

HB

360

HFIN

FILE

4/10

amended
not adopted
line 20

24-LS1468A.5
Bullock
4/7/06

AMENDMENT

OFFERED IN THE HOUSE

TO: HB 360

1 Page 1, line 1, following "systems":

2 Insert "; and relating to the regulation of an exposed aquifer that is a drinking
3 water source"

5 Page 1, following line 15:

6 Insert a new bill section to read:

7 "* Sec. 2. AS 46.03 is amended by adding a new section to read:

8 Sec. 46.03.085. Exposed aquifers. (a) The department shall adopt regulations
9 providing for water quality standards and the protection of an exposed aquifer. The
10 regulations must include a procedure for the review of a proposed development on
11 property containing an exposed aquifer and for monitoring the water quality of the
12 exposed aquifer until the aquifer is no longer exposed and set a fee to accompany the
13 filing of the proposed development plan to cover the cost of the review.

14 (b) A person developing property containing an exposed aquifer shall prepare
15 and file a development plan with the department providing for the protection of the
16 exposed aquifer, shall pay the required fee, and may not proceed with the development
17 before receiving approval of the development plan by the department.

18 (c) In this section,

19 (1) "exposed aquifer" means an aquifer that is exposed to the surface
20 as a result of previous mining activity and ~~is used as~~ a source of drinking water;

21 (2) "proposed development" means a development project or
22 subdivision for which the construction of improvements has not started within 100 feet
23 of an exposed aquifer."

- 1
- 2 Renumber the following bill section accordingly.

FISCAL NOTE

STATE OF ALASKA
2006 LEGISLATIVE SESSION

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

Revision Date/Time (Note if correction): _____ Dept. Affected: Dept of Environmental Conservation
Title Regulation of public accomodations water RDU Environmental Health
supply systems Component Drinking Water
Sponsor Representative Kevin Meyer
Requester House Finance Committee 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	288.1	288.1	288.1	288.1	288.1	288.1
Travel	15.0	15.0	15.0	15.0	15.0	15.0
Contractual	86.6	36.6	36.6	36.6	36.6	36.6
Supplies	33.6	5.0	5.0	5.0	5.0	5.0
Equipment	0.0	0.0	0.0	0.0	0.0	0.0
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	423.3	344.7	344.7	344.7	344.7	344.7

CAPITAL EXPENDITURES						
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CHANGE IN REVENUES ()	0.0	0.0	0.0	0.0	0.0	0.0
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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	373.3	294.7	294.7	294.7	294.7	294.7
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	423.3	344.7	344.7	344.7	344.7	344.7

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	4	4	4	4	4	4
Part-time	0	0	0	0	0	0
Temporary	0	0	0	0	0	0

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 FY04 and FY05 budget process, 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 for the total number of systems that would be regulated under this legislation. However, based on available information, there are an estimated 3,000 systems that would be regulated.

(Continued on page 2)

Prepared by: Kristin Ryan, Director
Division: Environmental Health
Approved by: Kurt Fredriksson
Agency: Department of Environmental Conservation

Phone (907) 269-7644
Date/Time: 4/10/06 8:00 AM
Date: 4/10/06 8:00 AM

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 includes the option for DEC to require systems to submit plans to DEC for review and approval for construction, extensions, installations and operation. Existing statute allows DEC to waive this requirement and this fiscal note assumes DEC will employ this waiver for Class C systems.

- **Personal Services** - Funding 4 permanent full time positions is needed to develop regulations, implement the regulations, perform compliance monitoring, provide technical assistance, and conduct enforcement.
- **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. Contractual funding is also needed for position support costs.
- **Supplies** - Additional supplies are needed in the first year of start up and one time costs for office furniture and computers for all new permanent staff thereafter for ongoing office supplies, field equipment (such as personal safety gear, field equipment, cameras), and computer replacement costs.
- **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.

Personal Services New Position Detail

Department of Environmental Conservation
HB 360 (revised)

Scenario: DEC 07 Fiscal Notes (5168)
Component: Drinking Water (2066)
RDU: Environmental Health (207)

PCN	Job Class Title	Time Status	Retire Code	Barg Unit	Location	Salary Sched	Range & Steps	Budgeted Months	Split / Annual Count Salary	COLA	Premium Pay	Annual Benefits	Total Costs
18-#001	Environ Program Spec IV	FT	A	GG	Anchorage	2A	20B	12.0	55,056	1,489	0	29,802	86,347
Justification:						Funding Detail:							
Implement HB360. Compliance monitoring, technical assistance, and enforcement for Class C public water systems.						1004	General Fund Receipts					100.00%	86,347
						Total Funding:		100.00%		86,347			
18-#002	Environ Program Spec II	FT	A	GG	Anchorage	2A	16B	12.0	41,748	1,129	0	25,111	67,988
Justification:						Funding Detail:							
Implement HB360. Compliance monitoring, technical assistance, and enforcement for Class C public water systems.						1004	General Fund Receipts					100.00%	67,988
						Total Funding:		100.00%		67,988			
18-#003	Engineering Assistant II	FT	A	GG	Anchorage	2A	18B	12.0	48,024	1,299	0	27,323	76,646
Justification:						Funding Detail:							
Implement HB360. Plan reviews, technical assistance, and enforcement for Class C public water systems.						1004	General Fund Receipts					100.00%	76,646
						Total Funding:		100.00%		76,646			
18-#004	Environ Program Technician	FT	A	GG	Anchorage	2A	13B	12.0	33,864	916	0	22,332	57,112
Justification:						Funding Detail:							
Implement HB360. Compliance monitoring, technical assistance, and enforcement for Class C public water systems.						1004	General Fund Receipts					100.00%	57,112
						Total Funding:		100.00%		57,112			

Note: If a position is split, an asterisk (*) will appear in the Split/Count column. If the split position is also counted in the component, two asterisks (**) will appear in this column.

Personal Services New Position Detail

Department of Environmental Conservation
HB 360 (revised)

Scenario: DEC 07 Fiscal Notes (5168)
Component: Drinking Water (2066)
RDU: Environmental Health (207)

Component Summary:

Total New Positions: 4

<u>Fund Description</u>	<u>Fund Percent</u>	<u>Fund Amount</u>
1004 General Fund Receipts	100.00%	288,093
Total Funding:	100.00%	288,093

Note: If a position is split, an asterisk (*) will appear in the Split/Count column. If the split position is also counted in the component, two asterisks (**) will appear in this column.

HB 360 Fiscal Note Detail

Regulation of Class C (public accomodation) water systems

	<u>FY2007</u>	<u>FY2008</u>	<u>FY2009</u>	<u>FY2010</u>	<u>FY2011</u>	<u>FY2012</u>
Expenditures						
Personal Services						
New PCNs						
EPS IV	86.4	86.4	86.4	86.4	86.4	86.4
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	<u>57.1</u>	<u>57.1</u>	<u>57.1</u>	<u>57.1</u>	<u>57.1</u>	<u>57.1</u>
Total PS	288.1	288.1	288.1	288.1	288.1	288.1
Travel	15.0	15.0	15.0	15.0	15.0	15.0
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	<u>36.6</u>	<u>36.6</u>	<u>36.6</u>	<u>36.6</u>	<u>36.6</u>	<u>36.6</u>
Sub-total	86.6	36.6	36.6	36.6	36.6	36.6
Supplies						
General Office	6.0	4.0	4.0	4.0	4.0	4.0
PC/Wk Str	27.6	0.0	0.0	0.0	0.0	0.0
Field Supplies	<u>0.0</u>	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>
Sub-total	33.6	5.0	5.0	5.0	5.0	5.0
Total Operating	423.3	344.7	344.7	344.7	344.7	344.7
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	373.3	294.7	294.7	294.7	294.7	294.7
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	423.3	344.7	344.7	344.7	344.7	344.7



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 1998. 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 coliform. 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.

FISCAL NOTE

STATE OF ALASKA
2006 LEGISLATIVE SESSION

Fiscal Note Number: 1
Bill Version: HB 360
(H) Publish Date: 2/9/06

Revision Date/Time (Note if correction): _____ Dept. Affected: Dept of Environmental Conservation
Title: Regulation of public accomodations water supply systems RDU: Environmental Health
Component: Drinking Water
Sponsor: Representative Kevin Meyer
Requester: House Resources Committee 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						
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CHANGE IN REVENUES ()	0.0	0.0	0.0	0.0	0.0	0.0
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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 #1

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.

Regulation of Class C (public accomodation) water systems

	<u>FY2007</u>	<u>FY2008</u>	<u>FY2009</u>	<u>FY2010</u>	<u>FY2011</u>	<u>FY2012</u>
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	<u>0.0</u>	<u>49.2</u>	<u>49.2</u>	<u>49.2</u>	<u>49.2</u>	<u>49.2</u>
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	<u>0.0</u>	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>
Sub-total	34.5	1.0	1.0	1.0	1.0	1.0
Total Operating	<u>535.1</u>	<u>497.8</u>	<u>497.8</u>	<u>497.8</u>	<u>497.8</u>	<u>497.8</u>
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	<u>535.1</u>	<u>497.8</u>	<u>497.8</u>	<u>497.8</u>	<u>497.8</u>	<u>497.8</u>



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)

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



Alaska Conservation Alliance

Uniting for Alaska's Future

March 14, 2006

The Honorable Mike Chenault
Co-Chair, House Finance Committee
House of Representatives
Alaska State Capitol, Room 519
Juneau, Alaska 99801-1182

The Honorable Kevin Meyer
Co-Chair, House Finance Committee
House of Representatives
Alaska State Capitol, Room 519
Juneau, Alaska 99801-1182

Dear Representatives Chenault and Meyer,

On behalf of the 40 conservation groups and businesses and 38,000 Alaskans represented by the Alaska Conservation Alliance (ACA), I would like to express support for HB360. ACA would like to commend Representative Meyer for taking the lead to close an important gap in the regulatory process by ensuring that small water systems are monitored and kept safe in the state of Alaska.

Over 100,000 individuals in Alaska are dependent upon water systems that are too small to be regulated by the EPA, but are larger than private wells. With the number of water-borne outbreaks increasing dramatically in the last several years, we believe the regulations put in place by HB360 are vital to safeguard public health and drinking water in small public water systems. ACA would like to emphasize the importance of including regular water testing as part of the established regulations. Though these tests will add to the need for monetary backing, as evidenced by the Department of Environmental Conservation's fiscal note, they are indispensable as a means to ensure drinking water safety.

The Alaska Conservation Alliance would like to thank you for your consideration of HB360 and would urge you to adopt this important piece of legislation.

Sincerely,

Kate Troll
Executive Director

cc: The Honorable Representative Stoltze
The Honorable Representative Foster
The Honorable Representative Hawker
The Honorable Representative Holm
The Honorable Representative Kelly
The Honorable Representative Weyhrauch
The Honorable Representative Kerttula
The Honorable Representative Joule
The Honorable Representative Moses



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.

Standards v. Health Effects



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 (NCOOD), 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.

Health Effects of Drinking Water Contaminants

Arizona Water Series: Number 5

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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)	3.0×10^{-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
<i>Giardia lamblia</i>	TT ¹	stomach and intestinal distress
<i>Legionella</i>	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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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 immunocompromised 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.

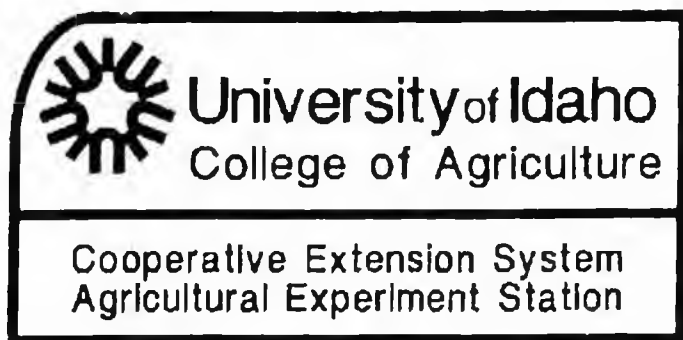
Volatile Organics

Chemicals that, as liquid, evaporate into the air.

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	0.0000003	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
Endosulf	0.1	0.1	Liver, kidney, gastrointestinal	Herbicide on crops, lanau 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
Ethylene/ene	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 low 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 (benz(a)pyrene)	zero	0.0002	Cancer	Coal tar coatings, burning organic matter, volcanoes, fossil fuels
PCBs	zero	0.0005	Cancer	Coastal oils from electrical transformers, plasticizers
Pentachloro, phenol	zero	0.001	Liver and kidney effects, aneurysm	Wood preservatives, herbicide, cooling tower wastes
Phthalate, (B (2-ethylhexyl))	zero	0.005	Cancer	PVC and other plastics
Picloram	0.5	0.5	Kidney, liver damage	Herbicide on broadleaf and woody plants
Smazine	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	0.005	0.005	Kidney, liver, nervous system	Solvent in rubber other organic products, chemical production wastes
Axenes (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 fixtures
Copper	1.3	TT	Gastrointestinal, nausea	Natural/industrial deposits, wood preservatives, plumbing
Other Interim Standards				
Beta phase radionuclides	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 effects	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 mg/L pCi/L picuries

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Water Testing

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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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Water Testing and Interpreting Your Results

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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

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."



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 bacteria, 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 supplies.

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/dch/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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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 $\mu\text{g}/\text{L}$ (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.

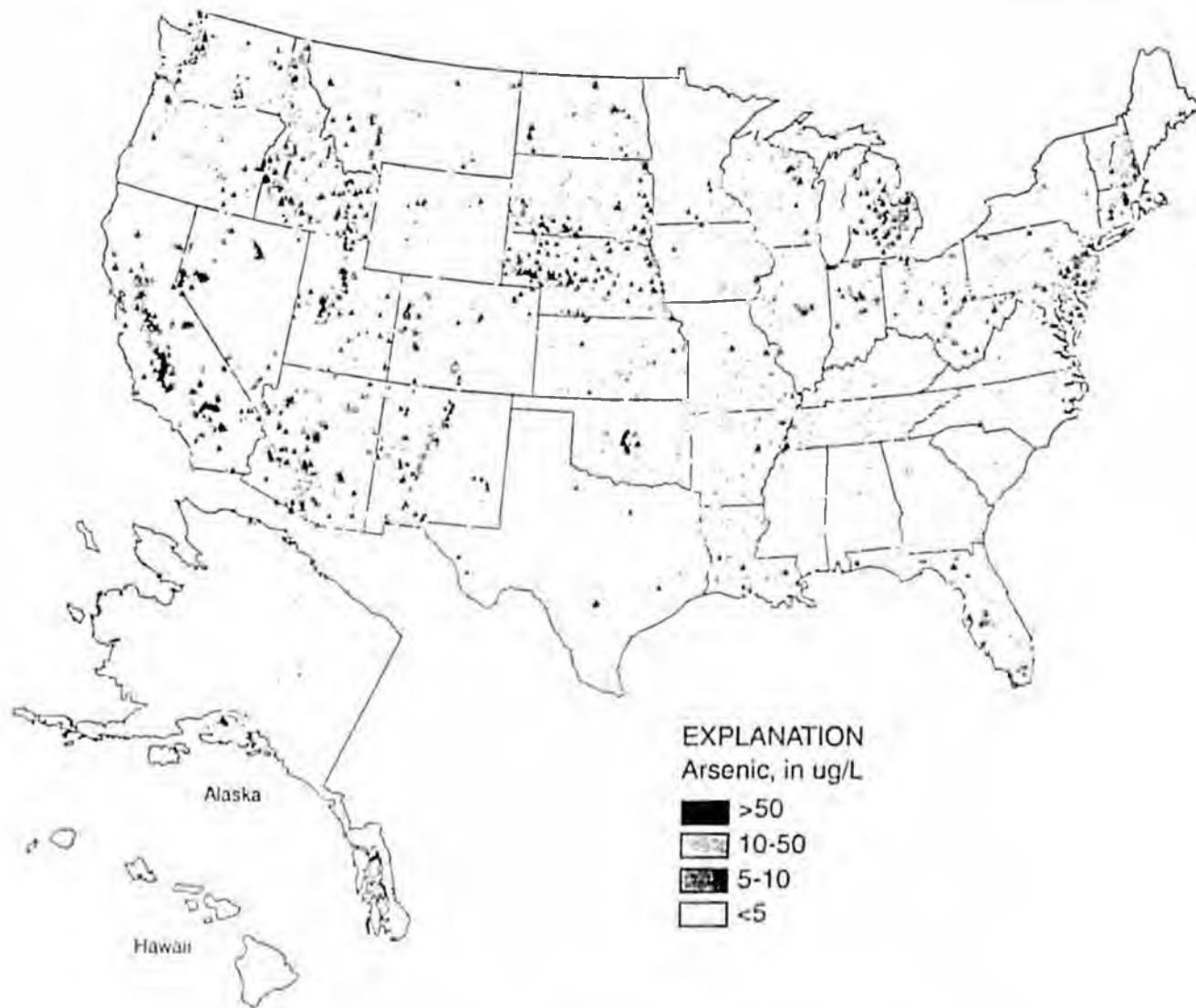


Figure 1. Arsenic concentrations in ground water of the United States.

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 $\mu\text{g/L}$, 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 $\mu\text{g/L}$, 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 $\mu\text{g/L}$, compared to fewer than 1 percent exceeding the current 50 $\mu\text{g/L}$ 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 $\mu\text{g/L}$, 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.

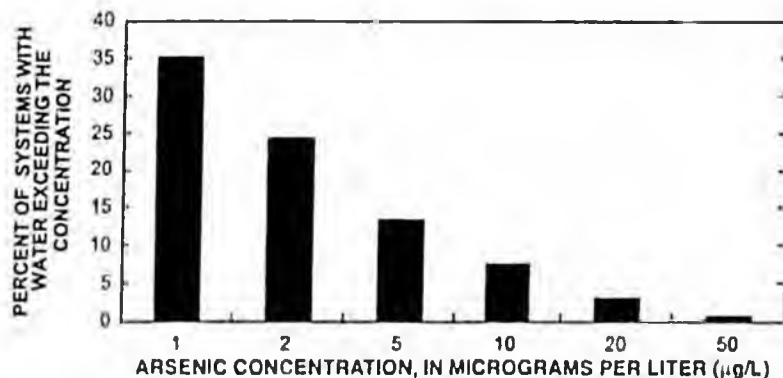


Figure 2. Percentage of small public water-supply systems estimated to exceed targeted arsenic concentrations in their ground-water resource ($\mu\text{g/L}$, micrograms per liter).

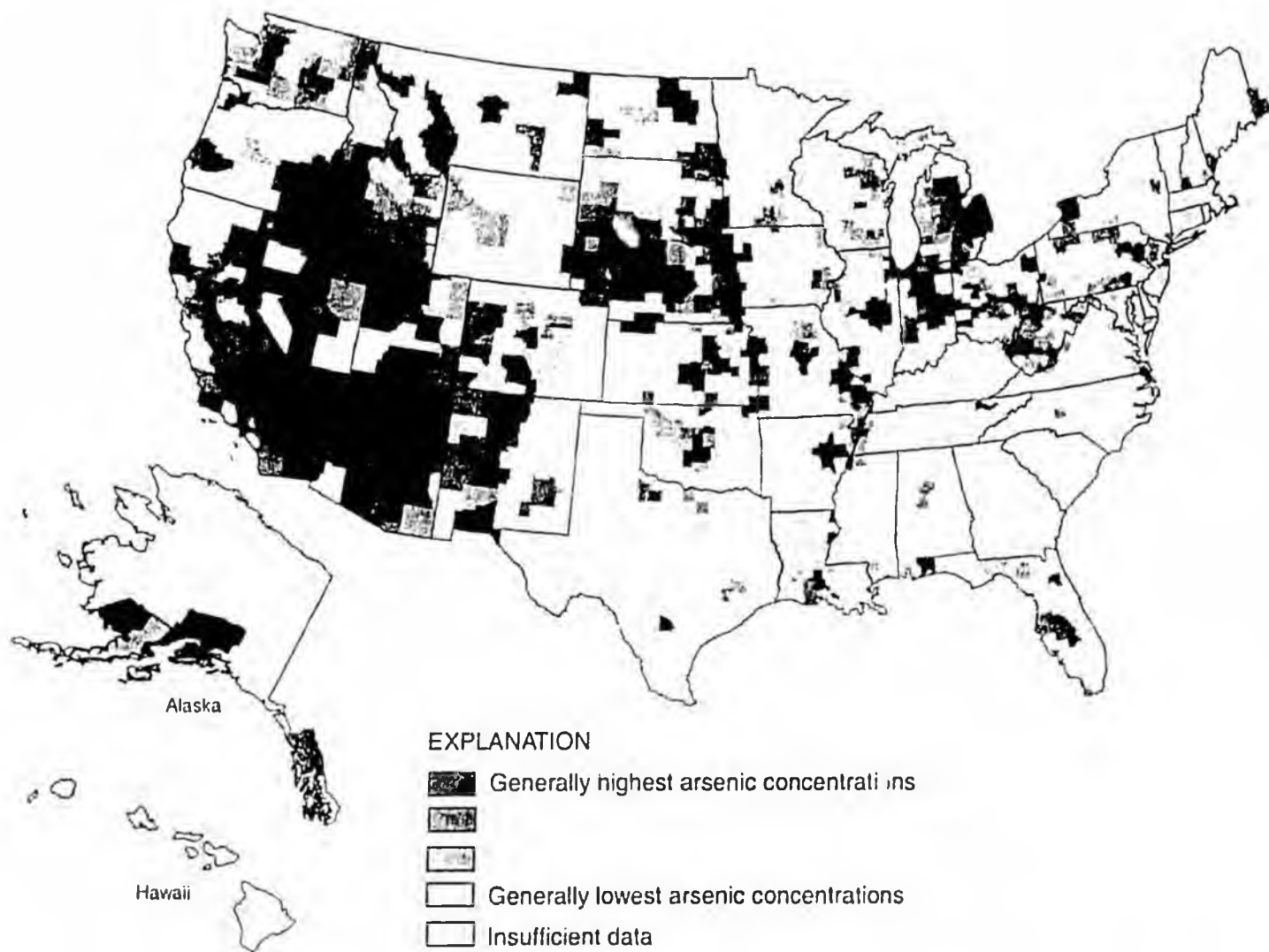
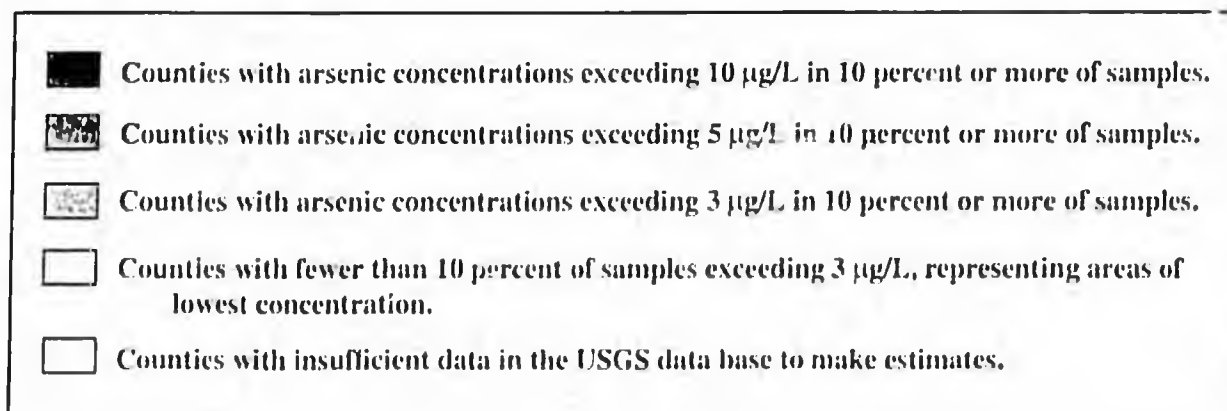


Figure 3. Counties with arsenic concentrations exceeding possible new MCLs in 10 percent or more of ground-water samples.



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HEALTH

Drinking Water Quality and Health no. 9.307

by P. Kendall¹

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.

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.

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**Drinking Water Quality &
Health Report**

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 occurring 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 (fertilizer, 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 safety. 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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