sanitary, the water used in many restaurants, day care facilities and other public places is often untested and could be contaminated. By monitoring and establishing standards for small public water systems the Department of Environmental Conservation will be able to respond to complaints from the public, ensure drinking water is safe and be prepared to respond to an emergency.


**Email:** Representative_Kevin_Meyer@legis.state.ak.us • **Toll Free:** (866) 465-4945
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# REPRESENTATIVE KEVIN MEYER

HOUSE DISTRICT 30

**MEMORANDUM**

**DATE:** January 16, 2006

**TO:** Representative Kevin Meyer

**FROM:** Mike Pawlowski

**RE:** Sectional Analysis for HB 360
(Version No. 24 – LS1468\A)

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As a preliminary matter, note that a sectional summary of a bill should not be considered an authoritative interpretation of the bill and the bill itself is the best statement of its contents. If you would like an interpretation of the bill as it may apply to a particular set of circumstances, please advise.

Section 1. Adds a new section requiring the Department of Environmental Conservation to adopt regulations establishing minimum drinking water standards and standards for the construction, improvement, and maintenance of water supply systems serving a place of public accommodation. Defines "public accommodation" and "water supply system."

Section 2. Requires plans be submitted to the Department of Environmental Conservation prior to the construction, extension, installation or operation of a water supply system as defined in section 1.

**Sectional**

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# FISCAL NOTE

**STATE OF ALASKA**
**2006 LEGISLATIVE SESSION**

Fiscal Note Number:
Bill Version: HB 360
() Publish Date:

Revision Date/Time (Note if correction):

| | |
|---|---|
| Title | Regulation of public accomodations water supply systems |
| Sponsor | Representative Kevin Meyer |
| Requester | House Resources Committee |

| | |
|---|---|
| Dept. Affected: | Dept of Environmental Conservation |
| RDU | Environmental Health |
| Component | Drinking Water |
| Component No. | 2066 |

**Expenditures/Revenues** (Thousands of Dollars)

Note: Amounts do not include inflation unless otherwise noted below.

| OPERATING EXPENDITURES | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 | FY 2012 |
|---|---|---|---|---|---|---|
| Personal Services | 379.7 | 428.9 | 428.9 | 428.9 | 428.9 | 428.9 |
| Travel | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 |
| Contractual | 95.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| Supplies | 8.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Equipment | 34.5 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Land & Structures | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Grants & Claims | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Miscellaneous | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **TOTAL OPERATING** | **535.1** | **497.8** | **497.8** | **497.8** | **497.8** | **497.8** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **CAPITAL EXPENDITURES** | | | | | | |
| **CHANGE IN REVENUES ( )** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

**FUND SOURCE** (Thousands of Dollars)

| | | | | | | |
|---|---|---|---|---|---|---|
| 1002 Federal Receipts | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1003 GF Match | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1004 GF | 485.1 | 447.8 | 447.8 | 447.8 | 447.8 | 447.8 |
| 1005 GF/Program Receipts | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1037 GF/Mental Health | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other (1007 Interagency) | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 |
| **TOTAL** | **535.1** | **497.8** | **497.8** | **497.8** | **497.8** | **497.8** |

**Estimate of any current year (FY2006) cost:** 0.0
**Mark this box (X) if funding for this bill is included in the Governor's FY 2007 budget proposal:** [ ]

**POSITIONS**

| | | | | | | |
|---|---|---|---|---|---|---|
| Full-time | 5 | 5 | 5 | 5 | 5 | 5 |
| Part-time | 0 | 0 | 0 | 0 | 0 | 0 |
| Temporary | 0 | 1 | 1 | 1 | 1 | 1 |

**ANALYSIS:** *(Attach a separate page if necessary)*

This legislation would require the DEC Drinking Water program to regulate public accommodations drinking water systems that serve 24 people or less for at least 60 days of the year. It excludes private homes and duplexes. The water systems that would qualify are not federally regulated and are classified by the state as "Class C" public water systems. The legislature, through the budget process, recently directed the department to eliminate services to Class C public water systems. This legislation would restore DEC's responsibility for a portion of the Class C systems in the state. There is no definitive inventory or data source for the total number of systems that could be regulated under this legislation but based on information from other agencies (DHSS, DEED, DEC Food Safety) on public accommodations, there is an estimated 3,000 systems that would be regulated.
(Continued on page 2)

| | | | |
|---|---|---|---|
| Prepared by: | Kristin Ryan, Director | Phone | (907) 269-7644 |
| Division | Environmental Health | Date/Time | 2/4/06 11:00 AM |
| Approved by: | Kurt Fredriksson | Date | 2/4/2006 |
| Agency | Department of Environmental Conservation | | |

FISCAL NOTE

STATE OF ALASKA
2006 LEGISLATIVE SESSION

BILL NO. HB 360

**ANALYSIS CONTINUATION**

(Continued from page 1)

Regulations will be promulgated that will require Class C systems to conduct annual tests for fecal coliform bacteria and nitrates with results sent to DEC. If the system has a surface water source, filtration and/or disinfection will be required. The legislation requires systems to submit plans to DEC for review and approval for construction, extensions, installations and operation.

- **Personal Services** - Funds are for 5 permanent FT positions and one non-permanent seasonal College Intern. The full time positions will develop regulations, implement the regulations, perform compliance monitoring, provide technical assistance, conduct plan reviews and enforcement. Funds are included in the second year and beyond for a seasonal College Intern that will be employed to assist the engineer's plan review process. This position will be used to support the program during seasonal peaks and to enhance recruitment of engineering positions for the Drinking Water program.

- **Travel** - Support travel for inspections and complaint investigations.

- **Contractual** - RSA to Dept. of Law for legal assistance with regulations development, professional services contracts to develop registration and compliance monitoring database, public notices, and position support costs in the first year. Thereafter, contractual funding is for position support costs.

- **Supplies** - Additional supplies are needed in the first year of start up and thereafter standard office supplies.

- **Equipment** - One time costs for office furniture and computers for all new permanent staff thereafter ongoing office equipment and computer replacement costs and inspection equipment costs (such as personal safety gear, field equipment, cameras).

- **Other Fund Source** - Interagency authority is included for an RSA with DHSS. A small subset of Class C systems; facilities that provide child care and/or assisted living, are currently provided limited services by DEC through an RSA from DHSS that began in FY2006 as an unbudgeted RSA. This RSA funding is expected to continue and is therefore included in this fiscal note.

# HB 360 Fiscal Note Detail

## Regulation of Class C (public accomodation) water systems

| | FY2007 | FY2008 | FY2009 | FY2010 | FY2011 | FY2012 |
|---|---|---|---|---|---|---|
| **Expenditures** | | | | | | |
| **Personal Services** | | | | | | |
| New PCNs | | | | | | |
| EPS IV | 86.4 | 86.4 | 86.4 | 86.4 | 86.4 | 86.4 |
| EE I | 91.6 | 91.6 | 91.6 | 91.6 | 91.6 | 91.6 |
| EEA II | 76.6 | 76.6 | 76.6 | 76.6 | 76.6 | 76.6 |
| EPS II | 68.0 | 68.0 | 68.0 | 68.0 | 68.0 | 68.0 |
| EPT | 57.1 | 57.1 | 57.1 | 57.1 | 57.1 | 57.1 |
| College Intern IV | 0.0 | 49.2 | 49.2 | 49.2 | 49.2 | 49.2 |
| Total PS | 379.7 | 428.9 | 428.9 | 428.9 | 428.9 | 428.9 |
| **Travel** | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 |
| **Contractual** | | | | | | |
| DB/IT | 30.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| DOL RSA | 20.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Position support | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| Sub-total | 95.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| **Supplies** | 8.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| **Equipment** | | | | | | |
| PC/Wk Stn | 34.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other | 0.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Sub-total | 34.5 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| **Total Operating** | 535.1 | 497.8 | 497.8 | 497.8 | 497.8 | 497.8 |
| **Fund Sources** | | | | | | |
| 1002 Fed | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1003 GFM | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1004 GF | 485.1 | 447.8 | 447.8 | 447.8 | 447.8 | 447.8 |
| 1005 GF/PR | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1007 IA | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 |
| **Total Fund Sources** | 535.1 | 497.8 | 497.8 | 497.8 | 497.8 | 497.8 |

# Appendix D Glossary

### *Cryptosporidium*

A protozoan associated with the disease cryptosporidiosis in humans. The disease can be transmitted through ingestion of drinking water, person-to-person contact, or other exposure routes. Cryptosporidiosis may cause acute diarrhea, abdominal pain, vomiting, and fever that last 1-2 weeks in healthy adults, but may be chronic or fatal in immuno-compromised people.

### Exposure

Contact between a person and a chemical. Exposures are calculated as the amount of chemical available for absorption by a person.

### *Giardia lamblia*

A protozoan, which can survive in water for 1 to 3 months, associated with the disease giardiasis. Ingestion of this protozoan in contaminated drinking water, exposure from person-to-person contact, and other exposure routes may cause giardiasis. The symptoms of this gastrointestinal disease may persist for weeks or months and include diarrhea, fatigue, and cramps.

### Maximum Contaminant Level (MCL)

Maximum permissible level of a contaminant in water which is delivered to any user of a public water system.

### Nitrates

Inorganic compounds that can enter water supplies from fertilizer runoff and sanitary wastewater discharges. Nitrates in drinking water are associated with methemoglobinemia, or blue baby syndrome, which results from interferences in the blood's ability to carry oxygen.

### Organics

Chemical molecules that contain carbon and other elements such as hydrogen. Organic contaminants of concern to drinking water include chlorohydrocarbons, pesticides, and others.

### Per capita

Per person; generally used in expressions of water use, gallons per capita per day (gpcd).

### Point-of-Use Water Treatment

Refers to devices used in the home or office on a specific tap to provide additional drinking water treatment.

### Point-of-Entry Water Treatment

Refers to devices used in the home where water pipes enter to provide additional treatment of drinking water used throughout the home.

### Radionuclides

Elements that undergo a process of natural decay. As radionuclides decay, they emit radiation in the form of alpha or beta particles and gamma photons. Radiation can cause adverse health effects, such as cancer, so limits are placed on radionuclide concentrations in drinking water.

### Risk

The potential for harm to people exposed to chemicals. In order for there to be risk, there must be hazard and there must be exposure.

### Treatment Technique

A specific treatment method required by EPA to be used to control the level of a contaminant in drinking water. In specific cases where EPA has determined it is not technically or economically feasible to establish an MCL, EPA can instead specify a treatment technique.

### Total Coliform

Bacteria that are used as indicators of fecal contaminants in drinking water.

### Toxicity

The property of a chemical to harm people who come into contact with it.

### Volatile Organics

Chemicals that, as liquid, evaporate into the air.

# Appendix A: National Primary Drinking Water Standards

| Contaminants | MCLG (mg/L) | MCL (mg/L) | Potential Health Effects from Ingestion of Water | Sources of Contaminant in Drinking Water |
|---|---|---|---|---|
| **Fluoride** | 4.0 | 4.0 | Skeletal and dental fluorosis | Natural deposits, fertilizer, aluminum industries, water additive |
| **Volatile Organics** | | | | |
| Benzene | zero | 0.005 | Cancer | Some foods, gas, drugs, pesticide, paint, plastic industries |
| Carbon Tetrachloride | zero | 0.005 | Cancer | Solvents and their degradation products |
| p-Dichlorobenzene | 0.075 | 0.075 | Cancer | Room and water deodorants, and "mothballs" |
| 1,2-Dichloroethane | zero | 0.005 | Cancer | Leaded gasoline, fumigants, paints |
| 1,1-Dichloroethylene | 0.007 | 0.007 | Cancer | Plastics, dyes, perfumes, paints |
| Trichloroethylene | zero | 0.005 | Cancer | Textiles, adhesives and metal degreasers |
| 1,1,1-Trichloroethane | 0.2 | 0.2 | Liver, Nervous system effects | Adhesives, aerosols, textiles, paints, inks, metal degreasers |
| Vinyl Chloride | zero | 0.002 | Cancer | May leach from PVC pipe, formed by solvent break down |
| **Coliform and Surface Water Treatment** | | | | |
| *Giardia Lamblia* | zero | TT | Gastroenteric disease | Human and animal fecal waste |
| *Legionella* | N/A | TT | Legionnaire's disease | Indigenous to natural waters, can grow in water heating systems |
| Standard Plate Count | N/A | TT | Indicates water quality, effectiveness of treatment | |
| Total Coliform * | zero | <5% + | Indicates gastroenteric pathogens | Human and animal fecal waste |
| Turbidity * | N/A | TT | Interferes with disinfection, filtration | Soil runoff |
| Viruses | zero | TT | Gastroenteric disease | Human and animal fecal waste |
| **Inorganics** | | | | |
| Antimony | zero | 0.006 | Cancer | Fire retardants, ceramics, electronics, fireworks, solder |
| Asbestos (>10um) | 7MFL | 7MFL | Cancer | Natural deposits, asbestos cement in water systems |
| Barium * | 2 | 2 | Circulatory system effects | Natural deposits, pigments, epoxy sealants, spent coal |
| Beryllium | 0.004 | 0.004 | Bone, lung damage | Electrical, aerospace, defense industries |
| Cadmium * | 0.005 | 0.005 | Kidney effects | Galvanized pipe corrosion, natural deposits, batteries, paints |
| Chromium * (total) | 0.1 | 0.1 | Liver, kidney, circulatory disorders | Natural deposits, mining, electroplating, pigments |
| Cyanide | 0.2 | 0.2 | Thyroid, nervous system damage | Electroplating, steel, plastics, mining, fertilizer |
| Mercury * (inorganic) | 0.002 | 0.002 | Kidney, nervous system disorders | Crop runoff, natural deposits, batteries, electrical switches |
| Nitrate * | 10 | 10 | Methemoglobulinemia | Animal waste, fertilizer, natural deposits, septic tanks, sewage |
| Nitrite | 1 | 1 | Methemoglobulinemia | Same as nitrate, rapidly converted to nitrate |
| Selenium * | 0.05 | 0.05 | Liver damage | Natural deposits, mining, smelting, coal/oil combustion |
| Thallium | 0.0005 | 0.002 | Kidney, liver, brain, intestinal | Electronics, drugs, alloys, glass |
| **Organics** | | | | |
| Acrylamide | zero | TT | Cancer, nervous system effects | Polymers used in sewage/wastewater treatment |
| Adipate, (di(2-ethylhexyl)) | 0.4 | 0.4 | Decreased body weight | Synthetic rubber, food packaging, cosmetics |
| Alachlor | zero | 0.002 | Cancer | Runoff from herbicide on corn, soybeans, other crops |
| Atrazine | 0.003 | 0.003 | Mammary gland tumors | Runoff from use as herbicide on corn and non-cropland |
| Carbofuran | 0.04 | 0.04 | Nervous, reproductive system effects | Soil fumigant on corn and cotton, restricted in some areas |
| Chlordane * | zero | 0.002 | Cancer | Leaching from soil treatment for termites |
| Chlorobenzene | 0.1 | 0.1 | Nervous system and liver effects | Waste solvent from metal degreasing processes |
| Dalapon | 0.2 | 0.2 | Liver and kidney effects | Herbicide on orchards, beans, coffee, lawns, road/railways |
| Dibromochloropropane | zero | 0.0002 | Cancer | Soil fumigant on soybeans, cotton, pineapple, orchards |
| o-Dichlorobenzene | 0.6 | 0.6 | Liver, kidney, blood cell damage | Paints, engine cleaning compounds, dyes, chemical wastes |
| cis-1,2-Dichloroethylene | 0.07 | 0.07 | Liver, kidney, nervous, circulatory | Waste industrial extraction solvents |

Notes: *Contaminants with interim standards which have been revised. TT=Special treatment techniques required
MFL=million fibers per liter +=less than 5% positive samples

| Contaminants | MCLG (mg/L) | MCL (mg/L) | Potential Health Effects from Ingestion of Water | Sources of Contaminant in Drinking Water |
|---|---|---|---|---|
| **Organics (continued)** | | | | |
| trans-1,2-Dichloroethylene | 0.1 | 0.1 | Liver, kidney, nervous, circulatory | Waste industrial extraction solvents |
| Dichloromethane | zero | 0.005 | Cancer | Paint stripper, metal degreaser, propellant, extraction |
| 1,2-Dichloropropane | zero | 0.005 | Liver, kidney effects, Cancer | Soil fumigant, waste industrial solvents |
| Dinoseb | 0.007 | 0.007 | Thyroid, reproductive organ damage | Runoff of herbicide from crop and non-crop applications |
| Dioxin | zero | 0.00000003 | Cancer | Chemical production by-product, impurity in herbicides |
| Diquat | 0.02 | 0.02 | Liver, kidney, eye effects | Runoff of herbicide on land & aquatic weeds |
| 2,4-D * | 0.07 | 0.07 | Liver and kidney damage | Runoff from herbicide on wheat, corn, rangelands, lawns |
| Endothall | 0.1 | 0.1 | Liver, kidney, gastrointestinal | Herbicide on crops, land/aquatic weeds, rapidly degraded |
| Endrin | 0.002 | 0.002 | Liver, kidney, heart damage | Pesticide on insects, rodents, birds, restricted since 1980 |
| Epichlorohydrin | zero | TT | Cancer | Water treatment chemicals, waste epoxy resins, coatings |
| Ethylbenzene | 0.7 | 0.7 | Liver, kidney, nervous system | Gasoline, insecticides, chemical manufacturing wastes |
| Ethylene dibromide | zero | 0.00005 | Cancer | Leaded gasoline additives, leaching of soil fumigant |
| Glyphosate | 0.7 | 0.7 | Liver, kidney damage | Herbicide on grasses, weeds, brush |
| Heptachlor | zero | 0.0004 | Cancer | Leaching of insecticide for termites, very few crops |
| Heptachlor epoxide | zero | 0.0002 | Cancer | Biodegradation of heptachlor |
| Hexachlorobenzene | zero | 0.001 | Cancer | Pesticide production waste by-product |
| Hexachlorocyclopentadiene | 0.05 | 0.05 | Kidney, stomach damage | Pesticide production intermediate |
| Lindane | 0.0002 | 0.0002 | Liver, kidney, nerve, immune, circul | Insecticide on cattle, lumber, gardens, restricted 1983 |
| Methoxychlor | 0.04 | 0.04 | Growth, liver, kidney, nerve effects | Insecticide for fruits, vegetables, alfalfa, livestock, pets |
| Oxamyl (Vydate) | 0.2 | 0.2 | Kidney damage | Insecticide on apples, potatoes, tomatoes |
| PAHs (benzo(a)pyrene) | zero | 0.0002 | Cancer | Coal tar coatings, burning organic matter, volcanoes, fossil fuels |
| PCBs | zero | 0.0005 | Cancer | Coolant oils from electrical transformers, plasticizers |
| Pentachlorophenol | zero | 0.001 | Liver and kidney effects, and cancer | Wood preservatives, herbicide, cooling tower wastes |
| Phthalate, (di (2 ethylhexyl)) | zero | 0.006 | Cancer | PVC and other plastics |
| Picloram | 0.5 | 0.5 | Kidney, liver damage | Herbicide on broadleaf and woody plants |
| Simazine | 0.004 | 0.004 | Cancer | Herbicide on grass sod, some crops, aquatic algae |
| Styrene | 0.1 | 0.1 | Liver, nervous system damage | Plastics, rubber, resin, drug industries, leachate from city landfills |
| Tetrachloroethylene | zero | 0.005 | Cancer | Improper disposal of dry cleaning and other solvents |
| Toluene | 1 | 1 | Liver, kidney, nervous, circulatory | Gasoline additive, manufacturing and solvent operations |
| Toxaphene | zero | 0.003 | Cancer | Insecticide on cattle, cotton, soybeans, cancelled 1982 |
| 2,4,5-TP | 0.05 | 0.05 | Liver and kidney damage | Herbicide on crops, right-of-way, golf courses, cancelled 1983 |
| 1,2,4-Trichlorobenzene | 0.07 | 0.07 | Liver, kidney damage | Herbicide production, dye carrier |
| 1,1,2-Trichloroethane | 0.003 | 0.005 | Kidney, liver, nervous system | Solvent in rubber other organic products, chemical production wastes |
| Xylenes (total) | 10 | 10 | Liver, kidney, nervous system | By-product of gasoline refining, paints, inks, detergents |
| **Lead and Copper** | | | | |
| Lead * | zero | TT+ | Kidneys, nervous system damage | Natural/industrial deposits, plumbing, solder, brass alloy faucets |
| Copper | 1.3 | TT# | Gastrointestinal irritation | Natural/industrial deposits, wood preservatives, plumbing |
| **Other Interim Standards** | | | | |
| Beta/ photon emitters | zero | 4 mrem/yr | Cancer | Decay of radionuclides in natural and man-made deposits |
| Alpha emitters | zero | 15 pCi/L | Cancer | Decay of radionuclides in natural deposits |
| Combined Radium 226/228 | zero | 5 pCi/L | Bone cancer | Natural deposits |
| Arsenic* | 0.05 | 0.05 | Skin, nervous system toxicity | Natural deposits, Smelters, glass, electronics wastes, Orchards |
| Total Trihalomethanes | zero | 0.10 | Cancer | Drinking water chlorination by-products |

Notes: *Contaminants with interim standards which have been revised. TT=Special treatment techniques required
+=Action Level 0.015mg/L #=Action Level 1.3mg/L pCi=picocuries

University of Idaho
College of Agriculture

Cooperative Extension System
Agricultural Experiment Station

*Quality Water for Idaho*
**Current Information Series No. 873**

# *Water Testing*

Ernestine Porter, Roy Taylor and Robert L. Mahler

## Should You Have Your Water Tested?

Whether to have your water tested is a serious question that concerns your health and that of your family. Your water should be safe to drink and acceptable for all other household uses. Contaminated water can cause illness and perhaps even death. In addition, a variety of less serious problems such as bad taste, off-color, odor and staining of clothes or fixtures are symptoms of water quality problems.

Even water that appears problem-free and crystal clear may not be safe or acceptable. Even so, not all people need to test their water. Testing for all possible contaminants is impractical and unnecessary.

## When Should You Test Your Water?

Whether you have a public or private water supply, you should have your water tested if the following situations arise:

| Situation | Test |
|---|---|
| Family members or house guests have recurrent incidents of gastrointestinal illness. | Test for coliform bacteria, nitrate and sulfate. |
| Household water plumbing contains lead pipes, fittings or solder joints. | Test for pH, corrosion index, lead, copper, cadmium and zinc. |
| You are buying a home and wish to assess the safety and quality of the existing water supply. | Test for coliform bacteria, nitrate, lead, iron, hardness, pH, sulfate, total dissolved solids (TDS), corrosion index and other parameters depending on proximity to potential sources of contamination. |
| You need a water softener to treat hard water. | Test for iron and manganese, which decrease the efficiency of cation exchange softeners, before purchase and installation. |
| You wish to monitor the efficiency and performance of home water treatment equipment. | Test for the specific water problem being treated upon installation, at regular intervals after installation and if water quality changes. |
| Water stains plumbing fixtures and laundry. | Test for iron, manganese and copper. |
| Water has an objectionable taste or smell. | Test for hydrogen sulfide, pH, corrosion index, copper, lead, iron, zinc, sodium, chloride and TDS. |
| Water appears cloudy, frothy or colored. | Test for color, turbidity and detergents. |
| Pipes or plumbing show signs of corrosion. | Test for corrosion index, pH, lead, iron, manganese, copper and zinc. |
| Water leaves scaly residues and soap scum and decreases the cleaning action of soaps and detergents. | Test for hardness. |
| Water supply equipment (pump, chlorinators, etc.) wears rapidly. | Test for pH, corrosion index. |

## Public vs. Private Water Supplies

Many homeowners get water simply by turning on the faucet and making a monthly payment to a municipal or other local water system. They use public water supplies in which individual households are connected to the same water system. Public systems draw water from rivers, reservoirs, springs and groundwater wells.

In private systems, individuals or individual households provide their own systems. Most private drinking water comes from wells, sometimes from springs and ponds.

If your water comes from a public water system, your water is tested regularly for contaminants that are covered by federal and state standards. These contaminants include pathogens, radioactive elements and certain toxic chemicals. However, some public water supplies may have water quality problems caused by inadequate treatment facilities or distribution systems. Some rural water supply districts do not have enough money to hire trained specialists or to comply immediately with expanding government requirements. In addition, corrosive water or deteriorating household pipes may add contaminants to drinking water after it enters the house.

If your drinking water comes from your own well, you alone are responsible for ensuring its safety. Routine testing for a few of the most common contaminants is highly recommended. Even if your water supply currently is pure and safe, regular testing can be valuable because it establishes a record of water quality. This record can be helpful in solving any future problems and in establishing or assessing damages to your water supply.

## Testing Private Water Supplies

**Routine Tests** -- The following testing frequencies are guidelines. Test more often if you suspect a problem with the quality of your water supply.

- **Once each year,** test for coliform bacteria, nitrate, pH and total dissolved solids (TDS). The best times to test for these contaminants are during spring or summer following a rainy period. These tests also should be conducted after repairing or replacing an old well or pipes and after installing a new pump.
- **Every 3 years,** test for sulfate, chloride, iron, manganese, lead, hardness and corrosion index.
- **If a new baby is expected** in the household, it is a good idea to test for nitrate in the early months of pregnancy, before bringing the infant home and again during the first 6 months of the baby's life.

**Special Situations** -- Where you live, and what is next to where you live, can sometimes affect the quality of your water. If someone in your family becomes ill or if the taste, odor or color of your water changes, your water supply may be contaminated.

| Situation | Test |
| --- | --- |
| Your well is in an area of intensive agricultural use. | Test for pesticides commonly used in the area, coliform bacteria, nitrate, pH and TDS. |
| You live near a mining operation. | Test for iron, lead, arsenic, manganese, aluminum, pH and corrosion index. |
| Your well is near a gas drilling operation. | Test for chloride, sodium, barium and strontium. |
| Your water smells of gasoline or fuel oil and your well is located near an operating or abandoned gas station or near buried fuel storage tanks. | Test for fuel components or volatile organic compounds (VOC). |
| Your well is near a road salt storage site or a heavily salted roadway and the water tastes salty or corrosion appears on pipes. | Test for chloride, TDS and sodium. |

## Collecting Test Samples

Most testing laboratories or services provide their own sample containers. Use the containers and carefully follow the laboratory's instructions for collecting, preserving and handling water samples. Samples for coliform bacteria testing must be collected in sterile containers under sterile conditions. Some collection procedures call for water to run from an inside tap for several minutes before you fill the sample containers. Other instructions ask you to collect samples in the morning, after water has been confined in the pipes overnight. Samples should arrive at a laboratory within 24 hours of collection.

Laboratories may sometimes send a trained technician to collect the sample or to analyze the sample in your home. Ask if this service is available. You may obtain better samples and therefore more reliable test results.

Record all your water test results as a reference for future testing. Even slight changes in contaminant concentrations are good indicators of new water problems. By comparing recent test results with past results, you may discover you need a change in treatment or that a treatment device is working poorly.

## Testing Services

- Public water supply systems are tested regularly for primary contaminants, monitored for levels of sodium and certain unregulated chemical contaminants and examined for corrosion in the water distribution system. They will provide water quality reports upon request.
- Private testing laboratories are listed in the yellow pages of the telephone book. Make sure they are certified by your state health department.
- County and state health laboratories, departments of health and local hospital laboratories often provide water testing services.
- Water treatment companies and plumbing supply stores may offer certain free tests in your home.
- Local engineering firms may test water for certain contaminants.
- The University of Idaho offers water testing services.
- Be wary of companies offering "free home water testing." Some of them may be interested only in selling you a water treatment device, whether or not you need it.

Contact the Extension agent in your county for information about water testing in your area.

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University of Idaho
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# Drinking Water Standards & Health Effects

SAFE DRINKING WATER ACT • CELEBRATING 25 YEARS • PROTECT OUR HEALTH FROM SOURCE TO TAP

Drinking water standards are set by the U.S. Environmental Protection Agency (USEPA) to control the level of contaminants in the nation's drinking water. The Safe Drinking Water Act (SDWA) requires USEPA to set these standards, which public water systems in the U.S. are required to meet. USEPA has set standards for 90 chemical, microbiological, radiological, and physical contaminants in drinking water. Seven of these are new standards which will be enforceable January 1, 2002. USEPA and others are currently conducting research and collecting information to determine which currently unregulated contaminants pose the greatest public health risk and will therefore be regulated in the future.

USEPA also sets Secondary Drinking Water Regulations, which are non-enforceable guidelines for contaminants that may cause cosmetic effects (such as skin and tooth discoloration) or aesthetic effects (such as taste or odor). Water systems are not required by USEPA to adopt these secondary standards, but states may choose to adopt and enforce them.

## Public Water Systems Must Meet National Drinking Water Standards

Drinking water standards apply to **public water systems**, which provide water to at least 15 connections or 25 persons at least 60 days out of the year (most cities and towns, schools, businesses, campgrounds, and shopping malls are served by public water systems).

## Private Wells

The 10 percent of Americans whose water comes from private wells (individual wells serving fewer than 25 persons) are not required to be protected by these federal standards. People with private wells are responsible for making sure that their own drinking water is safe. Some states do set standards for private wells, so well owners should check their state requirements. USEPA recommends testing your water once per year to see if it meets federal and state standards. Call the Safe Drinking Water Hotline at **1-800-426-4791** or see the Safewater home page at www.epa.gov/safewater/faq/sco.html to find out how to get a list of certified testing labs in your state.

## Bottled Water

Bottled water is regulated by the U.S. Food and Drug Administration as a food product, and is required to meet standards equivalent to those USEPA sets for tap water. For information on bottled water regulations, call the FDA at 1-800-463-6332.

### Steps in Drinking Water Standard Setting:

USEPA uses the following steps to set enforceable, health-based drinking water standards.

1. **Determine whether a contaminant should be regulated based on peer-reviewed science,** including data on: how often the contaminant occurs in the environment; how humans are exposed to it; the health effects of exposure, (particularly to vulnerable subpopulations); how easily the contaminant can be detected in drinking water; whether technology exists to remove it from drinking water; and the likely impact of regulation on water systems, public health, and the economy.

2. Set a **Maximum Contaminant Level Goal (MCLG)** (the level of a contaminant in drinking water below which there is no known or expected health risk. MCLGs allow for a margin of safety). These goals take into account the risks of exposure for certain sensitive populations, such as infants, the elderly, and persons with compromised immune systems. These goals are not enforceable levels because they do not take available technology into consideration, and therefore are sometimes set at levels which public water systems cannot meet.

3. **Propose an enforceable standard in the form of a Maximum Contaminant Level (MCL)** (the maximum amount of a contaminant allowed in water delivered to a user of any public water system) **or a Treatment Technique (TT)** (required procedure or level of technological performance set when there is no reliable method to measure a contaminant at very low levels). MCLs are set as close to MCLGs as feasible, considering available technology and cost. Examples of rules requiring treatment techniques are the Surface Water Treatment Rule (requires disinfection and filtration) and the Lead and Copper Rule (requires optimized corrosion control). Water samples that contain lead or copper exceeding the **action level** trigger additional treatment or other requirements that a water system must follow. Required testing (monitoring) schedules are part of the enforceable standard.

   After determining a proposed MCL or TT that is as close to the MCLG as possible based on affordable technology, USEPA must complete an economic analysis to determine whether the benefits of that standard justify the costs. If not, USEPA may adjust the MCL for a particular class or group of systems to a level that "maximizes health risk reduction benefits at a cost that is justified by the benefits." USEPA may not adjust the MCL if the benefits justify the costs to large systems and small systems that are unlikely to receive variances.

4. **USEPA sets an enforceable MCL or TT.** After considering comments on the proposed standard and other relevant information, USEPA makes final an enforceable Maximum Contaminant Level or Treatment Technique, including required testing and reporting schedules.

5. States are authorized to grant **variances** from standards for systems serving up to 3,300 people if the systems cannot afford to comply with a rule (through treatment, an alternative source of water, or other restructuring) and the systems install EPA-approved variance technology. States can grant variances to systems serving 3,301 - 10,000 people with USEPA approval. SDWA does not allow small systems to have variances for microbial contaminants. Under certain circumstances **exemptions** from standards may be granted to allow extra time to seek other compliance options or financial assistance. After the exemption period expires, the public water system must be in compliance. The terms of variances and exemptions must ensure no unreasonable risk to public health.

## Determining Whether Standards Are Needed for Other Contaminants – the Contaminant Candidate List

The 1996 Amendments to SDWA require USEPA to establish every 5 years a list of contaminants which are known or anticipated to occur in public water systems, and may require future regulations under SDWA. In establishing this contaminant candidate list USEPA has divided the contaminants among those which are priorities for additional research, those which need additional occurrence data, and those that are priorities for consideration in rulemaking. The list was developed with significant input from the scientific community and other interested parties. The next steps for USEPA are to determine which contaminants to address first in all categories, and to outline plans of action for making regulatory decisions for five or more contaminants by the year 2001.

In order to support this decision-making, USEPA has also established a National Contaminant Occurrence Database (NCOD), which stores data on the occurrence of both regulated and unregulated contaminants. USEPA is also required to list and develop regulations for monitoring certain unregulated contaminants. This monitoring data will provide the basis for identifying contaminants that may be placed on future Contaminant Candidate Lists and support the USEPA Administrator's decisions to regulate contaminants in the future.

COOPERATIVE EXTENSION AZ1008

# Health Effects of Drinking Water Contaminants

*Arizona Water* Series: Number 5

The University of Arizona • College of Agriculture • Tucson, Arizona 85721 Revised 5/98

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Chemical contaminants occur in drinking water supplies throughout the United States, ranging from barely detectable amounts to levels that could possibly threaten human health. Determining the health effects of these contaminants is difficult, especially since researchers are still learning how chemicals react in the body to damage cells and cause illness.

## Acute and Chronic Health Effects

Toxic doses of chemicals cause either acute or chronic health effects. An acute effect usually follows a large dose of a chemical and occurs almost immediately. Examples of acute health effects are nausea, lung irritation, skin rash, vomiting, dizziness and even death.

The levels of chemicals in drinking water, however, are seldom high enough to cause acute health effects. They are more likely to cause chronic health effects — effects that occur long after exposure to small amounts of a chemical. Examples of chronic health effects include: cancer, birth defects, organ damage, disorders of the nervous system, and damage to the immune system.

Evidence relating chronic health effects to specific drinking water contaminants is limited. In the absence of exact scientific information, scientists predict the likely adverse effects of chemicals in drinking water using laboratory animal studies and, when available, human data from clinical reports and epidemiological studies. **The possible chronic health effects of the chemicals listed in this fact sheet are conservative estimates, rarely based on documented human health effects.**

## Setting Standards

In setting standards for drinking water contaminants, regulators estimate the concentration of a contaminant that a person can drink safely over a lifetime. These calculations are based on all available toxicological information and allow a generous safety margin. The following chart lists contaminants currently regulated by U.S. Environmental Protection Agency (EPA) standards.

The EPA standard for drinking water, the **Maximum Contaminant Level (MCL)**, is the highest amount of a contaminant allowed in drinking water supplied by municipal water systems. Although MCLs are set primarily to protect health, they also take into consideration the feasibility and cost of analysis and treatment of the regulated contaminant.

Contaminants are regulated when they occur in drinking water supplies and are expected to threaten public health. The EPA will continue to set standards for many other drinking water contaminants not listed in this fact sheet which meet these criteria.

### National Primary Drinking Water Standards

| ORGANIC CHEMICALS | MCL (mg/L)[1] | HEALTH EFFECTS |
|---|---|---|
| Acrylamide | TT[2] | probable cancer, nervous system |
| Adipate (diethylhexyl) | 0.4 | liver damage, reduced bone mass |
| Alachlor | 0.002 | probable cancer |
| Atrazine | 0.003 | reproductive and cardiac |
| Benzene | 0.005 | cancer, chromosome changes |

[1] Milligrams per liter (mg/L) = one part per million (ppm) or 1 ounce in 7800 gallons.

[2] TT = Treatment technique requirement in effect.

| ORGANIC CHEMICALS | MCL (mg/L)[1] | HEALTH EFFECTS |
|---|---|---|
| Benzo(a)pyrene (PAH) | 0.0002 | developmental and reproductive effects |
| Carbofuran | 0.04 | nervous and reproductive system |
| Carbon tetrachloride | 0.005 | cancer, liver damage |
| Chlordane | 0.002 | probable cancer |
| 2,4-D | 0.07 | liver, kidney, nervous system |
| Dalapon | 0.2 | increased kidney-to-body weight |
| Di[2-ethylhexyl]adipate | 0.4 | liver damage, reduced bone mass |
| Dibromochloropropane (DBCP) | 0.0002 | probable cancer |
| o-Dichlorobenzene | 0.6 | liver, kidney, nervous system, blood cells |
| p-Dichlorobenzene | 0.075 | liver, anemia, skin lesions |
| 1,2-Dichloroethane | 0.005 | probable cancer |
| 1,1-Dichloroethylene | 0.007 | liver/kidney effects, cancer, toxicity to fetus |
| cis-1,2-Dichloroethylene | 0.07 | nervous and circulatory systems, liver |
| trans-1,2-Dichloroethylene | 0.1 | nervous and circulatory systems, liver |
| Dichloromethane | 0.005 | probable cancer, liver damage |
| 1,2-Dichloropropane | 0.005 | probable cancer, liver, lungs, kidney |
| Di(2-ethylhexyl)phthalate (PAE) | 0.006 | possible cancer, liver, reproductive effects |
| Dinoseb | 0.007 | decreased body and thyroid weight |
| Dioxin (2,3,7,8-TCDD) | $3.0 \times 10^{-8}$ | liver damage, birth defects, probable cancer |
| Diquat | 0.02 | cataracts |
| Endothall | 0.1 | increased organ weight |
| Endrin | 0.002 | nervous system, kidney effects |
| Epichlorohydrin | TT[2] | probable cancer, changes in blood and chromosomes |
| Ethylbenzene | 0.7 | liver, kidney, nervous system, eyes |
| Ethylene dibromide (EDB) | 0.00005 | probable cancer |
| Glyphosphate | 0.7 | lung congestion |
| Heptachlor | 0.0004 | probable cancer |
| Heptachlor epoxide | 0.0002 | probable cancer |
| Hexachlorobenzene (HCB) | 0.001 | skin lesions, nerve and liver damage |
| Hexachlorocyclopentadiene (HEX) | 0.05 | damage to liver, kidney, stomach, heart |
| Lindane | 0.0002 | liver, kidney |
| Methoxychlor | 0.04 | liver, kidney, nervous system, heart |
| Monochlorobenzene (Chlorobenzene) | 0.1 | liver, kidney, nervous system |

[1] Milligrams per liter (mg/L) = one part per million (ppm) or 1 ounce in 7800 gallons.
[2] TT = Treatment technique requirement in effect.

| ORGANIC CHEMICALS | MCL (mg/L)[1] | HEALTH EFFECTS |
|---|---|---|
| Oxamyl (Vydate) | 0.2 | decreased body weight |
| Pentachlorophenol | 0.001 | probable cancer, liver, kidney, reproductive effects |
| Picloram | 0.5 | liver damage |
| Polychlorinated byphenyls (PCBs) | 0.0005 | possible cancer, nose and throat irritation, liver function |
| Simazine | 0.004 | possible cancer, tremors, liver, kidney, nervous system |
| Styrene | 0.1 | liver, nervous system, cancer |
| Tetrachloroethylene | 0.005 | probable cancer, liver, kidney, nervous system |
| Toluene | 1.0 | kidney, liver, nervous system (memory, speech, hearing) |
| Toxaphene | 0.003 | possible cancer, liver, kidney, nervous system |
| 2-4-5-TP (Silvex) | 0.05 | liver, kidney |
| 1,2,4-Trichlorobenzene | 0.07 | increased adrenal gland weight |
| 1,1,1-Trichloroethane | 0.2 | nervous system |
| 1,1,2-Trichloroethane | 0.005 | liver, kidney, cancer |
| Trichloroethylene (TCE) | 0.005 | possible cancer, liver damage |
| Vinyl chloride | 0.002 | cancer, liver, nervous system |
| Xylenes (Total) | 10.0 | liver, kidney, cancer, bladder, respiratory tract |

[1] Milligrams per liter (mg/L) = one part per million (ppm) or 1 ounce in 7800 gallons.
[2] TT = Treatment technique requirement in effect.

| RADIONUCLIDES | MCL | HEALTH EFFECTS |
|---|---|---|
| Beta particle and photon activity | 4 mrem/yr[1] | cancer |
| Gross alpha particle activity | 15 pCi/L[2] | cancer |
| Combined radium 226 + 228 | 5 pCi/L[2] | bone cancer |

[1] "Rem" (Roentgen Equivalents in Man) means a dosage of ionizing radiation that gives the same biological effect as one roentgen of X-ray or gamma-ray radiation. A millirem (mrem) is 1/1000 of a rem.
[2] "Picocurie" (pCi) is the quantity of radioactive material producing 2.22 nuclear transformations per minute.

## An Explanation of Treatment Technique

Treatment Technique requirements vary with each contaminant. In general, depending upon the size of the population served by a water supplier, a predetermined number of samples must be taken within a specific time period. Only a certain percentage of these samples may exceed a specified level for each contaminant. For example, a water supplier serving more than 100,000 people must sample for lead from 100 household taps every six months. If more than 10% of these samples exceed 0.015 mg/L of lead, the water supplier must begin treatment. Treatment may consist of reducing the corrosivity of the water (highly corrosive water tends to leach lead out from pipe fittings), or removing the lead from the supply source, or replacing water lines that contain lead compounds. For microbes, treatment standards should reduce the risk of infection to less than one in 10,000 per year.

| INORGANIC CHEMICALS | MCL (mg/L)[1] | HEALTH EFFECTS |
|---|---|---|
| Antimony | 0.006 | possible cancer |
| Arsenic[2] | 0.05 | dermal and nervous system toxicity |
| Asbestos | 7 MFL (million fibers per liter, >10 microns long) | lung disease, cancer |
| Barium | 2.0 | circulatory system (high blood pressure) |
| Beryllium | 0.004 | bones, lung, cancer |
| Cadmium | 0.005 | kidney, liver, bones, blood |
| Chromium (total) | 0.1 | liver/kidney, skin, circulatory system, nerve tissues |
| Copper (at tap) | TT[3] | stomach and intestinal distress, liver, kidney, anemia |
| Cyanide | 0.2 | weight loss, thyroid, nerve damage |
| Fluoride | 4.0 | skeletal damage |
| Lead (at tap) | TT[3] | central and peripheral nervous system damage, kidney, highly toxic to infants and pregnant women |
| Mercury (inorganic) | 0.002 | kidney, nervous system |
| Nickel | 0.1 | heart and liver damage, skin irritation |
| Nitrate-Nitrogen | 10.0 | spleen hemorrhage, methemoglobinemia |
| Nitrite (as N) | 1.0 | spleen hemorrhage, methemoglobinemia |
| Nitrate + Nitrite (both as N) | 10.0 | spleen hemorrhage, methemoglobinemia |
| Selenium | 0.05 | nervous and circulatory system, liver, kidney, hair loss |
| Thallium | 0.002 | blood changes, liver, kidney, hair loss |

1 Milligrams per liter (mg/L) = one part per million (ppm) or 1 ounce in 7800 gallons.
2 Under review
3 TT = Treatment Technique requirement in effect.

| MICROBIOLOGICAL | MCL | HEALTH EFFECTS |
|---|---|---|
| *Giardia lamblia* | TT[1] | stomach and intestinal distress |
| *Legionella* | TT[1] | Legionnaire's disease (pneumonia) |
| Standard Plate Count | TT[1] | varies with organism |
| Turbidity | PS[2] | interferes with disinfection |
| Viruses | TT[1] | intestinal distress, infectious hepatitis |

1 Treatment Technique requirement in effect.
2 PS (Performance Standard) 0.5 NTU - 1.0 NTU, (Nephelometric Turbidity Unit).

## National Secondary Drinking Water Standards

| CONTAMINANTS | SUGGESTED LEVELS | EFFECTS |
|---|---|---|
| Aluminum | 0.05-0.2 mg/l | discoloration of water |
| Chloride | 250 mg/l | taste, corrosion of pipes |
| Color | 15 color units | aesthetic |
| Copper | 1 mg/l | taste, staining of porcelain |
| Corrosivity | non-corrosive | aesthetic and health related (corrosive water can leach lead from pipes into drinking water). |
| Fluoride | 2.0 mg/l | brownish discoloration of teeth |
| Foaming agents | 0.5 mg/l | aesthetic |
| Iron | 0.3 mg/l | taste, staining of laundry |
| Manganese | 0.05 mg/l | taste, staining of laundry |
| Odor | 3 (Threshold Odor Number) | aesthetic |
| pH | 6.5 - 8.5 | water is too corrosive |
| Silver | 0.1 mg/l | discoloration of the skin (argyria) |
| Sulfate | 250 mg/l | taste, laxative effects |
| Total Dissolved Solids (TDS) | 500 mg/l | taste and possible relation between low hardness and cardiovascular disease, also an indicator of corrosivity (related to lead levels in water), can damage plumbing and limit effectiveness of detergents. |
| Zinc | 5 mg/l | taste |

**Note:** Copper and fluoride appear on both the Primary and Secondary Standards lists. The effects of each contaminant at the lower levels found on the Secondary list are aesthetic only. At higher concentrations each can cause adverse health reactions and are therefore listed as Primary Standards. "Aesthetic" refers to effects of contaminants that may make water look, taste, or smell unpleasant, yet are not necessarily harmful to health.

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# *Water Testing and Interpreting Your Results*

***by Meg Burgett***
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***Methemoglobinemia***
***"Blue Baby Syndrome"***
*When infants ingest nitrate, the nitrate is converted to nitrite in the body. Nitrites interfere with the blood's ability to carry oxygen, and the infant appears slightly "blue."*

If you're like many Alaskans, your family's drinking water comes from a private, on-site well-your well. The health and well-being of your family depends in a large part on the quality of water from that well. Daily activities of those near your well have a direct impact on the quality of drinking water. To protect that water, your actions should minimize any risk to any surrounding wells. Periodically checking your water supply will assure you that your efforts have been successful and the water your family is drinking is safe.

Which Tests?

Water tests come in a variety of sizes and options. You can test your water for just a few indicators, or for a comprehensive analysis. As with all things, the more you ask for, the more it will cost you.

When deciding which tests are appropriate for you, make sure the most important indicators for your situation are selected, and that costs are kept reasonable. Frequently, labs will group the most common household tests into a "package" for convenience. For an accurate assessment of the quality of your water, have it tested by a certified testing lab.

The following four tests address the most common and serious health concerns, and indicated the possibility of a contaminated water supply.

### NITRATES

**What is it?** Nitrates are a major component of fertilizer and wastewater. They also result from the breakdown of organic matter buried in the soil. Excess nitrates in drinking water could be the result of a number of things: the overuse of fertilizers close to the well; the presence of septic effluent in the groundwater supplies caused by a failed or failing septic system or inadequate dilution or separation between the system and the well; or runoff containing animal wastes close to the well.

Drinking water that has high levels of nitrate can cause a serious illness in infants under the age of six months. This condition is called methemoglobinemia or "blue baby" syndrome, and can result in death.

**Acceptable Levels?** Water with nitrate levels above 10 parts per million (ppm) nitrate as nitrogen (mg/l NO3-N), should not be given to children under the age of six months, or pregnant women. If your water has nitrate levels above 10 ppm, consult your physician before using the water for any drinking water purposes.

**Treatment Options?** Nitrate is not readily removed by filtration or other common home water treatment systems. The best method for limiting nitrate in well water is by controlling nearby sources of nitrate.

### BACTERIA

**What is it?** Bacteria occur naturally in the environment. While some are not harmful to human health, others such as fecal bacteria present a very serious health risk. Fecal bacteria belong to a group of bacteria called coliform bacteria. Labs routinely test for coliform bacteria to determine if your drinking water has been contaminated with surface runoff wastewater. Wastewater not only contains bacteria, but may also contain other microorganisms such as viruses and protozoa that are associated with severe illnesses.

Since not every bacteria can be reasonably tested, labs routinely test for coliform bacteria as an indicator of the presence of

> ***Surface Water***
> *A few Alaskans, especially in rural areas, use surface water for their family's source of water. If you use surface water, you need to have a good water treatment system that includes disinfection and filtration, to be sure your water is safe to drink. Check with your local water treatment companies for different kinds of surface water systems, or contact the U.S. EPA for a copy of their publication, "Manual of Individual and Non-Public Water Supply Systems," for a description of surface water treatment methods.*
>
> *Sometimes, a well can also have surface water influence. This means that the water on the surface is in direct contact with the groundwater supply. There are no hard and fast guidelines for determining when a well is surface water influenced. However, shallow wells (less than 30 feet) and wells close to surface water sources (less than 100 feet to the lake or creek) are more at risk of contamination by disease-causing micro-organisms frequently found in surface water. The quality of surface water supplies fluctuates much more than that of groundwater (well water) supplies. It is affected by changes in temperature, algal blooms, amount of rainfall and runoff, and the activities in the watershed. If your well is shallow or close to a surface water source, you should have it tested by a certified laboratory to determine if it is surface water influenced, or install a water treatment system that includes disinfection and filtration.*

this type of contamination. This test is used to indicate the "potability" of drinking water. Coliform bacteria enter the environment through the discharge of untreated waste or runoff containing animal and/or human wastes.

Bacteria is most commonly a problem in surface waters. Bacteria, protozoa and viruses can cause severe illness if ingested. Generally not a problem in groundwater sources (i.e. wells), it's presence could signal a real threat.

**Acceptable Level?** If your drinking water tests positive for coliform bactera, other organisms may be present also. You should take immediate steps to treat your water. To prevent illness, drinking water should be completely free of coliform bacteria.

**Treatment Options?** Bacteria can only be killed by disinfection (such as chlorine-more for cloudy water, less for clear, 8-10 drops/gallon), or boiling the water for several minutes (3-5 minutes) prior to drinking. Filtration can help improve the performance of disinfectants by reducing the numbers of micro-organisms, and by removing sediments that interfere with the disinfection process. Filtration alone cannot generally remove all microorganisms and should not be considered completely effective.

### *ARSENIC*

**What is it?** Natural ore deposits of arsenopyrite, a gold bearing mineral, may release arsenic to groundwater under anaerobic (no oxygen) conditions. Some stream sediments have also been found to contain arsenic, particularly those draining through placer mine tailings deposits.

Naturally occurring arsenic has been found in groundwater wells in the Fairbanks area, on the Seward and Kenai Peninsulas and Southcentral Alaska around Wasilla. It is a highly toxic contaminant and listed as a hazardous material. A suspected carcinogen, it is also a teratogen—capable of crossing the placental membrane into the metabolic system of unborn children. The actual toxicity to humans varies. Because it is slow to leave the body, arsenic is a cumulative substance.

**Acceptable Levels?** The maximum level for arsenic in drinking water is set at 0.05 (parts per million).

**Treatment Options?** Arsenic can be removed from drinking water by a number of available technologies, the choice of which depends on the amount of water to be treated, the amount of arsenic present, and the presence of other contaminants.

**Other water problems.**

Your water may contain other substances that while not dangerous to your health, can cause objectionable tastes or odors, or staining of appliances and fixtures. If these qualities are not desirable to your family, home treatment systems can eliminate any of these problems. To ensure that you select the appropriate equipment for your home, the level of a number of minerals needs to be determined.

### IRON

**What is it?** Excess iron in groundwater supplies comes from the parent material of the soil around the well. It can cause a metallic taste, stain clothing and fixtures, and promote the growth of iron bacteria in the water system.

Iron is not considered toxic, but affects the appearance and palatability of the drinking water.

**Acceptable Levels?** An upper limit of 0.3 ppm of iron has been set for drinking water.

**Treatment Options?** Depending upon concentrations, iron can be removed by water softeners, or an iron filter with a greensand media and potassium permanganate as a regenerant.

### MANGANESE

**What is it?** Like iron, manganese originates from the soil around a well. It typically produces black staining and can give water an off-taste. Manganese is not considered toxic but does affect the appearance and palatability of the water.

**Acceptable Levels?** An upper limit of 0.05 ppm manganese has been set for drinking water pplies.

**Treatment Options?** Again, depending upon concentrations, manganese can be removed by water softeners, or an iron filter as described above.

## HARDNESS

**What is it?** Hard water comes from elevated levels of calcium, magnesium and other similar substances found in the soil around a well. Hard water will tend to deposit calcium carbonate (limestone) scale in plumbing systems, particularly on hot water or boiler heating elements. Soft water tends to be corrosive, dissolving metal pipes and fittings.

**Acceptable Levels?** There is no toxicity associated with hardness and no health standard has been established by the environmental regulatory agencies.

**Treatment Options?** Water softeners offer the best treatment method for hard or soft water.

## HYDROGEN SULFIDE

**What is it?** Hydrogen sulfide can be present in ground water containing sulfur under anaerobic (no oxygen) conditions. It is also the product of a bacterial reaction in the presence of sulfate.

Hydrogen sulfide gives water a "rotten egg" taste and odor and is often more noticeable in hot water than cold water. In drinking water supplies it is normally present only at "nuisance" levels.

**Acceptable Levels?** Like hardness, no health standard has been established by the environmental regulatory agencies for this element.

**Treatment Options?** Hydrogen sulfide can be converted back to sulfate by any oxidant such as dissolved air, chlorine, or potassium permanganate used to regenerate iron filters. If air is used, the water must be detained in a tank and aerated with a diffuser similar to an aquarium. If the hydrogen sulfide is being produced by bacteria growing in the plumbing or treatment system, a thorough disinfection with chlorine is normally required to eliminate the growths.

**Testing Frequency**

Drinking water supplies should be tested for bacteria and nitrate at least once a year. The other tests discussed here, should be made regularly (every three years or so).

Events that occur near your drinking water well may indicate a need to have additional tests performed on your water. If your well is located near a fuel oil spill (this would also include any petroleum products), it would be advisable to have your water tested for Volatile Organic Chemicals (VOCs). A less expensive test, Total Petroleum Hydrocarbon or TPH, will also detect the presence of spilled fuel oil. Have your water supply checked if you have drilled a second well or changed the pump or plumbing. Also have the water supply tested if there is new, or increased activity in your area that has the potential to contaminate a water supply.

For more information:

If you have more questions concerning your drinking water or would like more information on this subject, contact your local offices of the Alaska Cooperative Extension (ACE) or the Alaska Department of Environmental Conservation (ADEC). For a listing of certified water test labs in Alaska, check the ADEC website at: http://www.state.ak.us/dec/deh/water

*For an excellent reference on this topic, check out Plain Talk About Drinking Water: Questions and Answers about the Water you Drink by Dr. James Symons.*

***Units of Measure***
*The most commonly used unit of measure for water tests is milligrams per liter (mg/l). Generally speaking, this is equal to one part per million (ppm)—one part contaminant to one million parts water. Some toxins are reported in even smaller units, parts per billion (ppb).*

*(For a little perspective, one ppm would be approximately equal to one or two grains of sugar dissolved in a bath tub full of water)*

*The following table gives a subjective interpretation of relative hardness levels using the two most common units of measure for hardness.*

| *Relative Hardness* | *ppm (as $CaCO_3$)* | *grains/ gallon* |
|---|---|---|
| *soft* | *0 - 75* | *0 - 4.39* |
| *mod. hard* | *75 - 150* | *4.39 -8.77* |
| *hard* | *150 - 300* | *8.77-17.54* |
| *very hard* | *>300* | *>17.54* |

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Visit the Alaska Cooperative Extension Web site at
www.uaf.edu/coop-ext

# Arsenic in Ground-Water Resources of the United States

Arsenic is a naturally occurring element in rocks, soils, and the waters in contact with them. Recognized as a toxic element for centuries, arsenic today also is a human health concern because it can contribute to skin, bladder, and other cancers (National Research Council, 1999). Recently, the National Research Council (1999) recommended lowering the current maximum contaminant level (MCL) allowed for arsenic in drinking water of 50 µg/L (micrograms per liter), citing risks for developing bladder and other cancers. The U.S. Environmental Protection Agency (USEPA) will propose a new, and likely lower, arsenic MCL during 2000 (U.S. Environmental Protection Agency, 2000). This fact sheet provides information on where and to what extent natural concentrations of arsenic in ground water exceed possible new standards.

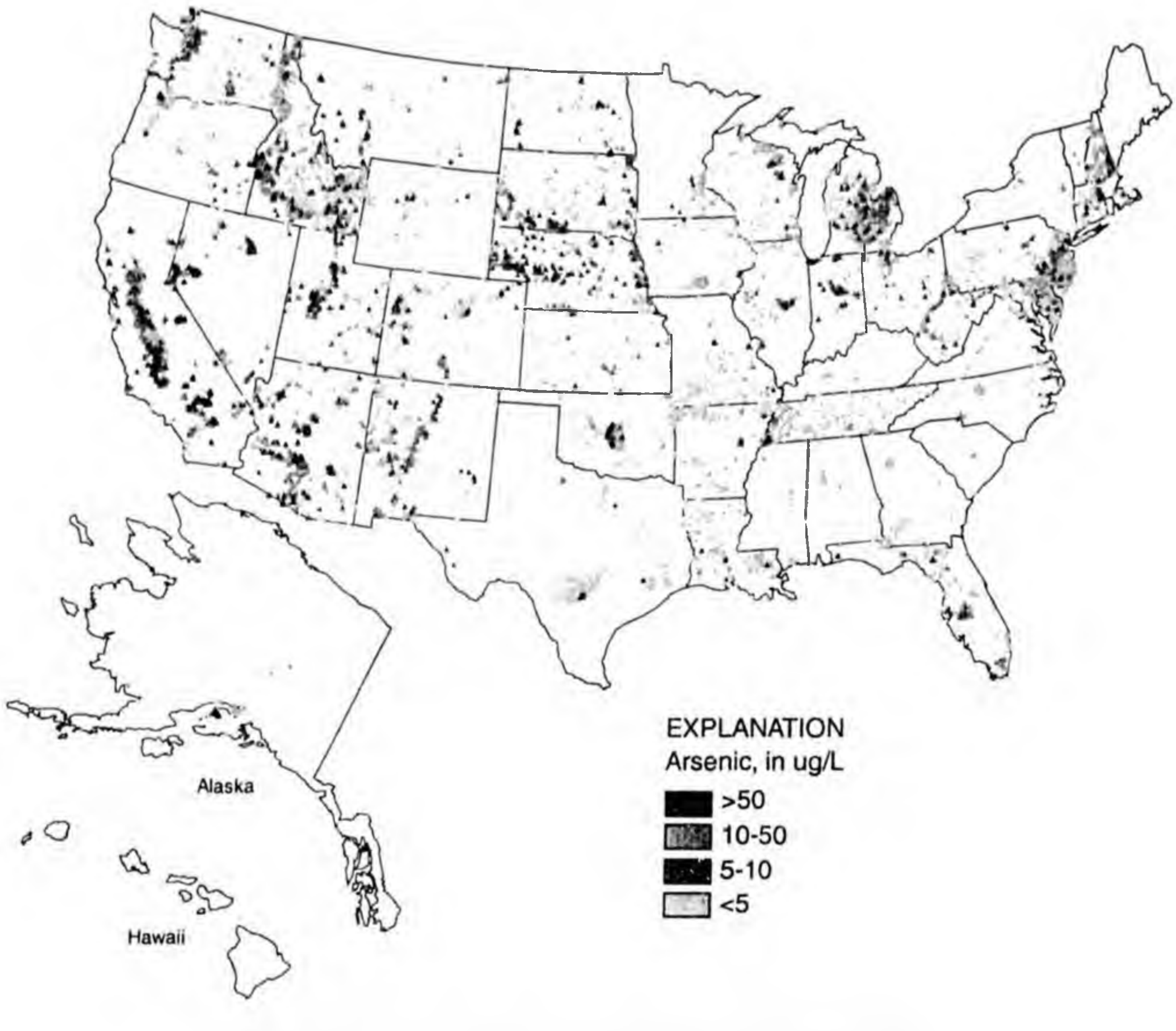


*Figure 1. Arsenic concentrations in ground water of the United States.*


U.S. Department of the Interior
U.S. Geological Survey

Fact Sheet FS–063–00
May 2000


USGS Arsenic

The U.S. Geological Survey (USGS) has collected and analyzed arsenic in potable (drinkable) water from 18,850 wells in 595 counties across the United States during the past two decades. These wells are used for irrigation, industrial purposes, and research, as well as for public and private water supply. Arsenic concentrations in samples from these wells are similar to those found in nearby public supplies (see Focazio and others, 1999). The large number of samples, broad geographic coverage, and consistency of methods produce a more accurate and detailed picture of arsenic concentrations than provided by any previous studies.

## Where do high concentrations of arsenic in ground water occur in the United States?

Arsenic concentrations in ground water generally are highest in the West. Parts of the Midwest and Northeast also have arsenic concentrations that exceed 10 µg/L, the World Health Organization's (WHO) provisional guideline for arsenic in drinking water (World Health Organization, 1999). Arsenic concentrations appear to be lower in the Southeast, based on a smaller amount of data. Arsenic concentrations also could be high at locations not shown on figure 1 because data are not available everywhere. Even at sampled locations, concentrations might differ between shallow and deep waters. Nonetheless, these data illustrate how arsenic concentrations vary across broad regions of the country.

## How frequently are arsenic concentrations in ground water likely to exceed possible new maximum contaminant levels?

To look at the Nation as a whole, arsenic data were grouped by county and linked to the number of public-supply systems withdrawing ground water in each county (Focazio and others, 1999). Estimates of the percentage of small public water-supply systems which exceed six targeted arsenic concentrations in their ground-water resource are shown in figure 2. Systems were called "small" if they served between 1,000 and 10,000 persons. Focazio and others (1999) provide similar information for both smaller and larger sized systems. The highest concentration evaluated is at the current MCL of 50 µg/L, along with several lower concentrations, one of which may become the new MCL.

As the concentration for a possible new MCL decreases, the likelihood of exceeding that standard increases. Just over 13 percent of small systems used water with arsenic concentrations greater than 5 µg/L, compared to fewer than 1 percent exceeding the current 50 µg/L MCL. Public systems exceeding a new, lower MCL will be required to either treat their water or find alternative sources of supply. This choice undoubtedly will increase costs for consumers while decreasing their exposure to arsenic. Although homeowners with private wells are not regulated, a lower drinking-water standard would mean that more homeowners will be consuming water with concentrations that exceed a standard.

USGS information provides a broad picture of arsenic concentrations in ground water throughout the United States. In 24 percent of the U.S. counties where data were available, at least 10 percent of samples had arsenic concentrations exceeding 10 µg/L, the WHO provisional guideline for arsenic. Water users in these counties (colored darkest brown in fig. 3) are the most likely to have ground water exceeding new standards for arsenic.

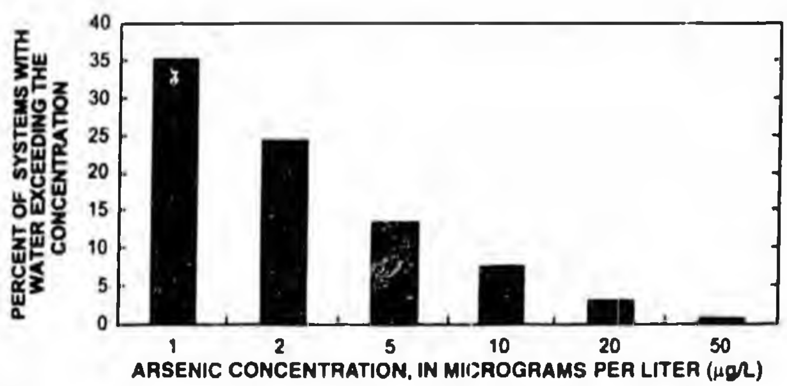


*Figure 2. Percentage of small public water-supply systems estimated to exceed targeted arsenic concentrations in their ground-water resource (µg/L, micrograms per liter).*

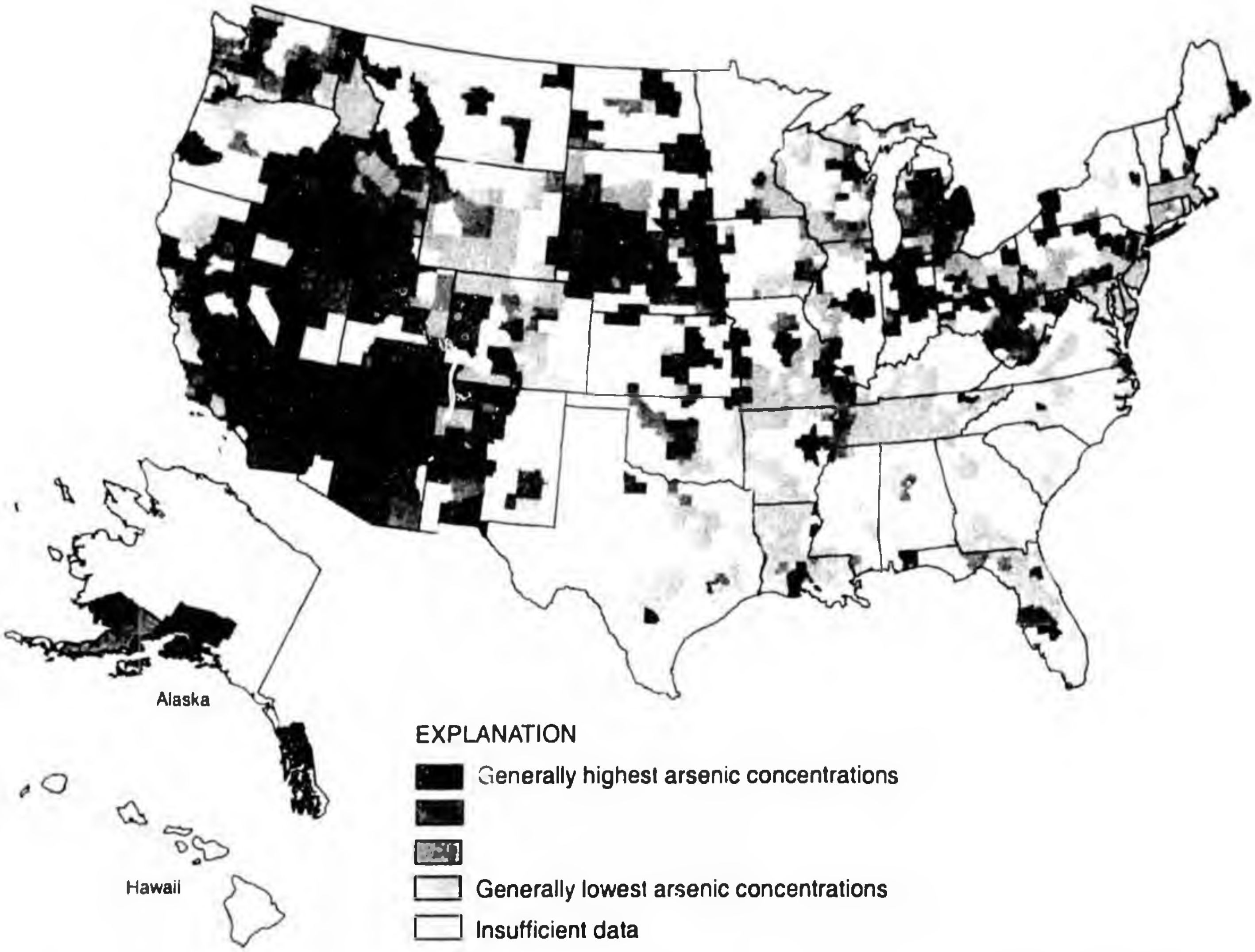


*Figure 3. Counties with arsenic concentrations exceeding possible new MCLs in 10 percent or more of ground-water samples.*

**Counties with arsenic concentrations exceeding 10 μg/L in 10 percent or more of samples.**

**Counties with arsenic concentrations exceeding 5 μg/L in 10 percent or more of samples.**

**Counties with arsenic concentrations exceeding 3 μg/L in 10 percent or more of samples.**

**Counties with fewer than 10 percent of samples exceeding 3 μg/L, representing areas of lowest concentration.**

**Counties with insufficient data in the USGS data base to make estimates.**

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# HEALTH

## Drinking Water Quality and Health no. 9.307

*by P. Kendall* [1]

### Quick Facts...

Water is our most essential nutrient.

Water contains different amounts of dissolved inorganic and organic compounds.

The Environmental Protection Agency regulates public water systems.

The Colorado Department of Health regulates bottled or vended water if the water does not leave Colorado. The Food and Drug Administration regulates if the water is involved in interstate commerce.

Colorado State University Cooperative Extension



People can survive days, weeks or months without food, but only about four days without water. The body uses water for digestion, absorption, circulation, transporting nutrients, building tissues, carrying away waste and maintaining body temperature.

The average adult consumes and excretes about 10 cups of water daily. Adults should drink six to eight cups of liquids per day. Although most of this liquid should come from beverages, food supplies some water. Our bodies make water as a by-product in the breakdown of fats, sugars and proteins to energy.

Water is always two parts hydrogen to one part oxygen. Beyond that, its composition depends on where it comes from, how it is processed and handled. Water can be hard or soft, natural or modified, bottled or tap, carbonated or still. About one-half of our water comes from underground water tables (groundwater) and one-half from surface water in rivers, lakes and reservoirs.

## Hard vs. Soft Water

The hardness of water relates to the amount of calcium, magnesium and sometimes iron in the water. The more minerals present, the harder the water. Soft water may contain sodium and other minerals or chemicals; however, it contains very little calcium, magnesium or iron. Many people prefer soft water because it makes soap lather better, gets clothes cleaner and leaves less of a ring around the tub. Some municipalities and individuals remove calcium and magnesium, both essential nutrients, and add sodium in an ion-exchange process to soften their water. The harder the water, the more sodium that must be added in exchange for calcium and magnesium ions to soften the water. This process has drawbacks from a nutritional standpoint.

First, soft water is more likely to dissolve certain metals from pipes than hard water. These metals include cadmium and lead, which are potentially toxic. Second, soft water may be a significant source of sodium for those who need to restrict their sodium intake for health reasons. Approximately 75 milligrams of sodium is added to each quart of water per 10 g.p.g. (grains per gallon) hardness. Finally, there is epidemiological evidence to suggest a lower incidence of heart disease in communities with hard water. The Environmental Protection Agency (EPA) doesn't set a mandatory upper limit for sodium in water, but suggests an upper limit of 20 milligrams per liter (quart) to protect individuals on sodium-restricted diets.

If you use a water softener, two ways to avoid excess sodium in drinking water are: 1) use low sodium bottled water, and 2) install a separate faucet in the kitchen for unsoftened water.

## Giardia and Other Microorganisms

Along with differences in mineral composition, water contains different levels of microorganisms. Bacteriological tests are available to determine if water is bacteriologically safe for human consumption. Contact the county health department for information on how and where such tests are performed.

Chlorination and filtration are effective controls for most bacteria. However, a tiny one-celled parasite not readily killed by chlorination, *Giardia lamblia*, deserves special discussion. Over the past several years, giardia has become an increasingly common problem in rural and mountain communities with inadequate filtration systems. Giardia is mostly found in surface waters such as mountain streams and lakes, not groundwater. Because one cannot see, taste, or smell giardia, it is best not to drink water directly from mountain streams or lakes.

Once ingested, the giardia cyst develops into a trophozoite that attaches to the wall of the small intestine. Disease symptoms usually include diarrhea with cramping and gas, dehydration, weakness and loss of appetite. Symptoms may take seven to 10 days to appear and last up to six weeks. Most people are unaware at the time of ingestion that they have been infected.

Laboratory identification can confirm the disease by diagnosis of the organism in the stool. The disease is curable with prescribed medication. If untreated, the symptoms may disappear on their own and reoccur intermittently over a period of months.

Treatment also can help prevent spread of the disease between people and between pets and people. For example, in a Colorado Department of Health study person-to-person contacts within families or between small children in day care centers were responsible for 46 percent of the 360 cases investigated. In fact, only 15 percent of the respondents had ingested stream or lake water in the three weeks prior to the onset of symptoms.

Prevention is the best solution. Always wash your hands after changing diapers and performing other hygiene activities. Wash children's hands frequently. Thoroughly clean change surfaces after diapering.

It's best to carry your own water on camping or backpacking trips. If this is not practical, the next best solution is to boil the water. Although giardia cysts are killed at temperatures of 131 degrees F, boiling for one minute at sea level and up to five minutes at 10,000 feet is recommended to eliminate other microorganisms that might be more heat resistant than giardia. Giardia also will not survive in water held at 59 degrees F for 30 minutes if one iodine tablet has been added per quart. Filters are available, but are expensive and inconvenient. Furthermore, many products marketed for backpackers are not effective in filtering out the tiny giardia cysts.

Protection is the key to the control of giardiasis. Since feces can contain the organism, bury waste 8 inches deep and at least 100 feet away from natural waters. Dogs, like people, can get infected with giardia. Unless carefully controlled, dogs can contaminate the water and continue the chain of infection from animals to humans.

## Fluoride

Fluoride is found naturally in Colorado water supplies in different amounts. The dental benefits of fluoridated water are well documented. Fluoride concentrations of 1.0 milligrams per liter or greater will reduce the incidence of dental cavities. However, concentrations over 2.0 milligrams per liter can darken tooth enamel causing fluorosis.

The American Dental Association and the American Medical Association endorse fluoridation. Yet, after more than 40 years of fluoridation, nearly 40 percent of tap water remains unfluoridated. Opponents have long argued that fluoridation violates individual rights, certain religious beliefs that ban medications, and does not prevent tooth decay. They also claim it promotes a variety of ills. A recent study in which male (but not female) rats given water with high levels of sodium fluoride developed a rare bone cancer, added fuel to their concerns. Proponents counter that fluoridation is not a form of medication, but an adjustment of an essential nutrient to a level favorable to health. What that level is and whether or not it should come from fluoridated drinking water will be at the crux of the next round of debates.

Tooth decay is on the decline in the United States (50 percent decline in the last 20 years). The decline is occuring in fluoridated and to a lesser extent in non-fluoridated areas. Fluoride treatments, fluoridated toothpaste, better diets and improved oral hygiene are all factors.

Like most elements, fluoride appears to be both beneficial to health and potentially toxic. The goal is to determine the optimum level and then decide how best to achieve that level. The EPA currently sets the maximum allowable level of sodium fluoride in drinking water (natural or added) at 4 milligrams per liter (4 parts per million) and the maximum recommended level at 2 milligrams per liter. The EPA reviews drinking water standards every three years.

## Lead

Lead is a toxic heavy metal known to turn up in drinking water. Recent data indicate that levels formerly safe may threaten health, especially among infants and children. In an 1986 EPA survey, an estimated 40 million Americans (one in five) were using drinking water that contained potentially hazardous levels of lead.

Acute lead poisoning can cause severe brain damage and death. The effects of chronic, low-level exposure, however, are more subtle. The developing nervous systems of fetuses, infants, and children are particularly vulnerable. Recent studies show that lead exposure at a young age can cause permanent learning disabilities and hyperactive behavior. Low-level lead exposure also is associated with elevated blood pressure, chronic anemia, and peripheral nerve damage.

Natural water usually contains very little lead. Contamination generally occurs in the water distribution system or in the pipes of a home or facility. Lead pipes, brass faucets and lead solder used to join copper pipes are the culprits. If your home was built before 1986 when a nation-wide ban on lead pipes and lead solder went into effect, it is likely to have lead-soldered plumbing.

The severity of lead contamination depends in part on how "corrosive" your water is. Soft or acidic water is more likely to corrode plumbing and fixtures, leaching out lead. According to the EPA, about 80 percent of public water utilities deliver water that is moderately or highly corrosive.

The EPA is changing the focus of its lead regulation from a maximum contaminant level of 50 parts-per-billion at the tap to imposed treatment if more than 10 percent of collected samples from a water system exceed 15 parts-per-billion lead. Water systems that exceed such levels will be required to implement corrosion control measures to reduce leaching of lead into water. Techniques such as adding lime (calcium oxide) to reduce water acidity can greatly reduce lead levels at the tap. A number of other simple practices also can help reduce the level of lead at the tap.

1. Cook with and drink only cold water. Hot water tends to dissolve more lead from pipes.
2. Don't drink the first water out of your tap in the morning. Let the water run for about one minute until a change in temperature occurs.
3. For private wells, consider water treatment devices such as calcite filters that reduce acidity and make water less corrosive. Certain

point-of-purchase treatment devices (e.g., some ion-exchange filters, reverse osmosis devices and distillation units) also can remove lead.

4. If lead levels remain high, consider bottled water for drinking and cooking purposes.

## Nitrate

Nitrates may be found naturally in water or may enter water supplies through a number of sources (fertilizers, animal wastes, septic systems). High nitrate-containing water is a serious health concern for pregnant women and infants under the age of 6 months. Bacteria in the infants' digestive tracts may convert the relatively harmless nitrate to nitrite. In turn, the nitrite combines with some of the hemoglobin in blood to form methemoglobin that cannot transport oxygen. To protect those at risk, the Maximum Contaminant Level (MCL) for nitrate in water is 45 mg/l as nitrate ($NO_3$) or 10 mg/l as nitrogen (N). The MCL for nitrite is 1 mg/l.

## Sulfate

Sulfates occur naturally in groundwater combined with calcium, magnesium and sodium as sulfate salts. Sulfate content in excess of 250 to 500 ppm (mg/l) may give water a bitter taste and have a laxative effect on individuals not adapted to the water.

Water that smells like rotten eggs has a high level of hydrogen sulfide gas. The gas may occur naturally in water near oil or gas fields or as the result of bacterial contamination. To test for bacterial contamination contact the county health department or a commercial testing lab.

## Organic Chemicals

The term "organic chemical" includes such products as pesticides, herbicides, petroleum products and industrial solvents. Although most have not been routinely monitored, hundreds of different organic chemicals have been found in drinking water from accidental spills, improper disposal or non-point movement through soils to groundwater. Today, municipalities are required to monitor an increasing list of organic chemicals under the Safe-Drinking-Water Act.

As with other contaminants, the danger from organic chemicals in water is hard to assess. In high doses and pure form some of these chemicals may promote cancer, impair the nervous system or damage the heart. In low doses, organic chemicals may have cumulative effects, but so far not much is known about their nature or magnitude.

Once groundwater is contaminated, cleanup of that groundwater is extremely difficult. If the water is unsuitable for human use, it also may be unsuitable for agricultural uses and alternative sources of water may need to be found. Organic chemicals and groundwater contamination is an area where much research is needed. In the meantime, the prudent use and disposal of all chemicals (agricultural, industrial, home and garden) can go a long way to protect the environment and groundwater from contamination.

## Radon

Radon is a radioactive gas, a decay product of uranium, that can dissolve into water supplies. The gas also is found in rocks and soils that contain granite, shale, phosphate, and pitchblende. It is odorless, colorless and tasteless.

The EPA considers radon to be a major potential health threat, causing an estimated 10,000 to 40,000 lung-cancer deaths each year. While most deaths are from radon accumulated in houses from seepage through cracks and holes in the foundation, 30 to 1,800 deaths per year are attributed to radon from household water. Showering, dish-washing and laundering agitate water and release radon into the air.

The EPA estimates that at least 8 million people may have high radon levels in their water supply. Radon is most likely to be present in water from private wells or from small community systems. Large systems usually provide some kind of water treatment that aerates the water and disperses any radon gas that may be present.

Before you test your water for radon, test the air. If your indoor radon level is high and you use groundwater, test your water. If the air level is low, there is no need to test your water. Test results are expressed in picocuries of radon per liter of water (pCi/l). In general 10,000 pCi/l of radon in water contributes roughly 1 pCi/l of airborne radon throughout the house. EPA currently advises consumers to take action at total household air levels of 4 pCi/l. For waterborne radon, a simple step is to make sure your bathroom, laundry and kitchen are well ventilated. At moderate levels, this may adequately reduce your exposure to waterborne radon. However if you use a private well that has high levels of radon, water treatment devices such as granular activated carbon units and home aerators may be warranted.

## Bottled vs Tap Water

Sales of bottled water have increased dramatically over the last few years. Bottled-water companies and public water systems often battle over the relative merits of their products. EPA regulates public water systems. FDA regulates bottled water that crosses state lines. Bottled or vended water that stays in Colorado falls under the jurisdiction of the Colorado State Department of Health.

Public water systems generally are disinfected with chlorine. Bottled water is commonly disinfected by ozone treatment. Ozone is a high-strength oxygen that quickly reverts to normal oxygen. It is a strong oxidant, like chlorine, but does not add taste like chlorine does. The length of time chlorine and ozone remain active in water depends on many factors, including temperature. Chlorine usually provides residual disinfection throughout the public-water distribution system. Ozone provides a residual disinfection for a limited time. However, bottled water may be in distribution for several weeks and storage conditions, especially temperature, may adversely affect quality. In terms of bacterial content, it is questionable as to whether bottled water is better than most municipal tap water.

Bottled water often is purchased for its good taste. However, taste does not always indicate safeness. At the concentrations present in drinking water, most harmful substances (including some disease-causing microorganisms, nitrates, trace amounts of lead and mercury, and some pesticides and organic materials) have no taste. Differences in taste among bottled waters generally are due to differing amounts of carbon dioxide, calcium, iron compounds, sodium, and other minerals and mineral salts. Differences also may be due to the amount and type of processing.

**Mineral-free water or distilled water** is treated to remove the minerals that occur naturally in water. Almost all sodium is removed by these processes. The resulting water is rather flat and tasteless for drinking because of the lack of minerals.

**Drinking water** comes from municipal water systems, wells or springs. It often is treated by reverse osmosis to remove bacteria and other pathogens and most pesticides. The resulting water is purified but still contains some dissolved solids.

**Natural water** comes from unprotected well or spring systems and is bottled without extensive treatment. Because it is almost exclusively groundwater, it usually contains a range of minerals and is, therefore, quite flavorful. **Spring water** is ground water that has risen naturally to the surface. **Artesian spring water** also rises under its own pressure, but only after it has been reached by drilling.

**Mineral water** is simply water that contains minerals - which is true of virtually all water except distilled water. **Natural mineral water** contains just the minerals present in the water as it comes from the ground. Mineral water can be still or sparkling. The carbon dioxide that causes carbonation also can be natural or added during bottling.

As for contaminants, bottled water generally rates as good as but no better than municipal water supplies used for comparison purposes. If you do purchase bottled or vended water, purchase from a quality retailer who handles enough volume to rotate stock. If you have concerns about locally vended water, contact your county health department or the Colorado Department of Health, (303) 692-2000.

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