Parsons, Susan

From: Kate & Chris <samsa@pacifier.com>
Sent: Thursday, May 28, 2015 2:01 AM
To: Council Clerk – Testimony
Cc: Hales, Mayor; Commissioner Fritz; Commissioner Fish; Commissioner Novick; Commissioner Saltzman
Subject: Fw: LU 14-218444-HR-EN Testimony of Katherin Kirkpatrick 2015-05-28 -- Email 2 of 11
Attachments: LU 14-218444-HR-EN Testimony of Katherin Kirkpatrick 2015-05-28 -- Exhibit F.pdf; LU 14-218444-HR-EN Testimony of Katherin Kirkpatrick 2015-05-28 -- Exhibit G.pdf; LU 14-218444-HR-EN Testimony of Katherin Kirkpatrick 2015-05-28 -- Exhibit H.jpg; LU 14-218444-HR-EN Testimony of Katherin Kirkpatrick 2015-05-28 -- Exhibit I.pdf; LU 14-218444-HR-EN Testimony of Katherin Kirkpatrick 2015-05-28 -- Exhibit J.pdf; LU 14-218444-HR-EN Testimony of Katherin Kirkpatrick 2015-05-28 -- Exhibit K.pdf

Dear Karla:
Please accept this second portion of my attached testimony for submission into the record of LU 14-218444-HR-EN on the Mt. Tabor Reservoirs Decommissioning, scheduled for hearing this afternoon at 2:00 p.m. **This batch consists of Exhibits F through K in support of my legal brief sent in the previous e-mail.** Kindly send me an electronic receipt when the documents are entered.

Thank you,
Katherin Kirkpatrick
1319 SE 53rd Avenue
Portland, OR 97215
samsa@pacifier.com

PORTLAND WATER BUREAU

2013 Drinking Water Quality Report

SPANISH

Para obtener una copia de este reporte en español, por favor llame al **503-823-7525** o visite **www.portlandoregon.gov/water/reports**

RUSSIAN

Чтобы получить копию этого отчета на русском языке, пожалуйста, позвоните **503-823-7525** или зайдите на сайт **www.portlandoregon.gov/water/reports**

VIETNAMESE

Để đủộc một bản báo cáo này bằng ̃tieng Việt, xin gọi số **503-823-7525** hoặc đến mạng lủối **www.portlandoregon.gov/water/reports**

CHINESE

若想获得本报告的中文版本，请拨打 **503-823-7525** 或访问 **www.portlandoregon.gov/water/reports**

PORTLAND WATER BUREAU
FROM FOREST TO FAUCET

From the Administrator

I am pleased to share the 2013 Drinking Water Quality Report with you. While this report is mandated by the federal government, the Portland Water Bureau prides itself in providing this comprehensive and accessible report.

This year, you are likely reading the report online, rather than the traditional paper copy sent by mail. The Environmental Protection Agency recently changed the requirements to allow utilities to communicate this important information digitally. Customers are still able to request a paper copy and can do so by calling **503-823-7525** or visiting **www.portlandoregon.gov/water/reportrequest**.

One thing you might note is that the Portland Water Bureau monitors Portland's drinking water for more than 200 regulated and unregulated contaminants. We are fortunate that Portland's water is some of the highest-quality drinking water in the world.

The Portland Water Bureau works diligently to protect this essential resource, and to preserve and enhance the system that delivers water to your home or business. I urge you to take a minute to look through this report; learn about your water system and some of what goes into delivering water to your tap.

If you have questions or comments about this, please call Portland Water Bureau Customer Service at **503-823-7770**.

We welcome your interest in Portland's water system.

David G. Shaff

David G. Shaff
Administrator

Frequently Asked Questions About Water Quality

Is my water treated by filtration?

No. Neither the Bull Run nor the groundwater source is filtered. The Bull Run source meets the filtration avoidance criteria of the Surface Water Treatment Rule. The State of Oregon approved Portland's compliance with these criteria in 1992. Portland continues to meet these criteria on an ongoing basis.

Does the Portland Water Bureau add fluoride to drinking water?

No. The Portland Water Bureau does not add fluoride to the water. Fluoride is a naturally occurring trace element in surface and groundwater. The U.S. Public Health Service and the Centers for Disease Control and Prevention consider the fluoride levels in Portland's water sources to be lower than optimal for the prevention of tooth decay. You may want to consult with your dentist about fluoride treatment to help prevent tooth decay, especially for young children.

Is Portland's water soft or hard?

Portland's water is very soft. The hardness of Bull Run water is typically 3-8 parts per million (ppm) – approximately ¼ to ½ a grain of hardness per gallon. Portland's groundwater hardness is approximately 80 ppm (about 5 grains per gallon), which is considered moderately hard.

What is the pH of Portland's water?

The pH of Portland's drinking water typically ranges between 7.2 and 8.2.

Are sodium levels in Portland's drinking water affecting my health?

There is currently no drinking water standard for sodium. Sodium is an essential nutrient. Sodium in Portland's water typically ranges between 2 and 9 ppm, a level unlikely to contribute to adverse health effects.

Who can I call about water quality or pressure concerns?

The Water Line, **503-823-7525**, can answer your questions and concerns about water quality or pressure. The Water Line is available Monday–Friday from 8:30 a.m.– 4:30 p.m. If you have an emergency after these hours, please contact the after-hours number at **503-823-4874**.

How can I get my water tested?

Contact the LeadLine at **www.leadline.org** or **503-988-4000** for information about free lead-in-water testing. For more extensive testing, private laboratories can test your tap water for a fee. Not all labs are accredited to test for all contaminants. For information about accredited labs, call the Oregon Health Authority, Oregon Environmental Laboratory Accreditation Program at **503-693-4122**.

Public Involvement Opportunities

The Portland Water Bureau provides a variety of public information, public involvement and community outreach opportunities. If you have questions about Portland Water Bureau meetings, projects, or programs, please contact Portland Water Bureau Public Information, at **503-823-6926**, or visit the Water Blog to learn more about the bureau or to leave a comment: **www.portlandoregon.gov/water/blog.**

COVER PHOTO: ROMAN JOHNSTON

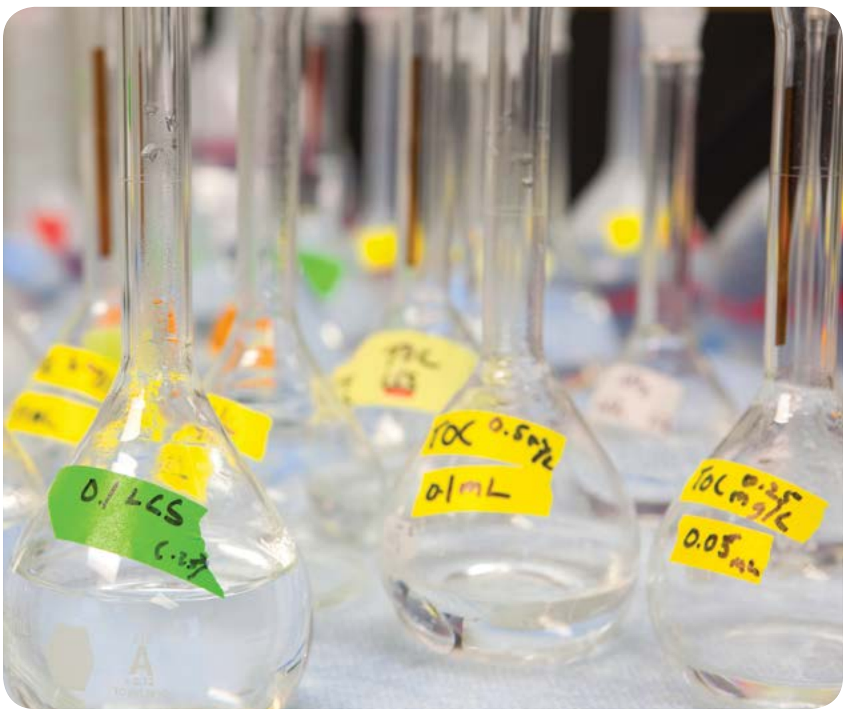
Drinking Water Treatment

The first step in the treatment process for Portland's drinking water is disinfection using chlorine. Next, ammonia is added to form chloramines which ensure that disinfection remains adequate throughout the distribution system.

The Portland Water Bureau also adds sodium hydroxide to increase the pH of the water to reduce corrosion of plumbing systems. This treatment helps control lead and copper levels at customers' taps, should these metals be present in property-side plumbing.

Water Testing

The Portland Water Bureau monitors for over 200 regulated and unregulated contaminants in drinking water, including pesticides and radioactive contaminants. All monitoring data in this report are from 2012. **If a known health-related contaminant is not listed in this report, the Portland Water Bureau did not detect it in drinking water.**



The Portland Water Bureau collects and analyzes more than 11,000 samples each year.

Special Notice for Immuno-Compromised Persons

Some people may be more vulnerable to contaminants in drinking water than the general population.

Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly people, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health-care providers. Guidelines from the Environmental Protection Agency and Centers for Disease Control and Prevention on appropriate means to lessen the risk of infection by *Cryptosporidium* and other microbial contaminants are available from the Safe Drinking Water Hotline at **800-426-4791**.

What the EPA Says About Drinking Water Contaminants

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the Environmental Protection Agency's Safe Drinking Water Hotline at **800-426-4791** or at **www.epa.gov/safewater**.

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

Contaminants in drinking water sources may include:

Microbial contaminants, such as viruses and bacteria, which may come from wildlife or septic systems

Inorganic contaminants, such as salts and metals, which can occur naturally or result from urban stormwater runoff, industrial or domestic wastewater discharges or farming

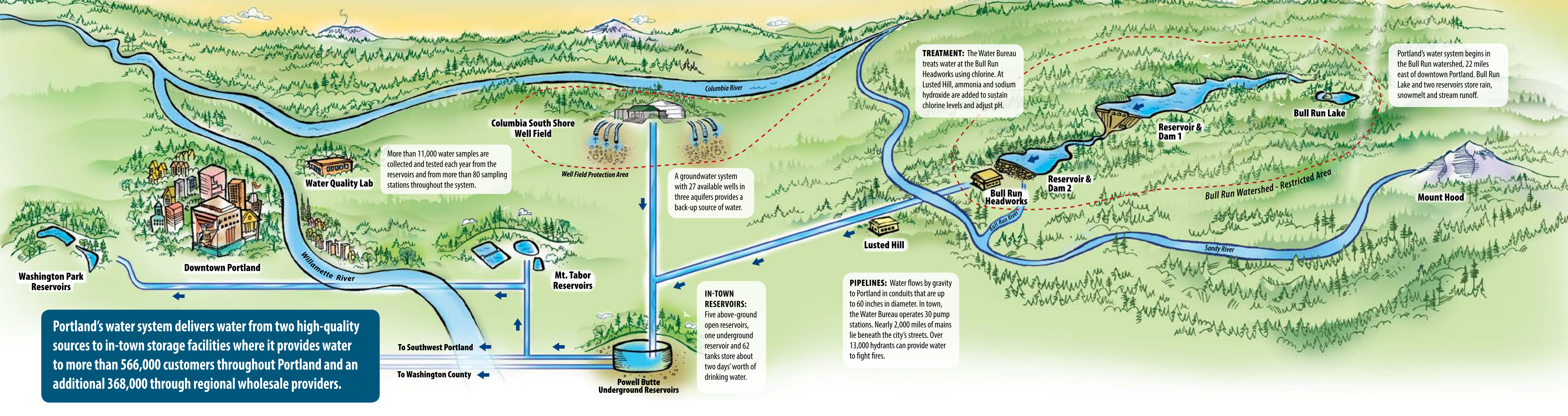
Pesticides and herbicides, which may come from a variety of sources such as farming, urban stormwater runoff and home or business use

Organic chemical contaminants, including synthetic and volatile organic chemicals, which are byproducts of industrial processes, and can also come from gas stations, urban stormwater runoff and septic systems

Radioactive contaminants, which can occur naturally

In order to ensure that tap water is safe to drink, the EPA has regulations that limit the amount of certain contaminants in water provided by public water systems and require monitoring for these contaminants. Food and Drug Administration regulations establish limits for contaminants in bottled water, which must provide the same protection for public health.

Portland's Water System *Established 1895*



The Bull Run Watershed is a surface water supply within the Bull Run Watershed Management Unit located in the Mt. Hood National Forest. A geological ridge separates the watershed from Mount Hood. Current regulations, and the availability of the Columbia South Shore Well Field, allow Portland to meet federal drinking water standards without filtering this high-quality Bull Run water supply. The watershed has an area of 102 square miles, and typically receives 80-170 inches of rainfall a year. The heaviest rains occur from late fall through spring. Two reservoirs store water for use year-round, particularly during the dry summer months.

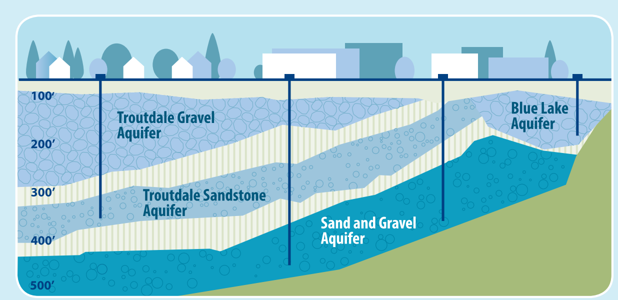
The watershed is used mainly for producing drinking water. Federal laws restrict public entry. No recreational, residential, or commercial uses occur within its boundaries. The Portland Water Bureau carefully monitors water quality and quantity. The Oregon Health Authority Drinking Water Program regularly inspects the watershed and the related treatment and distribution facilities.

The Portland Water Bureau completed a Source Water Assessment for the Bull Run water supply to comply with the 1996 Safe Drinking Water Act amendments. The only known contaminants of concern for the Bull Run water supply are naturally occurring microbial contaminants such as *Giardia lamblia, Cryptosporidium,* fecal coliform bacteria, and total coliform bacteria. These organisms are found in virtually all freshwater ecosystems and are present in the Bull Run supply at very low levels. The Bull Run supply complies with all applicable state and federal regulations for source water, including the 1989 Surface Water Treatment Rule filtration-avoidance criteria. The Portland Water Bureau is also operating under a variance for the treatment requirements for *Cryptosporidium*, see page 9 for more information. The Source Water Assessment report is available at **www.portlandoregon.gov/water** and by calling **503-823-7404**.

Bull Run Lake

The Columbia South Shore Well Field provides high-quality drinking water from groundwater production wells located in three different aquifers. In 2012, from January 21 to 31, the Portland Water Bureau used groundwater to provide 100% of the drinking water during storms in the Bull Run watershed that resulted in increased turbidity levels. From February 23 to 27, groundwater was again used to provide approximately 55-65% of drinking water supply during another Bull Run storm event. Over these periods, one billion gallons of groundwater were served. Beginning August 6 of last year, the Portland Water Bureau supplemented the Bull Run drinking water supply with approximately 41 million gallons of groundwater over the course of 18 days. This was part of an annual groundwater maintenance operation.

Portland has a long history of groundwater protection. In June 2008, the State of Oregon certified the Columbia South Shore Well Field Protection Plan. The protection program, encompassing portions of Portland, Gresham and Fairview, has identified commercial and industrial activities as the most significant potential sources of contamination. Together these cities regulate businesses in the groundwater protection area to prevent hazardous material spills that could seep into the ground. Events such as Aquifer Adventure, Cycle the Well Field and Groundwater 101 educate local residents on what can be done to help protect groundwater. To obtain a copy of Portland's groundwater protection program plan, which includes information on potential sources of contamination, call **503-823-7404**, or to learn more about upcoming events and how to protect groundwater, visit **www.portlandoregon.gov/water/groundwater**.



There are 27 usable wells capable of pumping water from three aquifers on the south shore of the Columbia River. The well field serves as a backup water supply during turbidity events, emergencies and when the bureau needs additional summer supply. The well field can produce up to 102 million gallons of water per day.

The Clackamas River Water District, City of Gresham, City of Lake Oswego, Rockwood Water People's Utility District, Sunrise Water Authority and Tualatin Valley Water District provide drinking water to some Portland customers who live near service area boundaries. Customers who receive water from these providers will also receive detailed water quality reports about these sources in addition to this report.

Regulated Contaminants Detected in 2012

Regulated Contaminant	Minimum Detected	Maximum Detected	Maximum Contaminant Level (MCL), Treatment Technique or Maximum Residual Disinfectant Level (MRDL)	Maximum Contaminant Level Goal (MCLG) or Maximum Residual Disinfectant Level Goal (MRDLG)	Sources of Contaminant
Source Water from Bull Run Watershed					
Turbidity	0.13 NTU	4.14 NTU*	Cannot exceed 5 NTU more than 2 times in 12 months	Not Applicable	Erosion of natural deposits
Total Organic Carbon	0.72 parts per million	1.9 parts per million	Not Applicable	Not Applicable	Naturally present in the environment
Giardia lamblia	Not detected	4 samples of 10 liters had 1 *Giardia* cyst	Treatment technique required: Disinfection to kill 99.9% of cysts	Not Applicable	Animal wastes
Fecal Coliform Bacteria	Not detected	98% of samples had 20 or fewer bacterial colonies per 100 milliliters of water (1 sample had 47 bacterial colonies per 100 milliliters)	At least 90% of samples measured during the previous six months must have 20 or fewer bacterial colonies per 100 milliliters of water	Not Applicable	Animal wastes

* *See Notes on page 7.*

Regulated Contaminant	Minimum Detected	Maximum Detected	MCL, Treatment Technique or MRDL	MCLG or MRDLG	Sources of Contaminant
Entry Points to Distribution System — from Bull Run Watershed and Columbia South Shore Well Field					
NUTRIENTS					
Nitrate-Nitrogen	<0.01 parts per million	0.11 parts per million	10 parts per million	10 parts per million	Found in natural aquifer deposits; animal wastes
METALS AND MINERALS					
Antimony	<0.05 parts per billion	0.13 parts per billion	6 parts per billion	6 parts per billion	Found in natural deposits
Arsenic	<0.5 parts per billion	1.4 parts per billion	10 parts per billion	0 parts per billion	
Barium	0.00083 parts per million	0.01 parts per million	2 parts per million	2 parts per million	
Chromium (total)	<0.2 parts per billion	0.3 parts per billion	100 parts per billion	100 parts per billion	
Copper	0.0005 parts per million	0.0016 parts per million	Not Applicable	1.3 parts per million	
Fluoride	<0.025 parts per million	0.14 parts per million	4 parts per million	4 parts per million	
Lead	<0.02 parts per billion	0.04 parts per billion	Not Applicable	0 parts per billion	
Distribution System of Reservoirs, Tanks and Mains					
MICROBIOLOGICAL CONTAMINANTS					
***E. coli* Bacteria**	Not Detected	A routine sample in July was *E. coli* positive and a repeat sample was total coliform positive	A routine sample and a repeat sample are total coliform positive, and one is also *E. coli* positive	0% of samples with detectable *E. coli* bacteria	Human and animal fecal waste
Total Coliform Bacteria	Not Detected	1.1% of samples in February (3 out of 276) had detectable coliform bacteria	Must not detect coliform bacteria in more than 5.0% of samples in any month	0% of samples with detectable coliform bacteria	Found throughout the environment
DISINFECTION BYPRODUCTS					
Total Trihalomethanes					
Running Annual Average at Any One Site	23 parts per billion	31 parts per billion	80 parts per billion	Not Applicable	Byproduct of drinking water disinfection
Single Result at Any One Site	3.2 parts per billion	38 parts per billion	Not Applicable		
Haloacetic Acids					
Running Annual Average at Any One Site	7.8 parts per billion	31 parts per billion	60 parts per billion	Not Applicable	Byproduct of drinking water disinfection
Single Result at Any One Site	<6 parts per billion	44 parts per billion	Not Applicable		
DISINFECTANT RESIDUAL					
Total Chlorine Residual	<0.1 parts per million	2.2 parts per million	4 parts per million	4 parts per million	Chlorine and ammonia are used to disinfect water

Regulated Contaminant	90th Percentile Values	Number of Sites Exceeding the Action Level	Lead and Copper Rule Exceedance	Maximum Contaminant Level Goal (MCLG)	Source of Contaminant
Lead and Copper Sampling at High-Risk Residential Water Taps					
Copper	0.34 parts per million	0% (0 of 112) of samples exceeded the copper action level of 1.3 parts per million	More than 10% of the homes tested have copper levels greater than 1.3 parts per million	1.3 parts per million	Corrosion of household and commercial building plumbing systems
Lead	12 parts per billion	4.5% (5 of 112) of samples exceeded the lead action level of 15 parts per billion	More than 10% of the homes tested have lead levels greater than 15 parts per billion	0 parts per billion	

Unregulated Contaminants Detected in 2012

Contaminant	Minimum Detected	Average Detected	Maximum Detected	Source of Contaminant
Entry Points to Distribution System — from Bull Run Watershed and Columbia South Shore Well Field				
Nickel	<0.2 parts per billion	0.25 parts per billion	0.8 parts per billion	Found in natural deposits
Sodium	2.6 parts per million	8.3 parts per million	18 parts per million	
Vanadium	3.1 parts per billion	4.3 parts per billion	5.4 parts per billion	

*See **Notes on Regulated and Unregulated Contaminants** on page 7 for more information.*

Definitions

Action Level
The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.

Maximum Contaminant Level (MCL)
The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

Maximum Contaminant Level Goal (MCLG)
The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

Maximum Residual Disinfectant Level (MRDL)
The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

Maximum Residual Disinfectant Level Goal (MRDLG)
The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.

Part Per Million (ppm)
One part per million corresponds to one penny in $10,000 or approximately one minute in two years. One part per million is equal to 1,000 parts per billion.

Part Per Billion (ppb)
One part per billion corresponds to one penny in $10,000,000 or approximately one minute in 2,000 years.

Treatment Technique
A required process intended to reduce the level of a contaminant in drinking water.

Notes on Regulated Contaminants

Turbidity
Bull Run is an unfiltered surface water supply. The rules for public water systems have strict standards for unfiltered surface water supplies. Turbidity levels in unfiltered water must not exceed 5 NTU (nephelometric turbidity units) more than two times in a twelve-month period. The typical cause of turbidity is sediment suspended in the water. The sediment can interfere with disinfection and provide a medium for microbial growth. Large storm events can result in increased turbidity, causing the Portland Water Bureau to shut down the Bull Run system and serve water from the Columbia South Shore Well Field. On January 21, a large storm in the Bull Run Watershed caused a sudden rise in turbidity. Turbidity was measured at 6.0 at the Bull Run intake, however this water was not served to customers. Instead, groundwater was used from January 21 to 31. Another storm event also resulted in the use of groundwater from February 23 to 27.

Total Organic Carbon
Total Organic Carbon (TOC) is naturally found in water and can react with disinfectants to produce disinfection by-products (DBPs). The Portland Water Bureau monitors for TOC to qualify for reduced DBP monitoring. Surface water systems are eligible for reduced DBP monitoring when DBP levels are ≤ 50% of the MCL and TOC monitoring is ≤ 4.0 mg/L.

Giardia
Wildlife in the watershed may be hosts to *Giardia lamblia*, the organism that causes giardiasis. The Portland Water Bureau uses chlorine to control these organisms.

Fecal Coliform Bacteria
The presence of fecal coliform bacteria in source water indicates that water may be contaminated with animal wastes. The Portland Water Bureau uses chlorine to kill these bacteria.

Nitrate - Nitrogen
Nitrate, measured as nitrogen, can support microbial growth (bacteria and algae). Nitrate levels exceeding the standards can contribute to health problems. At the levels found in Portland's drinking water, Nitrate is unlikely to contribute to adverse health effects.

Antimony, Arsenic, Barium, Chromium (total), Copper, Fluoride and Lead
These metals are elements found in the earth's crust which can dissolve into water that is in contact with natural deposits. At the levels found in Portland's drinking water, they are unlikely to contribute to adverse health effects. There is no maximum contaminant level (MCL) for copper and lead at the entry point to the distribution system. Copper and lead are regulated at customers' taps. For more information see Reducing Exposure to Lead on page 8.

E. Coli Bacteria
E. coli are bacteria that indicate that the water may be contaminated with human or animal wastes. Microbes in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches or other symptoms. The microbes may pose a special health risk for infants, young children, some of the elderly and people with severely compromised immune systems. The Portland Water Bureau uses chlorine to kill these bacteria. For more information see July 2012 Boil Water Notice on page 10.

Total Coliform Bacteria
Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other potentially-harmful bacteria may be present. The Portland Water Bureau uses chlorine to kill these bacteria.

Disinfection Byproducts
During disinfection, certain byproducts form as a result of chemical reactions between chlorine and naturally occurring organic matter in the water. These byproducts can have negative health effects. Trihalomethanes and haloacetic acids are regulated disinfection byproducts that have been detected in Portland's water. The disinfection process is carefully controlled to keep byproduct levels low.

Total Chlorine Residual
Total chlorine residual is a measure of free chlorine and combined chlorine and ammonia in our distribution system. Chlorine residual is necessary to maintain disinfection throughout the distribution system. Adding ammonia to chlorine results in a more stable disinfectant and helps to minimize the formation of disinfection byproducts.

Notes on Unregulated Contaminants

Unregulated contaminant monitoring helps the EPA to determine where certain contaminants occur and whether it needs to regulate those contaminants in the future.

Nickel, Sodium and Vanadium
Nickel, sodium and vanadium are metals found in the earth's crust; they can dissolve into water that is in contact with natural deposits. There are currently no maximum contaminant levels for nickel, sodium or vanadium. At the levels found in Portland's drinking water, they are unlikely to contribute to adverse health effects.

Reducing Exposure to Lead

Portland has removed all known lead service connections from its distribution system. Exposure to lead through drinking water is possible if materials in a building's plumbing contain lead. The level of lead in water can increase when water stands in contact with lead-based solder and brass faucets containing lead.

If present, lead at elevated levels can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The Portland Water Bureau is responsible for providing high-quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your drinking water, you may wish to request a free lead-in-water test from the LeadLine. Information on lead in drinking water, testing methods and steps you can take to minimize exposure is available from the **LeadLine, 503-988-4000**, **www.leadline.org** or the Safe Drinking Water Hotline **800-426-4791**, **www.epa.gov/safewater/lead**.

People are exposed to lead in many other ways. In the Portland area, dust from paint in homes built before 1978 is the most common source of exposure to lead. Other sources include soil, pottery, traditional folk medicines or cosmetics, some sports equipment such as fishing weights and ammunition, and some occupations and hobbies.

Corrosion Treatment

The Portland Water Bureau's corrosion control treatment reduces corrosion in plumbing by increasing the pH of the water. Comparison of monitoring results with and without pH adjustment shows more than 50 percent reduction in lead and 80 percent reduction in copper at the tap with pH adjustment.

Water Testing

Twice each year the Portland Water Bureau monitors for lead and copper in tap water from a sample group of more than 100 homes. These are homes in the Bull Run service area where the plumbing is known to contain lead solder, which is more likely to contribute to elevated lead levels. These houses represent a worst-case scenario for lead in water. Samples are collected after the water has been standing in the household plumbing for more than 6 hours. A Lead and Copper Rule exceedance for lead occurs when more than 10 percent of these homes exceed the lead action level of 15 parts per billion. In the most recent round of testing, less than 10 percent of homes exceeded the lead action level.

If you are concerned that your home tap water may have lead, call the LeadLine for a free lead-in-water test kit and to learn ways to reduce your exposure to all sources of lead. This program targets testing the water in households most at-risk from lead in water. These are homes built between 1970 and 1985 with pregnant women or children ages six or younger in the home.

Easy steps to avoid possible exposure to lead in drinking water

- **Run your water to flush out lead.** If the water has not been used for several hours, run each tap for 30 seconds to 2 minutes or until it becomes colder before drinking or cooking. This flushes water which may contain lead from the pipes.
- **Use cold, fresh water for cooking and preparing baby formula.** Do not cook with or drink water from the hot water tap; lead dissolves more easily into hot water. Do not use water from the hot water tap to make baby formula.
- **Do not boil water to remove lead.** Boiling water will not reduce lead.
- **Consider using a filter.** Check whether it reduces lead – not all filters do. Be sure to maintain and replace a filter device in accordance with the manufacturer's instructions to protect water quality. Contact NSF International at **800-NSF-8010** or **www.nsf.org** for information on performance standards for water filters.
- **Test your water for lead.** Call the **LeadLine** at **503-988-4000** to find out how to get a **FREE** lead-in-water test.
- **Test your child for lead.** Ask your physician or call the **LeadLine** to find out how to have your child tested for lead. A blood lead level test is the only way to know whether your child is being exposed to lead.
- **Regularly clean your faucet aerator.** Particles containing lead from solder or household plumbing can become trapped in your faucet aerator. Regular cleaning every few months will remove these particles and reduce your exposure to lead.
- **Consider buying low-lead fixtures.** New brass faucets, fittings and valves, may contribute to lead in your drinking water. Federal law currently allows brass fixtures, such as faucets, to contain up to 8 percent lead. These fixtures are labeled as "lead-free." When buying new fixtures, consumers should seek out those with the lowest lead content. Visit **www.nsf.org** to learn more about lead content in plumbing fixtures.

LeadLine – 503-988-4000

Call the **LeadLine** or visit **www.leadline.org** for information about lead hazards, free lead-in-water testing, free childhood blood lead testing and referrals to other lead reduction services.

www.leadline.org

The LT2 Rule

On March 14, 2012 the Oregon Health Authority (OHA) issued the Portland Water Bureau a variance from the state and federal drinking water rules requiring the treatment of Bull Run drinking water for the parasite *Cryptosporidium*. A variance is state permission not to meet an MCL or a treatment technique under certain conditions. A state may grant a variance if a water system demonstrates that the required treatment is not necessary to protect public health because of the nature of the water system's raw water source. OHA issued the treatment variance based on substantial data and analysis presented in Portland Water Bureau's comprehensive LT2 Treatment Variance Request. Because it received the variance, the Portland Water Bureau does not provide treatment for *Cryptosporidium*.

The following are among the conditions that must be met in order to maintain the variance:

Watershed Protection: The Portland Water Bureau must maintain or strengthen all existing legal and operational protections for the Bull Run, monitor the watershed on a routine basis in an effort to eliminate unauthorized entry, maintain strict controls for sanitary facilities within the watershed, implement field inspections and monitor tributaries and wildlife scat in the Bull Run watershed.

Raw Water Intake Monitoring: The Portland Water Bureau must conduct regular ongoing monitoring for *Cryptosporidium* at the Bull Run intake at least two days each week and each day when the turbidity is greater than 2.0 NTU. If *Cryptosporidium* is detected in any one sample, the Portland Water Bureau must begin a more intensive monitoring program. Under these circumstances, monitoring for *Cryptosporidium* would need to increase to at least four days per week, with a minimum of 250 liters per week and at least 13,334 liters over one year to demonstrate whether the *Cryptosporidium* concentration is less than 0.075 oocysts per 1,000 liters.

Reporting and Notification: The Portland Water Bureau must report the results of watershed and raw water monitoring to OHA. Any detections of *Cryptosporidium* must be reported to OHA within 24 hours. The Portland Water Bureau must notify the public through its website and issue a press release in the event of a *Cryptosporidium* detection at the raw water intake. The Portland Water Bureau must also notify OHA of any circumstances that may impact the conditions of the variance.

The treatment variance went into effect on April 1, 2012 and is valid for 10 years. OHA may revoke the variance if the requirements of the variance are not met.

2012 Results of *Cryptosporidium* Monitoring in the Bull Run Watershed

Location	Number of Samples	Volume	Detections
Raw Water Intake	281	6,452.0 L	None
Bull Run Tributaries	106	1,128.9 L	One 10-L sample had a detection of 2 *Cryptosporidium* oocysts
Wildlife Scat Samples	188	Not applicable	None

On January 5, 2012, prior to the treatment variance going into effect, two *Cryptosporidium* oocysts were detected in a sample collected from the South Fork Bull Run River. This sample was collected as a follow-up to a detection of one oocyst at the Intake and one oocyst at the South Fork in late 2011. Consultation with local health officials confirmed that these detections did not represent a public health threat. These monitoring results are not part of the data that is used by OHA to evaluate ongoing compliance with the treatment variance conditions.

Additional information on Portland Water Bureau's treatment variance can be found at **www.portlandoregon.gov/water/treatmentvariance**.

Uncovered Finished Drinking Water Reservoirs

The Portland Water Bureau submitted a plan to the EPA for complying with the covered storage requirements of the LT2 rule in March 2009. The plan outlined dates for the development of replacement storage for Portland's five uncovered drinking water reservoirs by 2021.

In November 2009, the City requested direction from EPA regarding the possibility of a variance to the uncovered finished drinking reservoir requirements of the LT2 rule. In December 2009, the EPA replied that no such option existed. However, in August 2011, EPA agreed to review the uncovered reservoir requirements of the LT2 rule. Per EPA's guidance, Portland submitted a request to the OHA in February 2012, for an extension to its water storage replacement schedule that would extend the final compliance date for replacement of the uncovered reservoirs to June 2026. In May 2012, OHA denied the Water Bureau's request for an adjustment to its regulatory schedule to replace the uncovered drinking water reservoirs at Mt. Tabor and Washington parks. In February 2013, then Commissioner-in-Charge Steve Novick submitted a revised request for an extension to the uncovered reservoir compliance schedule. The revised request was based on economic and regulatory circumstances cited by the City of Rochester, New York in its successful request for an extension to its own state mandated uncovered reservoir compliance schedule. Congressman Blumenauer also submitted a letter in support of Commissioner Novick's letter. In April 2013 OHA denied Commissioner Novick's request.

The Water Bureau's existing regulatory schedule to end the use of the uncovered reservoirs by December 31, 2020 remains in effect.

For updates on the Portland Water Bureau's actions regarding the LT2 rule visit **www.portlandoregon.gov/water/LT2**.

Developments in Water Quality

July 2012 Boil Water Notice

On July 20, 2012, the Portland Water Bureau received results showing the presence of *E. coli* in a sample from an open finished drinking water reservoir at Washington Park. As required by drinking water regulations, additional follow-up samples were collected. On July 21, the results of one of the follow-up samples was positive for total coliform. This constituted a violation of the Total Coliform Rule, which required that a boil water notice be issued to customers being served water from this reservoir. Additional water quality samples were collected throughout the affected area and the open reservoir was taken out of service.

On July 21 a boil water notice was issued to all Portland Water Bureau customers west of the Willamette River and customers of the Burlington, Lake Grove, Palatine Hill, West Slope, City of Tigard and Valley View water districts. On Sunday, July 22, results from all samples were negative for *E. coli* and other indicator bacteria, and the boil water notice was lifted. Throughout the incident, the Portland Water Bureau coordinated with the Multnomah County Health Department to monitor for evidence of a widespread waterborne disease outbreak. Continued monitoring by the health department concluded that no such evidence was detected, leading to the belief that the contamination was limited and had little to no effect on the health of the general public. Following the incident, the Portland Water Bureau conducted an investigation into the cause of the contamination. The reservoir was drained and inspected and sample lines were investigated. Although no source of contamination was found, the Water Bureau determined that the contamination was not the result of a deficiency in raw water treatment.

The City of Portland and Multnomah County utilize the Community Emergency Notification System to send phone, text/SMS and e-mail alerts to notify residents and businesses affected during an emergency. Visit **www.publicalerts.org** to register.

Dam 2 Tower Improvements

The Bull Run Water Supply Habitat Conservation Plan (HCP) is a 50-year plan to protect and improve aquatic habitat while continuing to manage the Bull Run watershed as a water supply for the City of Portland. The HCP is a comprehensive package of actions focused primarily on habitat improvement for Endangered Species Act listed salmon and steelhead, but also allows the City to comply with the water temperature requirements of the Clean Water Act for the lower Bull Run River. The plan was developed in coordination with more than a dozen public and private organizations working on salmon recovery in the Sandy River Basin.

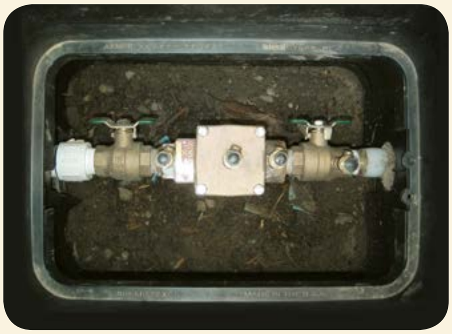
Construction at Dam 2 tower

The HCP includes flow and water temperature commitments for the lower Bull Run River. The most critical project to address water quality issues in the lower Bull Run River is a large infrastructure improvement at Bull Run Dam 2. Multi-level intakes are currently under construction on the Dam 2 North Tower that will allow the bureau to better manage the temperature of water sent to the lower Bull Run River for fish. The multi-level intakes will allow the bureau to withdraw water from higher levels early in the summer before it has warmed, saving the coldest water for use later in the summer when it is needed most.

The new intake tower will be tested in late summer 2013, and be in operation by 2014. Throughout the project, all construction activities are being closely monitored to protect Portland's drinking water source.

Cross-Connection Control

A cross-connection is where a potential source of contamination or pollution is connected to water lines on customers' premises. Backflow prevention assemblies are devices that can be installed in your water system to prevent water from flowing back through back siphon or back pressure into a private plumbing system or the public water supply. The State-mandated Portland Water Bureau Cross-Connection Control Program was designed to prevent backflow contamination from cross-connections. Backflow assemblies are required to be installed on the water service connections to all fire and landscape sprinkler systems. The law also requires backflow assemblies in commercial establishments such as hospitals and industrial facilities. The easiest way to keep you and your family safe from the potential hazards of cross-connections through backflow is to not create cross-connections in the first place. Short of that, it is important to control such cross-connections through the use of an appropriate backflow prevention assembly. If you have a cross-connection to a lawn sprinkler system, boiler, pool, water feature or other potential threat, you must have an approved backflow prevention assembly installed. After installation, the backflow assembly must be tested by a state certified backflow assembly tester. This test is required each year in order to comply with state health and plumbing codes. For more information contact **503-823-7336** or visit **www.portlandoregon.gov/water/crossconnection**.



Double Check Valve Assembly on a domestic service line

CITY OF PORTLAND, OREGON
Portland Water Bureau
Mayor Charlie Hales
Administrator David G. Shaff
1120 SW Fifth Avenue / Room 600
Portland, Oregon 97204

The Powell Butte Reservoir 2 Project is slated for completion by the end of 2013. The new 50-million gallon water storage facility is comprised of two 25-million gallon cells. The reservoir will allow the Portland Water Bureau to comply with drinking water regulations (see page 9) while maintaining sufficient storage capacity for future population growth and fire suppression. The project includes publicly required nature park improvements, such as an interpretive center, a permanent caretaker's house and trail system upgrades.

Printed on recycled paper
JUNE 2013

CONTACT INFORMATION

Portland Water Bureau
1120 SW Fifth Avenue/ Room 600
Portland, Oregon 97204
www.portlandoregon.gov/water

Public Water System #4100657
Portland Water Bureau Customer Service: 503-823-7770

Portland Water Bureau Water Line: 503-823-7525

FOR ADDITIONAL INFORMATION

Oregon Health Authority – Drinking Water Program:
971-673-0405
www.public.health.oregon.gov/HealthyEnvironments/DrinkingWater

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The City of Portland will provide auxiliary aids/services to persons with disabilities. To request an ADA accommodation, please call 503-823-7404 or by TTY at 503-823-6868. Copies of this report are available on the Portland Water Bureau's website — www.portlandoregon.gov/water/reports

SPANISH
Para obtener una copia de este reporte en español, por favor llame al **503-823-7525** o visite **www.portlandoregon.gov/water/reports**

RUSSIAN
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VIETNAMESE
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CHINESE
若想获得本报告的中文版本，请拨打 **503-823-7525 或访问 www.portlandoregon.gov/water/reports**

Parsons, Susan

From: Kate & Chris <samsa@pacifier.com>
Sent: Thursday, May 28, 2015 2:01 AM
To: Council Clerk – Testimony
Cc: Hales, Mayor; Commissioner Fritz; Commissioner Fish; Commissioner Novick; Commissioner Saltzman
Subject: Fw: LU 14-218444-HR-EN Testimony of Katherin Kirkpatrick 2015-05-28 -- Email 2 of 11
Attachments: LU 14-218444-HR-EN Testimony of Katherin Kirkpatrick 2015-05-28 -- Exhibit F.pdf; LU 14-218444-HR-EN Testimony of Katherin Kirkpatrick 2015-05-28 -- Exhibit G.pdf; LU 14-218444-HR-EN Testimony of Katherin Kirkpatrick 2015-05-28 -- Exhibit H.jpg; LU 14-218444-HR-EN Testimony of Katherin Kirkpatrick 2015-05-28 -- Exhibit I.pdf; LU 14-218444-HR-EN Testimony of Katherin Kirkpatrick 2015-05-28 -- Exhibit J.pdf; LU 14-218444-HR-EN Testimony of Katherin Kirkpatrick 2015-05-28 -- Exhibit K.pdf

Dear Karla:
Please accept this second portion of my attached testimony for submission into the record of LU 14-218444-HR-EN on the Mt. Tabor Reservoirs Decommissioning, scheduled for hearing this afternoon at 2:00 p.m. **This batch consists of Exhibits F through K in support of my legal brief sent in the previous e-mail.** Kindly send me an electronic receipt when the documents are entered.

Thank you,
Katherin Kirkpatrick
1319 SE 53rd Avenue
Portland, OR 97215
samsa@pacifier.com

PORTLAND WATER BUREAU

2014 Drinking Water Quality Report

SPANISH

Para obtener una copia de este reporte en español, por favor llame al **503-823-7770** o visite

www.portlandoregon.gov/water/reports

RUSSIAN

Чтобы получить копию этого отчета на русском языке, пожалуйста, позвоните **503-823-7770** или зайдите на сайт

www.portlandoregon.gov/water/reports

VIETNAMESE

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www.portlandoregon.gov/water/reports

CHINESE

若想获得本报告的中文版本，请拨打 **503-823-7770** 或访问：

www.portlandoregon.gov/water/reports

FROM FOREST TO FAUCET

From the Administrator

I am pleased to share the 2014 Drinking Water Quality Report with you. While this report is mandated by the federal government, the Portland Water Bureau prides itself in providing this comprehensive and accessible report.

Like last year, you are likely reading the report online, rather than the traditional paper copy sent by mail. The Environmental Protection Agency recently changed the requirements to allow utilities to communicate this important information digitally. Customers are still able to request a paper copy, and can do so by calling 503-823-7525 or visiting **www.portlandoregon.gov/water/reportrequest**.

One thing you might note is that the Portland Water Bureau monitors Portland's drinking water for more than 200 regulated and unregulated contaminants. We are fortunate that Portland's water is some of the highest-quality drinking water in the world.

The Portland Water Bureau works diligently to protect this essential resource, and to preserve and enhance the system that delivers water to your home or business. I urge you to take a minute to look through this report; learn about your water system and some of what goes into delivering water to your tap.

If you have questions or comments about this report, please call the Water Line at 503-823-7525.

We welcome your interest in Portland's water system.

David G. Shaff

David G. Shaff
Administrator

Frequently Asked Questions About Water Quality

Is my water treated by filtration?

No. Neither the groundwater nor Bull Run source water is filtered. The Bull Run source meets the filtration avoidance criteria of the Surface Water Treatment Rule. The State of Oregon approved Portland's compliance with these criteria in 1992. Portland continues to meet these criteria on an ongoing basis.

Does the Portland Water Bureau add fluoride to drinking water?

No. The Portland Water Bureau does not add fluoride to the water. Fluoride is a naturally occurring trace element in surface and groundwater. The U.S. Public Health Service and the Centers for Disease Control and Prevention consider the fluoride levels in Portland's water sources to be lower than optimal for the prevention of tooth decay. You may want to consult with your dentist about fluoride treatment to help prevent tooth decay, especially for young children.

Is Portland's water soft or hard?

Portland's water is very soft. The hardness of Bull Run water is typically 3-8 parts per million (ppm) – approximately ¼ to ½ a grain of hardness per gallon. Portland's groundwater hardness is approximately 80 ppm (about 5 grains per gallon), which is considered moderately hard.

What is the pH of Portland's water?

The pH of Portland's drinking water typically ranges between 7.4 and 8.1.

Are sodium levels in Portland's drinking water affecting my health?

There is currently no drinking water standard for sodium. Sodium is an essential nutrient. Sodium in Portland's water typically ranges between 2 and 9 ppm, a level unlikely to contribute to adverse health effects.

Is there radon in Portland's drinking water?

Radon is a naturally occurring radioactive gas that cannot be seen, tasted or smelled. Radon has never been detected in the Bull Run surface water supply. In past years, radon has been detected at varying levels in Portland's groundwater wells. In 2013, a limited amount of groundwater was used during a short maintenance run. No data on radon was collected during that time. Based on the historical levels and limited amount of groundwater used, radon is unlikely to contribute to adverse health effects. For more information about radon, call the EPA's Radon Hotline 800-SOS-RADON or www.epa.gov/radon/rnwater.html.

Who can I call about water quality or pressure concerns?

The Water Line, **503-823-7525**, can answer your questions and concerns about water quality or pressure. The Water Line is available Monday–Friday from 8:30 a.m.– 4:30 p.m. If you have an emergency after these hours, please contact the after-hours number at **503-823-4874**.

How can I get my water tested?

Contact the LeadLine at **www.leadline.org** or **503-988-4000** for information about free lead-in-water testing. For more extensive testing, private laboratories can test your tap water for a fee. Not all labs are accredited to test for all contaminants. For information about accredited labs, call the Oregon Health Authority, Oregon Environmental Laboratory Accreditation Program at **503-693-4122**.

Public Involvement Opportunities

The Portland Water Bureau provides a variety of public information, public involvement and community outreach opportunities. If you have questions about Portland Water Bureau programs, public meetings, or capital projects please contact the Portland Water Bureau Public Information Group at **503-823-6926**, or visit the Water Bureau's website to learn more about the bureau or to leave a comment: **www.portlandoregon.gov/water**.

COVER PHOTO: BULL RUN LAKE.
CREDIT: ROMAN JOHNSTON.

Drinking Water Treatment

The first step in the treatment process for Portland's drinking water is disinfection using chlorine. Next, ammonia is added to form chloramines which ensure that disinfection remains adequate throughout the distribution system.

Finally, sodium hydroxide is added to increase the pH of the water to reduce corrosion of plumbing systems. This treatment helps control lead and copper levels at customers' taps, should these metals be present in commercial and household plumbing systems.

Water Testing

The Portland Water Bureau monitors for over 200 regulated and unregulated contaminants in drinking water, including pesticides and radioactive contaminants. All monitoring data in this report are from 2013. **If a known health-related contaminant is not listed in this report, the Portland Water Bureau did not detect it in drinking water.**

The Portland Water Bureau collects and analyzes more than 11,000 samples each year.

Special Notice for Immuno-Compromised Persons

Some people may be more vulnerable to contaminants in drinking water than the general population.

Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly people, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health-care providers. Guidelines from the Environmental Protection Agency and Centers for Disease Control and Prevention on appropriate means to lessen the risk of infection by *Cryptosporidium* and other microbial contaminants are available from the Safe Drinking Water Hotline at **800-426-4791**.

What the EPA Says About Drinking Water Contaminants

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the Environmental Protection Agency's Safe Drinking Water Hotline at **800-426-4791** or at **www.epa.gov/safewater**.

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

Contaminants in drinking water sources may include:

Microbial contaminants, such as viruses and bacteria, which may come from wildlife or septic systems.

Inorganic contaminants, such as salts and metals, which can occur naturally or result from urban stormwater runoff, industrial or domestic wastewater discharges or farming.

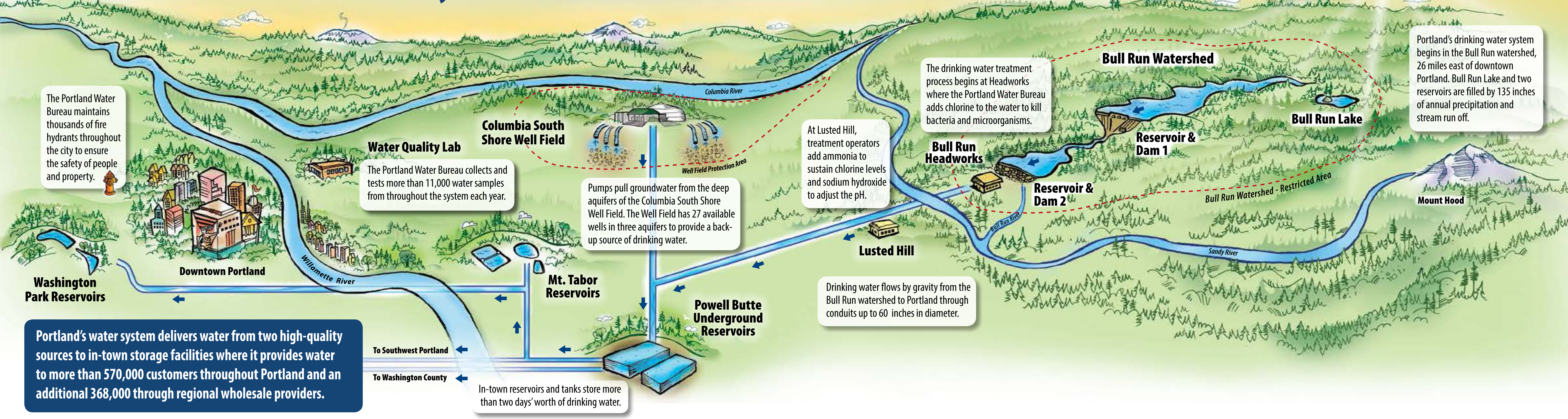
Pesticides and herbicides, which may come from a variety of sources such as farming, urban stormwater runoff and home or business use.

Organic chemical contaminants, including synthetic and volatile organic chemicals, which are byproducts of industrial processes, and can also come from gas stations, urban stormwater runoff and septic systems.

Radioactive contaminants, which can occur naturally.

In order to ensure that tap water is safe to drink, the EPA has regulations that limit the amount of certain contaminants in water provided by public water systems and require monitoring for these contaminants. Food and Drug Administration regulations establish limits for contaminants in bottled water, which must provide the same protection for public health.

Portland's Water System *Established 1895*



The Bull Run Watershed is a surface water supply within the Bull Run Watershed Management Unit located in the Mt. Hood National Forest. The watershed is Portland's primary drinking water source. The Bull Run watershed and Mount Hood are separated by a geological ridge, preventing Mount Hood snowmelt from reaching Portland's water supply. Current regulations, and the availability of the Columbia South Shore Well Field, allow Portland to meet federal drinking water standards without filtering this high-quality Bull Run water supply. The watershed has an area of 102 square miles, and typically receives 80-170 inches of rainfall a year. The heaviest rains occur from late fall through spring. Two reservoirs store water for use year-round, particularly during the dry summer months.

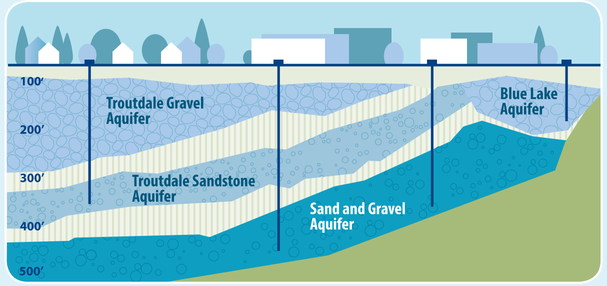
The watershed is used mainly for producing drinking water. Federal laws restrict public entry. No recreational, residential, or commercial uses occur within its boundaries. The Portland Water Bureau carefully monitors water quality and quantity. The Oregon Health Authority Drinking Water Services regularly inspects the watershed and the related treatment and distribution facilities.

The Portland Water Bureau completed a Source Water Assessment for the Bull Run water supply to comply with the 1996 Safe Drinking Water Act amendments. The only known contaminants of concern for the Bull Run water supply are naturally occurring microbial contaminants such as *Giardia, Cryptosporidium,* fecal coliform bacteria, and total coliform bacteria. These organisms are found in virtually all freshwater ecosystems and are present in the Bull Run supply at very low levels. The Bull Run supply complies with all applicable state and federal regulations for source water, including the 1989 Surface Water Treatment Rule filtration-avoidance criteria. The Portland Water Bureau is also operating under a variance for the treatment requirements for *Cryptosporidium*, see page 9 for more information. The Source Water Assessment report is available at **www.portlandoregon.gov/water/sourcewaterassessment** and by calling **503-823-7525**.

Bull Run Lake

The Columbia South Shore Well Field provides high-quality drinking water from groundwater production wells located in three different aquifers. In 2013, over the course of 7 days beginning July 30, the Portland Water Bureau supplemented the Bull Run drinking water supply with approximately 30 million gallons of groundwater as part of an annual groundwater maintenance operation.

Portland's long history of groundwater protection in the Columbia South Shore dates back to the original development of the well field in the early 1980s. In June 2008, the State certified the most recent update of the Columbia South Shore Well Field Protection Program. This program, a collaborative effort of Portland, Gresham and Fairview, identified commercial and industrial activities as the most significant potential sources of contamination for groundwater. Together these cities regulate businesses in the groundwater protection area to prevent hazardous material spills that could seep into the ground. Public events such as Aquifer Adventure, Cycle the Well Field and Groundwater 101 educate local residents on how to help protect groundwater. To obtain a copy of Portland's Well Field Protection Program certification, which includes information on potential sources of contamination, call **503-823-7473**. To read more about the program, find upcoming events, and learn how to help protect groundwater, visit the Portland Water Bureau's groundwater website at **www.portlandoregon.gov/water/groundwater**.



There are 27 usable wells capable of pumping water from three aquifers on the south shore of the Columbia River. The well field serves as a backup water supply during turbidity events, emergencies and when the bureau needs additional summer supply. The well field can produce up to 102 million gallons of water per day.

The Clackamas River Water District, City of Gresham, City of Lake Oswego, Rockwood Water People's Utility District, Sunrise Water Authority and Tualatin Valley Water District provide drinking water to some Portland customers who live near service area boundaries. Customers who receive water from these providers will also receive detailed water quality reports about these sources in addition to this report.

Contaminants Detected in 2013

Regulated Contaminant	Minimum Detected	Maximum Detected	Maximum Contaminant Level (MCL), Treatment Technique or Maximum Residual Disinfectant Level (MRDL)	Maximum Contaminant Level Goal (MCLG) or Maximum Residual Disinfectant Level Goal (MRDLG)	Sources of Contaminant
Untreated Source Water from the Bull Run Watershed					
Turbidity	0.16 NTU	3.13 NTU	Cannot exceed 5 NTU more than 2 times in 12 months	Not Applicable	Erosion of natural deposits
Total Organic Carbon	0.76 parts per million	1.7 parts per million	Not Applicable	Not Applicable	Naturally present in the environment
Giardia	Not detected	2 *Giardia* cysts in 11.3 L	Treatment technique required: Disinfection to kill 99.9% of cysts	Not Applicable	Animal wastes
Fecal Coliform Bacteria	Not detected	99% of samples had 20 or fewer bacterial colonies per 100 milliliters of water (1 sample had 24 bacterial colonies per 100 milliliters and 1 sample had 27 bacterial colonies per 100 milliliters)	At least 90% of samples measured during the previous six months must have 20 or fewer bacterial colonies per 100 milliliters of water	Not Applicable	Animal wastes

Treated Drinking Water from Bull Run Watershed and Columbia South Shore Well Field Entry Points to the Distribution System					
NUTRIENTS					
Nitrate - Nitrogen	<0.01 parts per million	0.23 parts per million	10 parts per million	10 parts per million	Found in natural aquifer deposits; animal wastes
METALS AND MINERALS					
Arsenic	<0.50 parts per billion	0.88 parts per billion	10 parts per billion	0 parts per billion	Found in natural deposits
Barium	0.00091 parts per million	0.0081 parts per million	2 parts per million	2 parts per million	
Chromium (total)	<0.50 parts per billion	0.82 parts per billion	100 parts per billion	100 parts per billion	
Copper	<0.00050 parts per million	0.0011 parts per million	Not Applicable	1.3 parts per million	
Fluoride	<0.025 parts per million	0.13 parts per million	4 parts per million	4 parts per million	

Treated Drinking Water from Points throughout the Distribution System of Reservoirs, Tanks and Main Water Pipes					
MICROBIOLOGICAL CONTAMINANTS					
Total Coliform Bacteria	Not Detected	12% (45 out of 384) of samples in September had detectable coliform bacteria	Must not detect coliform bacteria in more than 5.0% of samples in any month	0% of samples with detectable coliform bacteria	Found throughout the environment
DISINFECTANT RESIDUAL					
Total Chlorine Residual Running Annual Average	1.3 parts per million	1.6 parts per million	4 parts per million	4 parts per million	Chlorine and ammonia are used to disinfect water
Total Chlorine Residual At Any One Site	<0.1 parts per million	3.3 parts per million	Not Applicable	Not Applicable	
DISINFECTION BYPRODUCTS					
Total Trihalomethanes					
Running Annual Average at Any One Site	11 parts per billion	26 parts per billion	80 parts per billion	Not Applicable	Byproduct of drinking water disinfection
Single Result at Any One Site	11 parts per billion	42 parts per billion	Not Applicable		
Haloacetic Acids					
Running Annual Average at Any One Site	1.5 parts per billion	32 parts per billion	60 parts per billion	Not Applicable	Byproduct of drinking water disinfection
Single Result at Any One Site	1.5 parts per billion	61 parts per billion	Not Applicable		

Regulated Contaminant	90th Percentile Values	Number of Sites Exceeding the Action Level	Lead and Copper Rule Exceedance	Maximum Contaminant Level Goal (MCLG)	Source of Contaminant
Lead and Copper Sampling at High-Risk Residential Water Taps					
Lead	16 parts per billion	12% (13 of 108) of samples exceeded the lead action level of 15 parts per billion	More than 10% of the homes tested have lead levels greater than 15 parts per billion	0 parts per billion	Corrosion of household and commercial building plumbing systems
Copper	0.48 parts per million	0% (0 of 108) of samples exceeded the copper action level of 1.3 parts per million	More than 10% of the homes tested have copper levels greater than 1.3 parts per million	1.3 parts per million	

Unregulated Contaminant	Minimum Detected	Average Detected	Maximum Detected	Source of Contaminant
Treated Drinking Water from Bull Run Watershed and Columbia South Shore Well Field Entry Points to the Distribution System				
Sodium	2.8 parts per million	6.9 parts per million	17 parts per million	Found in natural deposits

*See **Notes on Contaminants** on page 7 for more information.*

Definitions

Action Level
The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.

Maximum Contaminant Level (MCL)
The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

Maximum Contaminant Level Goal (MCLG)
The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

Maximum Residual Disinfectant Level (MRDL)
The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

Maximum Residual Disinfectant Level Goal (MRDLG)
The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.

Part Per Million (ppm)
One part per million corresponds to one penny in $10,000 or approximately one minute in two years. One part per million is equal to 1,000 parts per billion.

Part Per Billion (ppb)
One part per billion corresponds to one penny in $10,000,000 or approximately one minute in 2,000 years.

Treatment Technique
A required process intended to reduce the level of a contaminant in drinking water.

Notes on Contaminants

Turbidity
Bull Run is an unfiltered surface water supply. The rules for public water systems have strict standards for unfiltered surface water supplies. Turbidity levels in unfiltered water must not exceed 5 NTU (nephelometric turbidity units) more than two times in a twelve-month period. The typical cause of turbidity is sediment suspended in the water. The sediment can interfere with disinfection and provide an environment for microbial growth. Large storm events can result in increased turbidity, causing the Portland Water Bureau to shut down the Bull Run system and serve water from the Columbia South Shore Well Field.

Total Organic Carbon
Total Organic Carbon (TOC) is naturally found in water and can react with disinfectants to produce disinfection by-products (DBPs). The Portland Water Bureau monitors for TOC to qualify for reduced DBP monitoring. Surface water systems are eligible for reduced DBP monitoring when DBP levels are ≤ 50% of the MCL and TOC monitoring is ≤ 4.0 mg/L.

Giardia
Wildlife in the watershed may be hosts to *Giardia*, the organism that causes giardiasis. The Portland Water Bureau uses chlorine to control these organisms.

Fecal Coliform Bacteria
The presence of fecal coliform bacteria in source water indicates that water may be contaminated with animal wastes. The Portland Water Bureau uses chlorine to kill these bacteria.

Nitrate - Nitrogen
Nitrate, measured as nitrogen, can support microbial growth (bacteria and algae). Nitrate levels exceeding the standards can contribute to health problems. At the levels found in Portland's drinking water, Nitrate is unlikely to contribute to adverse health effects.

The Portland Water Bureau monitors for more than 200 regulated and unregulated contaminants.

Arsenic, Barium, Chromium (total) and Fluoride
These metals are elements found in the earth's crust. They can dissolve into water that is in contact with natural deposits. At the levels found in Portland's drinking water, they are unlikely to contribute to adverse health effects.

Total Coliform Bacteria
Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other potentially-harmful bacteria may be present. The Portland Water Bureau uses chlorine to kill these bacteria. During the month of September, coliforms were found in more samples than allowed and this was a warning of potential problems. For more information, see *Total Coliform Detections in September 2013* on page 10.

Disinfection Byproducts
During disinfection, certain byproducts form as a result of chemical reactions between chlorine and naturally occurring organic matter in the water. These byproducts can have negative health effects. Trihalomethanes and haloacetic acids are regulated disinfection byproducts that have been detected in Portland's water. The disinfection process is carefully controlled to keep byproduct levels low.

Total Chlorine Residual
Total chlorine residual is a measure of free chlorine and combined chlorine and ammonia in our distribution system. Chlorine residual is necessary to maintain disinfection throughout the distribution system. Adding ammonia to chlorine results in a more stable disinfectant and helps to minimize the formation of disinfection byproducts.

Lead and Copper
There is no maximum contaminant level (MCL) for lead or copper at the entry point to the distribution system. The main source of lead and copper is the corrosion of building plumbing. Lead and copper are tested at customers' taps where levels are the highest. Infants and children who drink water containing lead in excess of the action level could experience delays in their physical or mental development. Children could show slight deficits in attention span and learning abilities. Adults who drink this water over many years could develop kidney problems or high blood pressure. For more information, see *Reducing Exposure to Lead* on page 8.

Sodium
There is currently no drinking water standard for sodium. Sodium is an essential nutrient. At the levels found in drinking water, it is unlikely to contribute to adverse health effects.

Reducing Exposure to Lead

Portland has removed all known lead service connections from its distribution system. Exposure to lead through drinking water is possible if materials in a building's plumbing contain lead. The level of lead in water can increase when water stands in contact with lead-based solder and brass faucets containing lead.

If present, lead at elevated levels can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The Portland Water Bureau is responsible for providing high-quality drinking water, but cannot control the variety of materials used in plumbing components in homes or buildings. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your drinking water, you may wish to request a free lead-in-water test from the LeadLine. Information on lead in drinking water, testing methods and steps you can take to minimize exposure is available from the **LeadLine, 503-988-4000**, **www.leadline.org** or the Safe Drinking Water Hotline **800-426-4791**, **www.epa.gov/safewater/lead**.

People are exposed to lead in many other ways. In the Portland area, dust from paint in homes built before 1978 is the most common source of exposure to lead. Other sources include soil, pottery, traditional folk medicines or cosmetics, some sports equipment such as fishing weights and ammunition, and some occupations and hobbies.

Corrosion Treatment

The Portland Water Bureau's corrosion control treatment reduces corrosion in plumbing by increasing the pH of the water. Comparison of monitoring results with and without pH adjustment shows more than 50 percent reduction in lead and 80 percent reduction in copper at the tap with pH adjustment.

Water Testing

Twice each year the Portland Water Bureau and regional water providers in the Bull Run service area monitor for lead and copper in tap water from a sample group of more than 100 homes. These are homes in the Bull Run service area where the plumbing is known to contain lead solder, which is more likely to contribute to elevated lead levels. These houses represent a worst-case scenario for lead in water. Samples are collected after the water has been standing in the household plumbing for more than 6 hours. A Lead and Copper Rule exceedance for lead occurs when more than 10 percent of these homes exceed the lead action level of 15 parts per billion. In the most recent round of testing, more than 10 percent of homes exceeded the lead action level. As a result of exceeding the action level, the Portland Water Bureau has been informing customers and encouraging them to follow the easy steps to reduce exposure to lead in water (see sidebar).

If you are concerned that your home tap water may have lead, call the LeadLine for a free lead-in-water test kit and to learn ways to reduce your exposure to all sources of lead. This program is available to anyone, but targets testing the water in households most at-risk from lead in water. These are homes built between 1970 and 1985 with pregnant women or children ages six or younger in the home.

Easy steps to avoid possible exposure to lead in drinking water

- **Run your water to flush out lead.**
  If the water has not been used for several hours, run each tap for 30 seconds to 2 minutes or until it becomes colder before drinking or cooking. This flushes water which may contain lead from the pipes.
- **Use cold, fresh water for cooking and preparing baby formula.**
  Do not cook with or drink water from the hot water tap; lead dissolves more easily into hot water. Do not use water from the hot water tap to make baby formula.
- **Do not boil water to remove lead.**
  Boiling water will not reduce lead.
- **Consider using a filter.**
  Check whether it reduces lead – not all filters do. Be sure to maintain and replace a filter device in accordance with the manufacturer's instructions to protect water quality. Contact NSF International at **800-NSF-8010** or **www.nsf.org** for information on performance standards for water filters.
- **Test your water for lead.**
  Call the **LeadLine** at **503-988-4000** to find out how to get a **FREE** lead-in-water test.
- **Test your child for lead.**
  Ask your physician or call the **LeadLine** to find out how to have your child tested for lead. A blood lead level test is the only way to know whether your child is being exposed to lead.
- **Regularly clean your faucet aerator.**
  Particles containing lead from solder or household plumbing can become trapped in your faucet aerator. Regular cleaning every few months will remove these particles and reduce your exposure to lead.
- **Consider buying low-lead fixtures.**
  As of January 2014, all pipes, fittings and fixtures are required to contain less than 0.25% lead. When buying new fixtures, consumers should seek out those with the lowest lead content.

LeadLine – 503-988-4000

Call the **LeadLine** or visit **www.leadline.org** for information about lead hazards, free lead-in-water testing, free childhood blood lead testing and referrals to other lead reduction services.

www.leadline.org

Bull Run Treatment Variance

In March 2012, the Oregon Health Authority (OHA) issued the Portland Water Bureau a variance from the state and federal drinking water rules requiring the treatment of raw water from the Bull Run watershed for the parasite *Cryptosporidium*. A variance is state permission not to meet an MCL or a treatment technique under certain conditions. A state may grant a variance if a water system demonstrates that the required treatment is not necessary to protect public health because of the nature of the water system's raw water source. OHA issued Portland Water Bureau the treatment variance for *Cryptosporidium* based on substantial data and analyses presented in the *LT2 Treatment Variance Request* for the Bull Run drinking water source. The Portland Water Bureau is the only system in the United States to have received a variance to the treatment requirements for *Cryptosporidium* based on the high quality of its raw water and therefore does not provide treatment for *Cryptosporidium*.

As a result of the treatment variance, the following are among the state-mandated conditions that must be met in order to maintain the variance:

Watershed Protection: The Portland Water Bureau must maintain or strengthen all existing legal and operational protections for the Bull Run watershed, monitor the watershed on a routine basis in an effort to eliminate unauthorized entry, maintain strict controls for sanitary facilities, implement field inspections and monitor tributaries and wildlife scat in the watershed.

Raw Water Intake Monitoring: The Portland Water Bureau must conduct regular ongoing monitoring for *Cryptosporidium* where raw water first enters the drinking water system at least two days each week. If *Cryptosporidium* is detected in any one sample, the Portland Water Bureau must begin a much more intensive monitoring program to demonstrate whether the *Cryptosporidium* concentration is less than 0.075 oocysts per 1,000 liters. Additional detections of *Cryptosporidium* during this period of monitoring could result in OHA revoking the variance.

Reporting and Notification: The Portland Water Bureau must report the results of watershed and raw water monitoring to OHA. Any detections of *Cryptosporidium* must be reported to OHA within 24 hours. The Portland Water Bureau must notify the public through its website and issue a press release in the event of a *Cryptosporidium* detection at the raw water intake. The results of watershed field inspections and tributary and wildlife scat monitoring must be reported to OHA annually. The Portland Water Bureau must also notify OHA of any circumstances that may impact the conditions of the variance.

The treatment variance is valid for a period of 10 years from the date it was issued. OHA may revoke the variance if the conditions of the variance are not met.

2013 Results of *Cryptosporidium* Monitoring at the Raw Water Intake

Number of Samples	Total Volume	Detections
244	5,825.4 L	None

In 2013, there were no detections of *Cryptosporidium* during Raw Water Intake Monitoring. The most recent monthly intake reports can be found at **www.portlandoregon.gov/water/BRTVIntakeReports**.

The most recent annual Bull Run Treatment Variance Watershed Report summarizes the results of watershed field inspections and monitoring of tributaries and wildlife scat for Water Year 2013 (October 1, 2012 – September 30, 2013) and can be found at **www.portlandoregon.gov/water/2013BRTVReport**.

Additional information on Portland Water Bureau's treatment variance can be found at **www.portlandoregon.gov/water/treatmentvariance**.

Bull Run Reservoir 1

Developments in Water Quality

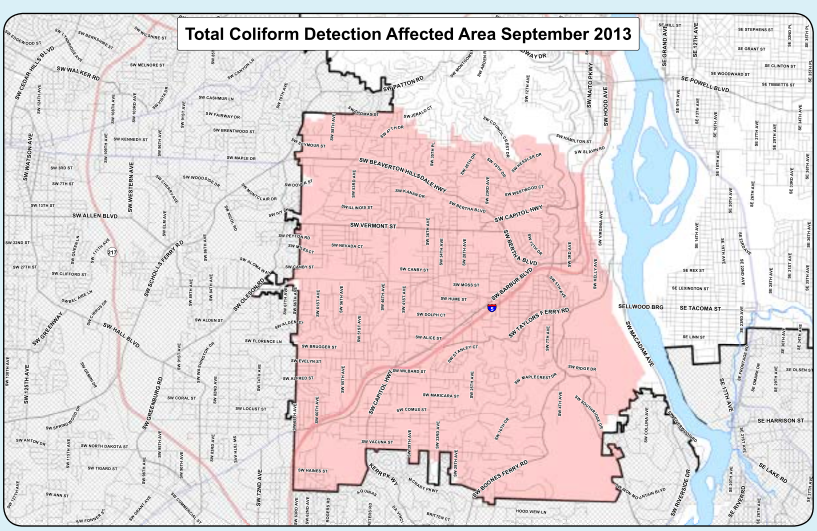
Total Coliform Detections in September 2013

The Portland Water Bureau routinely monitors for drinking water contaminants. This monitoring includes regular testing throughout the system for bacteria. During the month of September 2013, the Portland Water Bureau tested 384 samples for bacteria. Forty-five of these samples tested positive for total coliform bacteria. Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other potentially-harmful bacteria may be present. Coliforms were found in more samples than allowed and this was a warning of potential problems. The majority of the coliform detections were limited to an area of SW Portland that affected approximately 17,500 households and businesses. These detections occurred after a routine water quality sample collected from SW 27th Avenue and Nevada Court on September 17, 2013, was positive for total coliforms. Follow-up samples collected in the area were also positive for total coliforms. All samples were negative for *E. coli*. As a result of the detections, the Portland Water Bureau mailed a notice to all customers in the affected area.

Even after a thorough investigation, the Portland Water Bureau was unable to identify any sources of contamination or any operational issues in this area. It appears the issue was the result of unusually warm water combined with a decrease in demand. Warm, slow-moving water results in decreased disinfectant residuals. A disinfectant residual is the amount of disinfectant left in the system after the water has traveled from the treatment facility. Lower disinfectant residuals can lead to an increase in bacterial activity.

To improve the disinfection residual, the Portland Water Bureau increased the amount of disinfectant added when it treats the water. In addition, the Portland Water Bureau performed high-velocity flushing to remove sediments and organic matter from the pipes in this area. This further increased the disinfection residual and brought in fresh, cool water. Follow-up testing on October 22 did not detect any bacteria. Continued monitoring and testing in this area, as well as the entire drinking water system, indicates that these actions were effective in resolving this issue.

The Portland Water Bureau continues to regularly monitor the distribution system, including this effected area in southwest Portland.



Unidirectional Flushing

Drinking water systems, especially unfiltered systems like Portland, need to routinely clean the network of pipes to improve water quality. Over time, very fine sediment and organic matter from the Bull Run settle out of the water and accumulate in the bottom of the pipes. While the sediments are generally harmless, they can react with the residual disinfectant, reducing its effectiveness. Additionally, sudden changes in the flow of water can disturb these sediments resulting in discolored water.

Cleaning out these sediments from the distribution system is is done using a technique called Unidirectional Flushing (UDF). To perform a UDF, water in the pipes needs to flow at a high velocity. This is done through a system analysis to determine which valves to close to increase the flow of water in the area to be flushed. This high velocity water is then flushed out through a fire hydrant to remove the accumulated sediments.

As part of the preparation for UDF, Portland Water Bureau crews check and operate the valves in the area to be flushed to make sure they are functioning and in the proper position. Most flushing occurs Monday through Friday between 9:00 AM and 3:00 PM. The flushed water is dechlorinated and discharged into Portland's sewer system. To prevent sewer overflows, UDF is only done when little or no rain is falling. Therefore the majority of UDF work is done in the summer and fall.

This summer the Portland Water Bureau is focusing on flushing SW Portland (roughly bounded by Hwy 26 on the north, I-5 on the south, SW Barbur Blvd on the east, and SW 50th Ave on the west) and NW Portland in the Northwest Heights area.

Residents should not be out of water during flushing. However, some residents in the immediate vicinity of the work may experience temporary discoloration of their water. This discoloration does not pose a health risk; however residents should check their water before washing any laundry.

Advice to customers: If a flushing crew is in your neighborhood, please do not run water in your home unless it's necessary. If you experience some discoloration in your water, turn on each cold water faucet in your home and allow it to run for several minutes or until the water is clear. If you experience ongoing water quality problems, please call 503-823-7525.

Additional advice for customers and more detailed maps of current flushing areas can be found at **www.portlandoregon.gov/water/UDF**.

CITY OF PORTLAND, OREGON
Portland Water Bureau
Commissioner Nick Fish
Administrator David G. Shaff
1120 SW Fifth Avenue / Room 600
Portland, Oregon 97204

Before

After

The Portland Water Bureau is rebuilding the Key Station structures in the Bull Run Watershed. The Key Stations house stream-flow gages, water-quality sensors and sampling equipment used to monitor the four major streams that flow into the Bull Run Reservoirs. As part of this effort, the older sampling equipment at all four sites will be replaced with new sampling units that offer greater capabilities for targeted water quality monitoring during rainfall events.

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CONTACT INFORMATION

Portland Water Bureau
1120 SW Fifth Avenue/ Room 600
Portland, Oregon 97204
www.portlandoregon.gov/water
Public Water System #4100657

Portland Water Bureau Customer Service: 503-823-7770

Portland Water Bureau Water Line: 503-823-7525

FOR ADDITIONAL INFORMATION

Oregon Health Authority – Drinking Water Services: 971-6730405

http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Pages/index.aspx

The City of Portland will provide auxiliary aids/services to persons with disabilities. To request an ADA accommodation, please call 503-823-7404 or by TTY at 503-823-6868. Copies of this report are available on the Portland Water Bureau's website —
www.portlandoregon.gov/water/reports

SPANISH

Para obtener una copia de este reporte en español, por favor llame al **503-823-7770** o visite

www.portlandoregon.gov/water/reports

RUSSIAN

Чтобы получить копию этого отчета на русском языке, пожалуйста, позвоните **503-823-7770** или зайдите на сайт

www.portlandoregon.gov/water/reports

VIETNAMESE

Để đủộc một bản báo cáo này bằng ̃tieng Việt, xin gọi số **503-823-7770** hoặc đến mạng lủổi

www.portlandoregon.gov/water/reports

CHINESE

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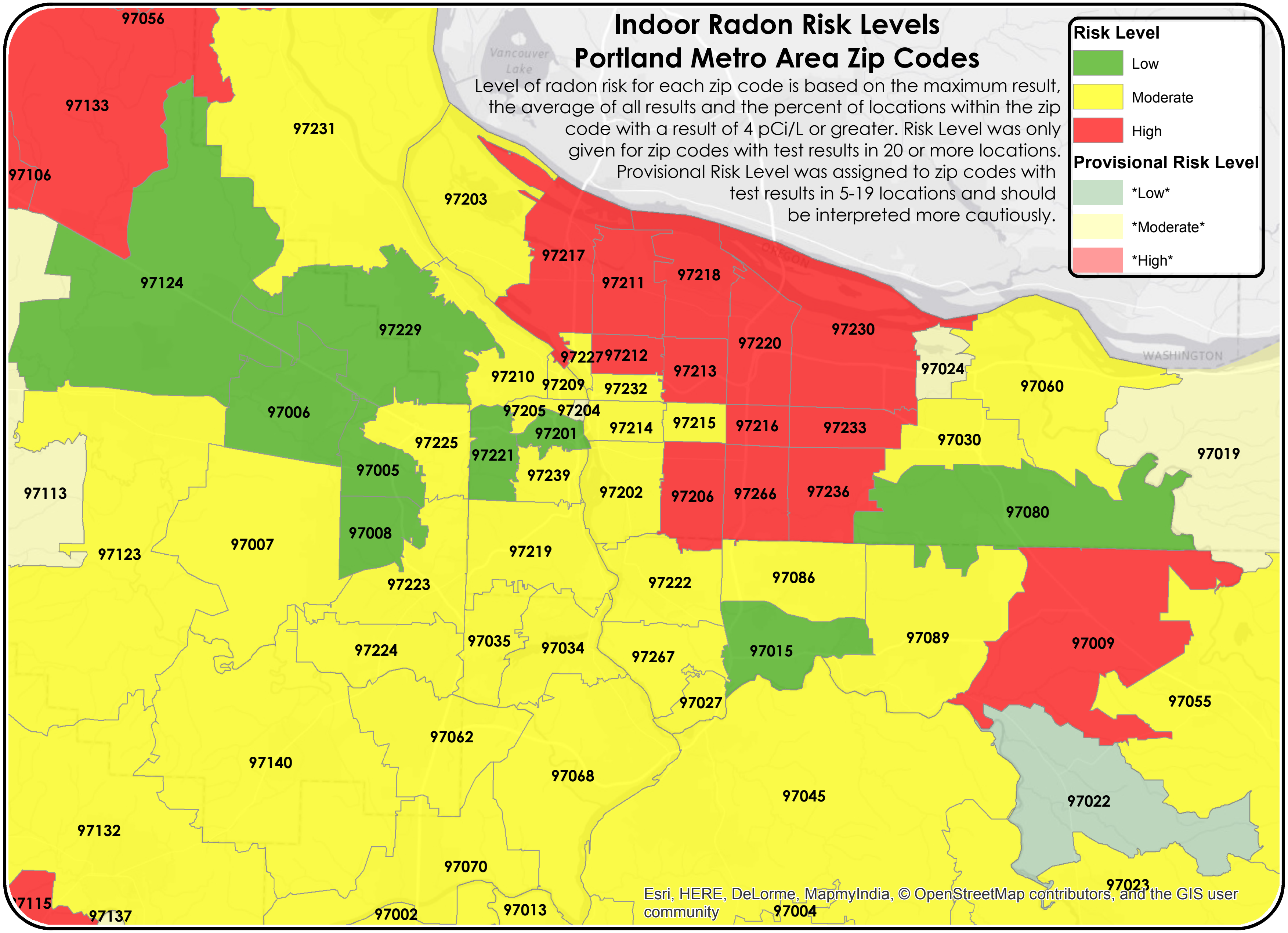
www.portlandoregon.gov/water/reports

Portland Water Bureau Retail and
Wholesale Distribution Area
Columbia South Shore
Well Field Protection Zone
Willamette
River
Columbia River
Bull Run Watershed
City of Portland
Boundary
Clackamas River
Sandy River

2014 RADON DATA



Radon

Reference Information

- People and Discoveries
- Commonly Encountered Radionuclides
  - Americium-241
  - Cesium-137
  - Cobalt-60
  - Iodine-129 &-131
  - Plutonium
  - Radium
  - Radon
  - Strontium-90
  - Technetium-99
  - Tritium
  - Thorium
  - Uranium
- Glossary
- Acronyms
- A-Z Subject Index
- Site Map

Radon (chemical symbol Rn) is a naturally occurring radioactive gas found in soils, rock, and water throughout the U.S. It has numerous different isotopes, but radon-220, and -222 are the most common. Radon causes lung cancer, and is a threat to health because it tends to collect in homes, sometimes to very high concentrations. As a result, radon is the largest source of exposure to naturally occurring radiation.

On this page:

The Basics

Who Discovered Radon

The German chemist Friedrich E. Dorn discovered radon-222 in 1900, and called it radium emanation. However, a scarcer isotope, radon-220, was actually observed first, in 1899, by the British scientist, R.B. Owens, and the New Zealand scientist, Ernest Rutherford. The medical community nationwide became aware of the possible extent of a radon problem in 1984. That year a nuclear plant worker in Pennsylvania discovered radioactivity on his clothing while exiting his place of work through the radiation detectors. The source of the radiation was determined to be radon decay products on his clothing originating from his home.

Where does radon come from?

Radon-222 is the decay product of radium-226. Radon-222 and its parent, radium-226, are part of the long decay chain for uranium-238. Since uranium is essentially ubiquitous in the earth's crust, radium-226 and radon-222 are present in almost all rock and all soil and water.

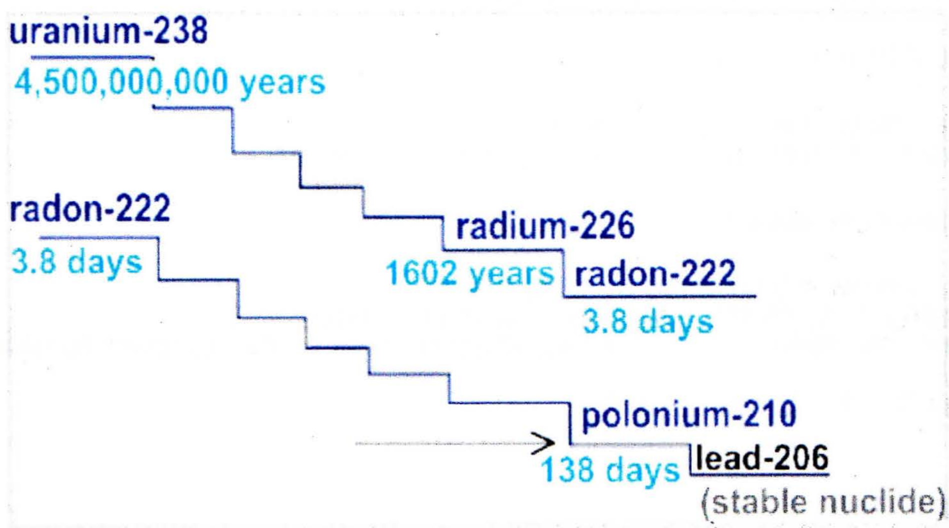
More Info

- Decay Chains - Uranium Decay
  This links provides an illustration of uranium-238 decays through a series of steps to become a stable form of lead.
- Uranium
  This fact sheet describes the basic properties and uses, and the hazards associated with this radionuclide. It also discusses radiation protection related to it.

What are the properties of radon?

Radon is a noble gas, which means it is basically *inert* (does not combine with other chemicals). Radon is a heavy gas and tends to collect in basements or other low places in housing. It has no color, odor, or taste. Radon-222 is produced by the decay of radium, has a half-life of 3.8 days, and emits an alpha particle as it decays to polonium-218, and eventually to stable lead. Radon-220, is the decay product of thorium - it is sometimes called thoron, has a half-life of 54.5 seconds and emits an alpha particle in its decay to polonium-216.

The illustration below provides an overview of the uranium-238 decay chain. Radon is part of that decay chain and is produced by the radioactive decay of radium.



More Info

- Radioactive Decay
  This page explains radioactive decay chains.

Does radon have any practical uses?

Radon has little practical use. Some medical treatments have employed radon in small sealed glass tubes, called seeds, that are specially manufactured to contain the exact amount of radioactivity needed for the application. Radon spas are used extensively in Russia and Central Europe to treat a number of conditions.

Exposure to Radon

How does radon get into the environment?

Radon-222 is the radioactive decay product of radium-226, which is found at low concentrations in almost all rock and soil. Radon is generated in rock and soil, and it creeps through cracks or spaces between particles up to the outside air. Although outdoor concentrations of radon are typically low, about 0.4 picocuries per liter (pCi/l) of air, it can seep into buildings through foundation cracks or openings and build up to much higher concentrations indoors, if the sources are large enough.

The average indoor radon concentration is about 1.3 pCi/l of air. It is not uncommon, though, for indoor radon levels to be found in the range of 5 - 50 pCi/l, and they have been found as high as 2,000 pCi/l. The concentration of radon measured in a house depends on many factors, including the design of the house, local geology and soil conditions, and the weather. Radon's decay products are all metallic solids, and when radon decay occurs in air, the decay products can cling to aerosols and dust, which makes them available for inhalation into the lungs.

Radon easily dissolves in water in areas of the country that have high radium content in soils and rocks, local ground water may contain high concentrations of radon. For example, underlying rock such as granite, or phosphate rock, typically have increased uranium and radium, and therefore radon. While radon easily dissolves into water, it also easily escapes from water when exposed to the atmosphere, especially if it is stirred or agitated. Consequently, radon concentrations are very low in rivers and lakes, but could still be high in water pumped from the ground. Some natural springs, such as those at Hot Springs, Arkansas, contain radon, and were once considered healthful.

More Info

- Radon in Water
  This site provides information Public Health Standards for Radon in Drinking Water
- Radon Home Page
  This site provides information about the hazards and management of radon.
- EPA Map of Radon Zones
  The purpose of this map is to assist National, State, and local organizations to target their resources and to implement radon-resistant building codes.

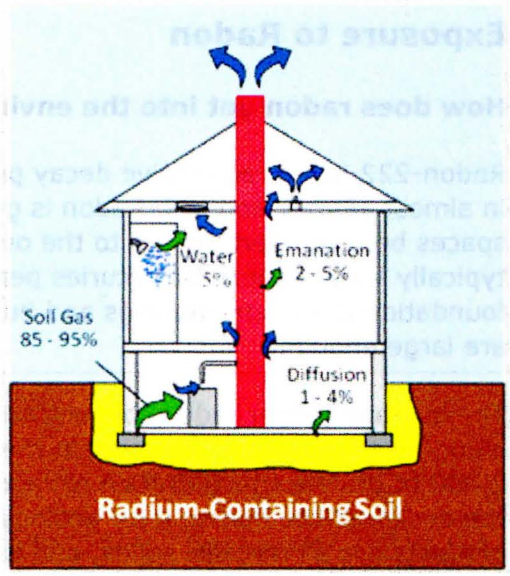
How does radon change in the environment?

Because radon is a chemically inert (unreactive) gas, it can move easily through rock and soil and arrive at the surface. The half-life of radon-222 is 3.8 days. As it undergoes radioactive decay, radon-222 releases alpha radiation and changes to polonium-218, a short-lived radioactive solid. After several more *transformations* (loss of particles or electromagnetic radiation from the nucleus), the series ends at lead-206, which is stable.

Radon dissolves in water, and easily leaves water that is exposed to the atmosphere, especially if the water is agitated. Consequently, radon levels are very low in rivers and lakes, but water drawn from underground can have elevated radon concentrations. Radon that decays in water, leaves only solid decay products which will remain in the water as they decay to stable lead.

How are people exposed to radon?

Most of the public's exposure to natural radiation comes from radon which can be found in homes, schools, and office buildings. The illustration at right shows the sources of radon that can accumulate in buildings.



Most radon in homes comes from radon in the soil that seeps into homes through cracks in the foundation or slab. The amount of radon in the soil varies widely and depends on the chemical make up of the soil. There can be a large difference in radon concentrations in the soil from house to house. The only way to know is to test.

Radon is also found in the water in homes, in particular, homes that have their own well rather than municipal water. When the water is agitated, as when showering or washing dishes, radon escapes into the air. However, radon from water in the home generally contributes only a small proportion (less than 5%) of the total radon in indoor air in most housing. Municipal water systems hold and treat water, which helps to release radon, so that levels are very low by the time the water reaches our homes. But, people who have private wells, particularly in areas of high radium soil content, may be exposed to higher levels of radon.

EPA estimates that the national average indoor radon level in homes is about 1.3 pCi/l of air. We also estimate that about 1 in 15 homes nationwide have levels at or above the level of 4 pCi/l, the level at which EPA recommends taking action to reduce concentrations. Levels greater than 2,000 pCi/l of air have been measured in some homes. The only way you can know if there is radon in your home is to test for it.

More Info

- Radon in Water
  This site provides information Public Health Standards for Radon in Drinking Water.
- Radon Home Page
  This site provides information about the hazards and management of radon.

How does radon get into the body?

People may ingest trace amounts of radon with food and water. However, inhalation is the main route of entry into the body for radon and its decay products. Radon decay products may attach to particulates and aerosols in the air we breathe (for example, cooking oil vapors). When they are inhaled, some of these particles are retained in the lungs. Radon decay products also cling to

Other methods may be necessary.

People who have private wells should test their well water to ensure that radon levels meet EPA's proposed standard.

More Info

- Radon in Drinking Water
  This page provides information on regulations, studies, and state contacts related to radon in drinking water.
- Radon
  This page provides access to a wide variety of information and publications on radon and preventing exposure to radon.
- National Radon Hotline:
  800.767-7236

What recommendations has the federal government made to protect human health from radon?

Since 1988, EPA and the U.S. Surgeon General have issued Health Advisories recommending that all homes be tested below the third floor for radon. They also recommended fixing homes with radon levels at or above 4 picocuries per liter (pCi/L), EPA's National Voluntary Action Level. EPA and the Surgeon General also recommend that schools nationwide be tested for radon.

More Info

- EPA Radon Publications, including:
  - EPA's "A Citizen's Guide to Radon
  - Consumer's Guide to Radon Reduction

What is EPA doing about radon?

EPA has established a voluntary program to promote radon awareness, testing, and reduction. The program sets an 'Action Level' of 4 picocuries per liter (pCi/l) of air for indoor radon. The action level is not the maximum safe level for radon in the home. However, the lower the level of radon, the better. Generally, levels can be brought below 2 pCi/l fairly simply.

In addition to working with homeowners, EPA is working with home builders and building code organizations. The goals are to help newly constructed homes be more radon resistant and to encourage radon testing when existing homes are sold.

More Info

- Radon Resistant New Construction
  This page provides information on radon resistant homes.
- Radon and Real Estate
  You will find a number of tools and resources use by the real estate community that EPA and its radon partners has developed.

The 1988 Indoor Radon Abatement Act authorizes EPA to provide grants to states to support testing and reducing radon in homes. With various non-governmental and public health organizations, EPA promotes awareness and reduction of indoor radon. Partners include the American Lung Association, the National Environmental Health Association, the American Society of Home Inspectors, and others. The page, Radon Publications and Resources, provides a list of EPA-sponsored publications in English and Spanish.

EPA has also proposed a standard for the maximum amount of radon that may be found in drinking from community water systems using ground water.

More Info

- Proposed Radon Rule
  This rule proposes maximum contaminant levels in drinking water.
- Indoor Radon Abatement Act
  This act provides grants to states to support the reduction of radon in homes.
- Radon Publications and Resources
  This is a list of EPA-sponsored publications in English and Spanish.

Understanding Radiation in Your Life, Your World

Programs · Topics · References

tobacco leaves, which are sticky, during the growing season, and enter the lungs when tobacco is smoked. Smoke in indoor environments also is very effective at picking up radon decay products from the air and making them available for inhalation. It is likely that radon decay products contribute significantly to the risk of lung cancer from cigarette smoke.

What does radon do once it gets into the body?

Most of the radon gas that you inhale is also exhaled. However, some of radon's decay products attach to dusts and aerosols in the air and are then readily deposited in the lungs. Some of these are cleared by the lung's natural defense system, and swallowed or coughed out. Those particles that are retained long enough release radiation damaging surrounding lung tissues. A small amount of radon decay products in the lung are absorbed into the blood.

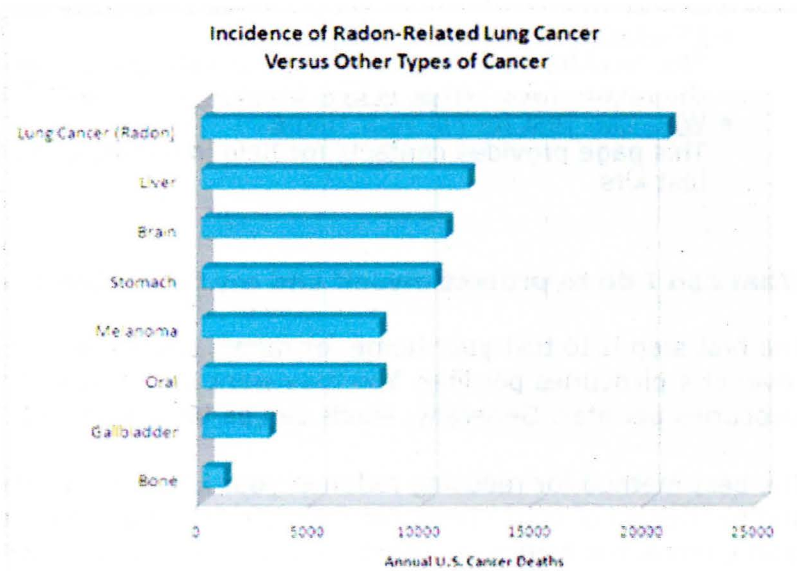
Most of the radon ingested in water is excreted within hours. There is some risk from drinking water with elevated radon, because radioactive decay can occur within the body where tissues, such as the stomach lining, would be exposed. However, alpha particles emitted by radon and its decay product in water prior to drinking quickly lose their energy and are taken up by other compounds in water, and do not themselves pose a health concern.

Health Effects of Radon

How can radon affect people's health?

Almost all risk from radon comes from breathing air containing radon and its decay products. The health risk of ingesting (swallowing) radon, in water for example, is much smaller than the risk of inhaling radon and its decay products.

When radon is inhaled, the alpha particles from its radioactive decay directly strike sensitive lung tissue causing damage that can lead to lung cancer. However,since radon is a gas, most of it is exhaled. The radiation dose comes largely from radon's decay products. They enter the lungs on dust particles that lodge in the airways of the lungs. These radionuclides decay quickly, exposing lung tissue to damage and producing other radionuclides that continue damaging the lung tissue.



There is no safe level of radon any exposure poses some risk of cancer. The National Academy of Sciences (NAS) studied and reported on the causes of lung cancer in two 1999 reports. They concluded that radon in indoor air is the second leading cause of lung cancer in the U.S. after cigarette smoking.

The NAS estimated that 15,000-22,000 Americans die every year from radon-related lung cancer. When people who smoke are exposed to radon as well, the risk of developing lung cancer is significantly higher than the risk of smoking alone. The chart at right compares lung cancer cases caused by radon to the incidence of other forms of cancer.

The NAS also estimated that radon in drinking water causes an additional 180 cancer deaths per year. However, almost 90% of those deaths were from lung cancer caused by inhaling radon released to the indoor air from water. Only about 10% of the deaths were from cancers of internal organs, mostly the stomach, caused by ingesting radon in water.

Is there a medical test to determine exposure to radon?

Several decay products can be detected in urine, blood, and lung and bone tissue. However, these tests are not generally available through typical medical facilities. Also, they cannot be used to determine accurate exposure levels, since most radon decay products deliver their dose and decay within a few hours.

The best way to assess exposure to radon is by measuring concentrations of radon (or radon decay products) in the air you breathe at home.

Protecting People from Radon

How do I know if there is radon in my home?

You cannot see, feel, smell, or taste radon. Testing your home is the only way to know if you and your family are at risk from radon. EPA and the Surgeon General recommend testing for radon in all homes below the third floor. EPA also recommends testing in schools.

Radon testing is inexpensive and easy to do. It should only take a few minutes of your time. Millions of Americans have already tested their homes for radon. Various low-cost, do-it-yourself test kits are available through the mail and in hardware stores and other retail outlets. You can also hire a trained contractor to do the testing for you.

More Info

- EPA Citizen's Guide to Radon
  This booklet describes commonly available tests for measuring radon concentrations in the home. (See "What is EPA Doing About Radon?".)
- Who Can Test for Fix Your Home
  This page provides contacts for help in finding qualified professionals and do-it-yourself test kits.

What can I do to protect myself and my family from radon?

The first step is to test your home for radon, and have it fixed if it is at or above EPA's Action Level of 4 picocuries per liter. You may want to take action if the levels are in the range of 2-4 picocuries per liter. Generally, levels can be brought below 2 pCi/l fairly simply.

The best method for reducing radon in your home will depend on how radon enters your home and the design of your home. For example, sealing cracks in floors and walls may help to reduce radon, but is not sufficient. There are also systems that remove radon from the crawl space or from beneath the concrete floor or basement slab that are effective at keeping radon from entering your home. These systems are simple and don't require major changes to your home.

United States
Environmental Protection
Agency

Report to Congress: Radon in Drinking Water Regulations

Office of Water (4607M)
EPA 815-R-12-002
www.epa.gov/safewater
May 2012

Report to Congress:
Radon in Drinking Water Regulations
May 2012

I. Introduction

EPA proposed the Radon in Drinking Water Rule in the *Federal Register* on November 2, 1999 (64 FR 59246). The proposed rule was designed to promote a multimedia approach that would reduce radon risks in indoor air, where the problem is the greatest, while protecting public health from the highest levels of radon in drinking water. Most radon exposure results from radon gas that enters indoor air from soil under homes and other buildings. Only approximately one to two percent of radon exposure comes from drinking water, which occurs primarily through inhaling radon gas that bubbles out of solution. Under the framework set forth in the 1996 amendments to the Safe Drinking Water Act (SDWA), EPA proposed that water systems comply with a lower maximum contaminant level (MCL) for radon in drinking water, or a higher, alternative maximum contaminant level (AMCL) for dissolved radon in drinking water combined with requirements for multimedia mitigation (MMM) programs to address radon that enters indoor air from soil under homes and buildings. Public water systems in States that adopt qualifying MMM programs would be subject to the AMCL, while those in States that did not adopt such programs would be subject to the MCL. Public water systems could also develop an MMM program with EPA approval in the absence of a State program. EPA proposed an MCL for radon in drinking water of 300 picocuries per liter (pCi/L) and an AMCL of 4,000 pCi/L.

As part of the 2003 appropriations process, Congress directed EPA to report on the pending radon in drinking water regulations by August 19, 2003 as follows: "The Committee directs the Administrator of the Environmental Protection Agency to report to the Congress, not later than 180 days after the date of enactment, on the pending radon in drinking water regulations. In developing such report, the Administrator shall (1) consult with the State drinking water, air, and radiation programs and (2) evaluate options to implement a single drinking water standard for radon" (House Report 107-740, page 105). EPA interprets the phrase "single drinking water standard," as used in this Report, to mean a single MCL for all systems, rather than giving States and public water systems the option of choosing between two different approaches (i.e., an MCL or an alternate MCL with an MMM program) for reducing public health risks from radon.

In developing this report, EPA identified three "single drinking water standard" options for consideration. The 1996 SDWA amendments require EPA to establish an AMCL and guidelines for MMM if EPA sets the MCL lower than 4,000 pCi/L, the drinking water standard equivalent to the natural background level of radon in outdoor air of 0.4 pCi/L [SDWA section 1412(b)(13)(F)].[1] Thus, the current SDWA allows EPA to issue a single drinking water standard

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[1] The transfer coefficient from water to indoor air is about 10,000 to 1. This transfer coefficient means that, given typical water use patterns and indoor physical configurations, on average, 10,000 picocuries of radon per liter of tap water will contribute approximately one picocurie per liter to the concentration of radon in indoor air. Therefore, 4 pCi/L of radon in indoor air corresponds to about 40,000 pCi/L in drinking water, which is over 100 times greater than the proposed MCL of 300 pCi/L.

that is above 4,000 pCi/L (i.e. > 4,000 pCi/L), but does not allow EPA to issue a *single* drinking water standard that is lower than 4,000 pCi/L (i.e. <4,000 pCi/L). To respond to Congress' request to evaluate options for a single MCL, this report discusses options for a single drinking water standard less than 4,000 pCi/L, which would require a change in SDWA to implement.

EPA's consultations with State drinking water programs elicited the following general opinions concerning these options: (1) State drinking water representatives favored a single standard without the MMM option; (2) based on current information, they recommended a single standard in the neighborhood of 4,000 pCi/L in water; and (3) they agreed that radon in indoor air is a serious health risk, but believed that this risk should be addressed through indoor air programs, not drinking water programs.

EPA's consultations with State air and radiation programs also elicited the following general opinions: (1) State air and radiation representatives supported a single MCL for drinking water ranging from 4,000 to 40,000 pCi/L; and (2) they expressed concern that a standard for radon in drinking water will mislead the public about the risks of radon in drinking water relative to the greater public health risk of radon in indoor air because the radon drinking water MCL is enforceable whereas the voluntary action level for indoor air is not.

A detailed summary of the consultation results is presented in Section V of this report.

This report discusses: (1) the pre-1996 background for the radon regulations, (2) the 1996 radon provisions of SDWA, (3) EPA's consultations with stakeholders prior to its 1999 proposed radon in drinking water rule, (4) major stakeholder comments on the proposed rule, (5) options for a single radon in drinking water standard, and (6) EPA's consultations with State drinking water, air, and radiation programs regarding these options.

II. Background

EPA estimates that out of about 146,000 lung cancer deaths each year in the U.S., about 21,100 lung cancer deaths were related to radon exposure from radon gas in the soil. Approximately 2,900 of these are radon-related lung cancer deaths occurred in non-smokers and 18,200 in smokers (EPA, 2003).[2] EPA also estimates that one in every 15 homes in the U.S. has indoor radon levels that exceed EPA's recommended action level of 4 pCi/L in indoor air, which is 10 times the average outdoor level of 0.4 pCi/L in air. By comparison, the 1999 EPA rule proposed a drinking water MCL of 300 pCi/L, which corresponds to an indoor air concentration of about 0.03 pCi/L, using the National Academy of Sciences' (NAS) transfer coefficient.[3] This

[2] The National Academy of Sciences estimated that radon in indoor air derived from soil gas causes 15,000 to 22,000 lung cancer deaths annually and that approximately 5,000 to 7,000 of these lung cancer deaths would be prevented if indoor air radon levels above 4 pCi/L were eliminated. (NAS, 1999a). The BEIR VI models estimate the fraction of lung cancers due to radon for a specified average radon level in homes and population size under steady state conditions. This fraction is then applied to the total number of U.S. lung cancer deaths occurring in a particular year.

[3] The transfer coefficient from water to indoor air is about 10,000 to 1. This transfer coefficient means that, given typical water use patterns and indoor physical configurations, on average, 10,000 picocuries of radon per liter of tap water will contribute approximately one picocurie per liter to the concentration of radon in indoor air. Therefore, 4 pCi/L of radon in indoor air corresponds to about 40,000 pCi/L in drinking water, which is over 100 times greater than the proposed MCL of 300 pCi/L.

means that limiting radon concentration in drinking water to the 1999 proposed MCL would correspond to an indoor air radon concentration two orders of magnitude below the EPA recommended action level. In any event, limiting radon concentrations in drinking water is unlikely to greatly affect actual exposure to radon gas, since exposure occurs primarily when radon gas enters the home from the soil.

Under the 1999 proposed rule, States would have the option of enhancing their indoor air radon abatement programs through the adoption of MMM programs, in lieu of adopting the MCL of 300 pCi/L for drinking water, provided they achieved comparable risk reductions. EPA estimates the costs to States and community water systems to achieve comparable risk reductions to a 300 pCi/L in water MCL (about 70 avoided cancer deaths per year) through a combination of an AMCL of 4,000 pCi/L in water and associated MMM programs to be approximately $100 to $110 million per year ($2010), depending on whether a 3% or 7% discount rate is used to annualize costs (this assumes that 80% of states adopted the AMCL and developed qualifying MMM programs). These cost estimates compare favorably with the estimate of about $520 to $620 million per year ($2010) to achieve these same risk reductions through the use of a 300 pCi/L MCL alone. EPA cautions, however, that this estimate is based on a 1992 study of average cost per cancer death avoided for voluntary State indoor air programs up to that time.[4]

A. *EPA Actions on Radon in Drinking Water Prior to the 1996 SDWA Amendments*

Prior to the 1996 Amendments to SDWA, EPA initiated a number of actions to address radon in drinking water. These actions include a 1986 advance notice of proposed rulemaking; a 1991 proposed rule; and a 1994 Report to Congress on the multimedia risks and costs of radon control (EPA, 1994). The following paragraphs discuss these actions in greater detail.

Section 1412 of SDWA, as amended in 1986, required EPA to publish maximum contaminant level goals (MCLGs) and to promulgate national primary drinking water regulations for contaminants that may cause an adverse effect on human health and that are known or anticipated to occur in public water supplies. On September 30, 1986, EPA published an advance notice of proposed rulemaking (51 FR 34836) concerning radon-222 and other radionuclides. The notice discussed EPA's understanding of the occurrence, health effects, and risks from these radionuclides, as well as the available analytical methods and treatment technologies, and sought additional data and public comment on EPA's planned regulation.

On July 18, 1991, EPA proposed a national primary drinking water regulation (56 FR 33050) for radon and the other radionuclides addressed in the 1986 advance notice of proposed rulemaking. The 1991 notice, which supplemented and updated the information presented in the 1986 notice, proposed an MCLG of zero, an MCL of 300 pCi/L in water, best available technologies (BAT) for removal of radionuclides in water, and monitoring, reporting, and public notification requirements for radon in public water supplies. The proposed rule was

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[4] See *Technical Support Document for the 1992 Citizen's Guide to Radon* (EPA 400-R-92-011), May 1992. EPA is not able to determine the extent to which the study results would be applicable to future MMM programs, which would be incremental to the existing voluntary programs. It is clear, however, that direct mitigation of radon in indoor air is substantially more cost effective than reducing indoor air levels through regulation of drinking water.

accompanied by an assessment of regulatory costs and economic impacts, as well as an assessment of the risk reduction associated with implementation of the MCL.

In the 1991 proposed rule, EPA estimated an incremental lifetime cancer risk at the proposed MCL of about two cancers for every 10,000 persons exposed to radon in drinking water (2×10^{-4} lifetime risk), approximately 80 avoided fatal cancer cases annually, approximately 27,000 affected public water systems, and a total annual cost of approximately $180 million (1991$). EPA received substantial comments on the proposal and supporting analyses from States, water utilities, and other stakeholder groups. Major comments on the proposed rule included concern over the costs of rule implementation, especially for small public water systems, and the larger risk to public health from radon in indoor air.

In 1992, Congress directed EPA to report on the multimedia risks from residential exposure to radon, the costs to control this exposure, and the risks from treating to remove radon. In addition, Congress extended the deadline for promulgating a final radon rule. Congress subsequently prohibited EPA from spending FY 1994 funds to issue a radon rule, effectively delaying the rule's promulgation one more year.

EPA's 1994 Report to Congress (EPA, 1994) estimated the risks, fatal cancer cases, cancer cases avoided by the 1991 proposed rule, and costs for mitigating radon in water and indoor air. The Report found that there are three exposure pathways for waterborne radon: (1) ingesting radon dissolved in water; (2) inhaling radon gas released from water during household use; and (3) inhaling radon progeny derived from radon released from water. This Report also estimated a total of 192 cancer fatalities per year from unregulated waterborne radon and annual treatment costs of approximately $272 million (1994$) to attain a drinking water MCL of 300 pCi/L avoiding 84 cancer fatalities annually. Additionally, the Report estimated a total of 13,600 cancer fatalities per year from radon in indoor air with approximately $1.5 billion in annual costs (to test all residences and mitigate those with levels above 4 pCi/L of radon in air) for a fully implemented voluntary indoor air mitigation program. The Report also assessed the risks of off-gas exposure from treating drinking water to remove radon and found, in an analysis of 20 water systems, that the estimated number of fatalities per year from treatment plant off-gas emissions to outdoor air was *de minimis*.

At the direction of Congress, EPA's Science Advisory Board (SAB) reviewed the supporting analyses for the Report to Congress. The final part of the Report included SAB's comments on the analyses and an EPA discussion of the issues raised by SAB. In general, SAB found that EPA had conducted a reasonable analysis of occurrence data, technologies, and costs as a function of system size. The Committee suggested only minor changes to EPA's central tendency risk estimates, but suggested expansion of the uncertainty bounds surrounding the central risk estimates.

B. *1996 Amendments to SDWA - Requirements for Radon in Drinking Water*

The 1996 Amendments to SDWA established new requirements for the national drinking water program. Among other mandates, Congress amended section 1412 of SDWA to direct

EPA to: (1) withdraw the 1991 proposed regulation for radon; (2) arrange for a NAS Risk Assessment of radon in drinking water; (3) set an MCLG and MCL for radon-222; (4) set an AMCL if the MCL was below the background concentration in outdoor air[5], and (5) if an AMCL was established, develop MMM program guidelines and evaluate MMM programs every five years [SDWA 1412(b)(13)]. Pursuant to these requirements, EPA proposed the Radon in Drinking Water Rule on November 2, 1999 (64 FR 59246). In this action, EPA proposed an MCLG of zero and an MCL of 300 pCi/L in water. Also, EPA proposed an AMCL of 4,000 pCi/L in water combined with requirements for MMM programs to address radon in indoor air.

EPA proposed to set the MCL at 300 pCi/L for drinking water after considering several factors. First, the Agency considered the general statutory requirement that the MCL be set as close to the MCLG of zero as feasible, and its responsibility to protect public health. In addition, the radon-specific provisions of SDWA amendments provide that, in promulgating a radon standard, the Agency take into account the costs and benefits of programs to control indoor air radon [SDWA 1412(b)(13)(E)]. The proposed MCL takes into account and relies on the unique conditions of this SDWA provision. SDWA amendments reflect the reality that the preponderance of radon risk is attributable to indoor air and the most cost-effective means of reducing radon risk is to reduce radon in indoor air directly, rather than through drinking water treatment. In the 1999 proposed rule, EPA requested comment on a preliminary determination that a level of 100 pCi/L in water was "feasible" within the meaning of the statute, but proposed an MCL of 300 pCi/L in consideration of the costs and benefits of control programs for radon from other sources, in accordance with Section 1412(b)(13)(E) of the statute.

In proposing an alternate MCL (AMCL) of 4,000 pCi/L, EPA relied on the technical and scientific guidance contained in the 1999 NAS report on the risks of radon in drinking water (NAS, 1999b). Specifically, NAS estimates that the average natural background concentration of radon in outdoor air is 0.4 pCi/L, and that the "transfer coefficient" from water to indoor air is about 10,000 to 1. This transfer coefficient means that, given typical water use patterns and indoor physical configurations, on average, 10,000 picocuries of radon per liter of tap water will contribute about one picocurie per liter to the concentration of radon in indoor air. This means that the drinking water level that corresponds to 0.4 pCi/L in air is 4,000 pCi/L in water. SDWA requires that there be both an MCL and an AMCL when the MCL is below the 0.4 pCi/L background concentration in outdoor air (i.e., 4,000 pCi/L in water).

EPA also proposed guidelines for MMM programs to reduce the risks of radon in indoor air. The proposed radon rule requires that water systems meet the MCL of 300 pCi/L unless the State or water system itself develops and implements an EPA-approved MMM program to address indoor air radon, in which case the water system must meet the AMCL of 4,000 pCi/L. EPA must evaluate any such MMM program based on its guidelines and information developed by NAS and approve the program if it is expected to achieve health risk reduction benefits equal to or greater than those that would result from compliance with the MCL. The proposed MMM

[5] Specifically, SDWA 1412(b)(13)(F) requires an AMCL if the MCL is "more stringent than necessary to reduce the contribution to radon in indoor air from drinking water to a concentration that is equivalent to the national average concentration of radon in outdoor air". The "transfer coefficient" estimated by NAS determines the contribution to radon in indoor air from a given concentration of radon in drinking water.

program guidelines include four components to ensure that the statutory requirements are satisfied: (1) a process for involving the public; (2) quantitative goals both for mitigations of existing homes with elevated indoor air radon levels and for new homes built radon-resistant; (3) implementation plans to achieve quantitative goals; and (4) plans for measuring and reporting results including health risk reduction benefits and an explanation of why the plan is expected to achieve health risk reduction benefits equal to or greater than those achievable by compliance with the MCL. EPA developed the four MMM program criteria based on the extensive stakeholder consultation discussed in Section III of this Report.

III. Consultation Activities Prior to the 1999 Radon Proposal and Stakeholder Comments on the Proposed Rule

A. *Outreach Activities*

In developing the proposed radon in drinking water rule, EPA consulted with a broad range of stakeholders and technical experts. Participants in a series of stakeholder meetings held in 1997 and 1998 included representatives of public water systems, State drinking water and indoor air programs, Tribal water utilities and governments, environmental and public health groups, and other Federal agencies. EPA convened an expert panel in Denver, Colorado in November 1997 to review treatment technology costing approaches. This panel made a number of recommendations for modification to EPA cost estimating protocols that were incorporated into the radon cost estimates in the proposed rule and this Report.

EPA conducted one-day public meetings in Washington, D.C., on June 26, 1997, in San Francisco, California on September 2, 1997, and in Boston, Massachusetts on October 30, 1997, to discuss plans for developing a proposed national primary drinking water regulation for radon. EPA presented information related to developing the proposed rule and solicited stakeholder comments at each meeting. Participants in these stakeholder meetings included representatives from the National Rural Water Association, the National Association of Water Companies, the Association of Metropolitan Water Agencies, State departments of environmental protection, State health departments, water utilities, Tribes, private industry, professional organizations, environmental and public health groups, and other members of the public. In order to inform and involve Tribal governments in the rulemaking process, EPA staff also made presentations on the proposed rule at Tribal meetings in October 1998 and February 1999.

EPA held a series of conference calls in 1998 and 1999 with State drinking water and indoor air program personnel to discuss issues related to developing guidelines for MMM programs. EPA also held a public meeting in Washington, D.C., on March 16, 1999, to discuss the preliminary cost-benefit estimates for the radon in drinking water rule and the multimedia mitigation framework. In order to address environmental justice issues, EPA convened a public meeting in Washington, D.C., in March 1998 to discuss ways to involve minority, low-income, and sensitive sub-populations in the stakeholder process and to obtain input on the proposed radon rule. In addition, EPA made presentations at meetings of the American Water Works Association, the Association of State Drinking Water Administrators, the Association of State and Territorial Health Officials, the National Association of Counties, the National Governors'

Association, the National Association of Towns and Townships, the National League of Cities, and the Conference of Radiation Control Program Directors.

In 1998, the Agency conducted outreach directly to representatives of small entities that could be affected by the radon rule in accordance with the Small Business Regulatory Enforcement Fairness Act. This outreach provided a forum for small entity input on key issues related to the radon rule including compliance challenges for small water systems and the development and implementation of MMM program guidelines.

EPA also participated in the American Water Works Association Radon Technical Workgroup, convened in 1998. This workgroup provided input to EPA's technical analyses and discussed conceptual issues related to developing guidelines for MMM programs. Members of the Radon Technical Workgroup included representatives from State drinking water and indoor air programs, public water systems, drinking water testing laboratories, environmental groups, and the U.S. Geological Survey.

B. *Summary of Comments on the 1999 Proposed Rule*

EPA received numerous comments on the proposed rule during the public comment period. Commenters on the proposed rule submitted 775 comments which were communicated in over 2,000 pages of text. The commenters included water utilities, State and local governments, water utility associations, environmental groups, and private citizens. Significant comments on the proposed rule addressed topics such as the proposed MCL and rule structure, State resource drain for MMM program implementation, risk communication challenges, and risk reduction equity between the MCL and the AMCL/MMM option.

In the 1999 *Federal Register* notice, EPA proposed an MCL of 300 pCi/L and presented information on options for MCLs ranging from 100 pCi/L to 4,000 pCi/L in water. EPA requested comment on setting the MCL closer to or at the AMCL of 4,000 pCi/L and asked commenters to provide their rationale for how such alternative levels could be supported under SDWA and in the record for the rulemaking, given the statutory considerations EPA used in selecting the proposed MCL (as provided in Section 1412(b)(13)(E)). A number of commenters recommended that EPA give serious consideration to setting the MCL at the AMCL of 4,000 pCi/L (which would eliminate the need for an AMCL) in order to control radon levels in drinking water at a level comparable to background levels in outdoor air. Other commenters recommended MCLs of 500, 1,000, or 2,000 pCi/L based on the smaller exposure to radon in drinking water compared to exposure to radon in indoor air, and the costs of treating radon in drinking water compared to the costs of mitigating radon in indoor air. Some commenters also recommended a lower MCL (e.g., 100 pCi/L). Commenters variously mentioned the Agency's traditional target risk range (1 in 10,000 or 10^{-4}); the higher exposure risk from indoor air; the substantially lower risks from radon exposure to never-smokers (0.8 in 10,000 at 300 pCi/L water) versus current and former smokers (3.1 in 10,000 at 300 pCi/L water); economic costs and benefits; and small system implementation challenges as justifications for an MCL other than the proposed level of 300 pCi/L.

EPA also received a number of comments on the challenges that State drinking water programs and community water system operators might face in implementing an MMM program for radon in indoor air. They noted that an indoor air program could be difficult to design and implement and would require coordination between State air and water program personnel, and could divert funds from drinking water protection to support the implementation of indoor radon programs. Commenters were also concerned over the perceived inequity and potential tort liability of requiring systems to meet different MCLs depending on whether or not they had an MMM program, given that the distribution of costs and benefits from the MMM program would not necessarily mirror the distribution of costs and benefits to drinking water customers.

IV. Options for a Single Radon in Drinking Water Standard

In the development of this Report to Congress, EPA explored various options for a single radon in drinking water standard. The existing statutory requirements, as outlined in section 1412(b)(13) of the 1996 amendments to the Safe Drinking Water Act, direct EPA to propose an MCL and, if that MCL is less than the national average concentration of radon in outdoor air, also propose an AMCL equivalent to this concentration combined with a program to mitigate radon in indoor air. Pursuant to these requirements, EPA proposed: (1) an MCL of 300 pCi/L in water and (2) an AMCL of 4,000 pCi/L in water, which represents the average natural background levels of radon in outdoor air, combined with requirements for an MMM program to address radon in indoor air.

Three options for a single drinking water standard are discussed below: A) an MCL equal to 4,000 pCi/L, B) an MCL equal to 1,000 pCi/L, and C) an MCL equal to 300 pCi/L. Consistent with Congressional directive to evaluate options for a single standard, none of these options includes a provision for an AMCL combined with requirements for MMM programs. Only Option A, an MCL of 4,000 pCi/L, could be adopted under the current statute because this MCL is not less than atmospheric background and thus would not trigger the statutory requirements for an AMCL. Options B and C would require a change to the current provisions of SDWA. Estimated risks, annual national costs and benefits (discounted at 3% and 7%), and numbers of systems affected for these (and other) possible MCLs are presented in Table 1. All costs and benefits are given in 2010 constant dollars.

A. *Analysis of MCL Options*

Table 1 outlines the benefits, costs, risks, cases avoided, and numbers of systems and people affected for each regulatory option analyzed in the development of the 1999 proposed radon in drinking water rule, including the three options discussed in this Report. These figures have been updated since the proposed rule and reflect the inclusion of mixed water systems which accounts for an upward revision (from the proposal estimates) in the estimated cases and costs avoided at the various MCLs shown in Table 1.[6]

[6] For example, in the proposed rule, EPA estimated 62 fatal cancer cases avoided at the proposed MCL of 300 pCi/L. With the inclusion of mixed water systems, the revised estimate at 300 pCi/L is 70 fatal cancer cases avoided.

Mixed water systems were added to the radon economic analysis on the recommendation of the Government Accountability Office (GAO). GAO performed an exhaustive review of the radon in drinking water cost analysis in 2002.[7]

TABLE 1. Total National Benefits and Costs for Various MCL Options

Radon Level (pCi/L)	Lifetime Cancer Risks to General Population from Radon[1]	Lifetime Cancer Risks to Smokers from Radon[2]	Lifetime Cancer Risks to Never-Smokers from Radon	Annual Fatal Lung and Stomach Cancer Cases Avoided	Annualized National Benefits (discounted at 3%/7%, millions of 2010$)[3]	Annualized National Costs (discounted at 3%/7%, millions of 2010$)[3]	Numbers of CWS Above Radon Level[4] (# systems < 10K)[5]	Population Exposed Above Radon Level (thousands)[4]
4,000	26×10^{-4}	41×10^{-4}	10×10^{-4}	3	17/8	50/60	1,312 (1,311)	77
2,000	13×10^{-4}	21×10^{-4}	5.2×10^{-4}	9	43/20	80/100	2,852 (2,842)	381
1,000	6.6×10^{-4}	10×10^{-4}	2.6×10^{-4}	21	105/49	160/190	5,892 (5,846)	1,695
500	3.3×10^{-4}	5.2×10^{-4}	1.3×10^{-4}	44	224/105	320/380	11,408 (11,222)	6,893
300	2.0×10^{-4}	3.1×10^{-4}	0.8×10^{-4}	70	367/171	520/620	17,349 (16,942)	16,641
100	0.7×10^{-4}	1.0×10^{-4}	0.3×10^{-4}	140	711/332	1,040/1,260	31,307 (30,258)	56,054

Source: Except where noted, March 2002 Draft Economic Analysis for Radon in Drinking Water (EPA, 2002).

Notes:
1. Risks include inhalation and ingestion risks attributable to drinking water and represent mean (average) risks. For a more complete discussion of the derivation of the risk estimates supporting the proposed rule, please see Section XII of the November 2, 1999 Proposed Rule (64 FR 59246).
2. Smokers defined as persons who have smoked at least 100 cigarettes during their lifetime (CDC 1995).
3. Benefit and cost estimates are shown in 2010 dollars. These estimates reflect benefits and costs for treating to an MCL only. Benefits and costs associated with MMM programs are not reflected in this report because of the report's focus on MCL-only options.
4. Methods, Occurrence, and Monitoring Document for Radon in Drinking Water (EPA, 1999).
5. Under SDWA, systems serving 10,000 or less people are considered small.

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[7] See GAO's report *Drinking Water: Revisions to EPA's Cost Analysis for the Radon Rule Would Improve Its Credibility and Usefulness* (GAO-02-333), February 2002.

B. *MCL of 4,000 pCi/L (no statutory change required)*

Based on exposure data from 1997, an MCL of 4,000 pCi/L would impact approximately 1,300 water systems (i.e., this many systems are estimated to have source water exceeding the standard), most of which are small, serving a total population of about 77 thousand. As previously noted, this option would obviate the statutory requirement for an AMCL and MMM program. EPA estimates that lifetime exposure to drinking water at 4,000 pCi/L would correspond to an incremental lifetime cancer risk of 26 in 10,000 to the general population, which exceeds the risk range of 1 in 10,000 to 1 in 1 million (10^{-4} to 10^{-6}) traditionally used by EPA in developing national drinking water standards. This risk estimate is a weighted average of risks from radon exposure through drinking water to both smokers and never-smokers. Risks from radon to smokers (41 in 10,000) are about four times greater than the risks from radon to never-smokers (10 in 10,000), due to an apparent synergistic effect between smoking and radon exposure on lung cancer risk.

Treating drinking water to this level would avoid approximately 3 fatal lung and stomach cancer cases per year. The monetized costs and benefits depend upon the discount rate. At a discount rate of 3 percent, estimated annual costs are $50 million, and estimated annual benefits are $17 million based on a value of statistical life (VSL) approach.[8] At a discount rate of 7 percent, estimated annual costs are $60 million while estimated annual benefits are $8 million based on the same VSL approach.

C. MCL of 1,000 pCi/L (statutory change required to promulgate as single standard – i.e., with no AMCL)

An MCL of 1,000 pCi/L would impact approximately 5,900 systems, about 99% of which are small, serving a total population of about 1.7 million, based on the 1997 exposure data. Exposure at this level would correspond to an incremental lifetime cancer risk of 7 in 10,000 and would avoid approximately 21 fatal lung and stomach cancer cases annually. At a 3 percent discount rate, estimated annual costs are $160 million and annual monetized benefits, using the VSL approach, are about $105 million. At a discount rate of 7 percent, estimated annual costs are $190 million and estimated annual benefits are $49 million based on the VSL approach.

D. *MCL of 300 pCi/L (statutory change required to promulgate as single standard)*

Based on exposure data from 1997, the proposed MCL of 300 pCi/L would impact approximately 17,000 systems, about 98% of which are small, serving a total population of about 16.6 million. Exposure at this level would correspond to an incremental lifetime cancer risk of 2 in 10,000 and would avoid approximately 70 fatal lung and stomach cancer cases annually. At a 3 percent discount rate, estimated annual costs are $520 million and annual monetized benefits, using the VSL approach, are about $367 million per year. At a discount rate of 7 percent,

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[8] Estimating the VSL involves inferring individuals' implicit tradeoffs between small changes in mortality risk and monetary compensation. An adjusted central tendency estimate of $9.25 million ($8.8 million in 2007$, adjusted to 2010$) is used in the monetary benefits calculations in this report. This figure, adopted from EPA's *Revised Total Coliform Rule*, was determined from the VSL estimates in 26 studies reviewed in EPA's *Guidelines for Preparing Economic Analyses* (EPA, 2000).

estimated annual costs are $620 million and estimated annual benefits are $171 million based on the VSL approach.

V. September 2003 State Consultations

EPA conducted two consultation meetings in September 2003 to address Congress' directive in the 2003 appropriations language to "consult with State drinking water, air, and radiation programs." On September 16, 2003, EPA held a conference call with the Association of State Drinking Water Administrators (ASDWA) to solicit their views on a range of options for a single radon in drinking water standard. EPA also met with the Council of Radiation Control Programs Directors (CRCPD) on September 24, 2003, to solicit their views on the same range of options. These two consultations included 22 State drinking water representatives and 10 State radon program representatives, respectively. Both groups were given the same background material on the proposed radon rule and were asked the same discussion questions. The discussion questions and a summary of the perspectives of the participating State officials are presented below. While the participants presented a range of views and concerns, there was general agreement on a number of key points, as summarized below. A list of the participants for each consultation and the materials provided to them is appended to this Report.

A. *Discussion Questions*

i. What is your view of each single drinking water standard (4,000 pCi/L, 1,000 pCi/L, and 300 pCi/L) with respect to the following?
   - Public health protection impacts
   - Burden
   - Implementation
   - Anticipated stakeholder reaction

ii. What challenges do you see in successfully adopting any of these options?

iii. If a single drinking water standard would eliminate the statutory incentive to undertake a multimedia mitigation (MMM) program, what are your views with respect to the following?
   - Public health protection impacts
   - Burden
   - Implementation
   - Anticipated stakeholder reaction

iv. What other thoughts do you have regarding a single drinking water standard?

B. *Summary of State Perspectives from September 2003 Consultations*

The preceding questions were asked at each consultation meeting. A summary of perspectives from each group is presented below.

State Drinking Water Program Consultation with the Association of State Drinking Water Administrators (ASDWA) – September 16, 2003, Conference Call

- 22 State drinking water representatives participated on this conference call which was chaired by ASDWA.

- State drinking water representatives supported a single standard (MCL) for radon greater than 300 pCi/L in water, rather than two different standards for States with and without MMM programs.

- Drinking water representatives favored a single standard without the MMM option. They believed allowing a choice within a State would pose a significant risk communication challenge and could expose systems meeting the less stringent AMCL to tort liability. For example, they indicated that it will be challenging to explain to consumers that a drinking water AMCL of 4,000 pCi/L coupled with an effective indoor air mitigation (MMM) program is both equitable and as protective as a more stringent drinking water MCL, (e.g., 300 pCi/L with no MMM program requirement) given that not all drinking water consumers would benefit from the indoor air program.

- They were also concerned about the lack of resources and expertise within state drinking water programs to develop effective MMM programs and about the challenges of cross-agency coordination with air and radiation programs.

- Drinking water representatives did not support the proposed 300 pCi/L standard. Rather, they favored a drinking water MCL in the neighborhood of 4,000 pCi/L because it corresponds to background levels of radon in outdoor air.

- Some States were concerned about the resources that would be needed to implement a 300 pCi/L standard and felt that a standard in the neighborhood of 4,000 pCi/L would be more manageable. States, particularly in the northeast, had conducted inventories of systems likely to exceed the proposed drinking water standard of 300 pCi/L. For example, Vermont indicated that 80% of small groundwater systems exceed 300 pCi/L; 3% exceed 4,000 pCi/L . New York indicated that 60% of upstate wells exceed 300 pCi/L and less than 1% exceed 4,000 pCi/L. Rhode Island had found only 2 wells out of a survey of 144 that did not exceed 300 pCi/L, while 50% of their bedrock wells were expected to exceed 4,000 pCi/L. Pennsylvania noted that 1,900 systems exceed 300 pCi/L, and 50 systems exceed 4,000 pCi/L. Idaho estimated that 70-80% of its groundwater systems would exceed 300 pCi/L.

- State drinking water representatives stated that because indoor air presents the greatest exposure risk to individuals, creating a drinking water MCL for radon of 300 pCi/L would actually decrease the benefit to public health because reducing radon levels in water would entail large monetary costs but would only minimally decrease radon levels in air. Resources would be better spent decreasing radon levels in the air directly.

- Drinking water representatives agreed that indoor air exposure is a serious health risk; however, they believed health risks from indoor air exposure should be addressed through indoor air programs, not drinking water programs, and adequate funding for indoor air programs should be provided.

General concerns raised at the meeting by State drinking water representatives include:

- One State representative noted that under the anti-backsliding provisions of SDWA section 1412(b)(9), it would not be possible to relax an MCL of 300 pCi/L if it proved difficult to implement.

- One State questioned the appropriateness of including the synergistic risk to smokers in the general population risk estimates for radon in drinking water, noting that there are more effective ways to reduce cancer risk from smoking (e.g., public education).

- One State questioned whether EPA's traditional risk range (10^{-4} to 10^{-6}) should be applied to both inhalation and ingestion risk or only ingestion risk.[9]

- State representatives expressed concern about the cumulative impacts of multiple standards (arsenic, groundwater rule, radionuclides, disinfection byproducts, and radon) on small groundwater systems.

State Air and Radiation Programs Consultation with the Council of Radiation Control Program Directors (CRCPD) - September 24, 2003, Meeting in Washington, D.C.

- Ten State radon program representatives participated in this meeting which was arranged by CRCPD.

- State radon program representatives were concerned that a standard for radon in drinking water will mislead the public about the risks of radon in drinking water relative to the risks from radon in indoor air. If there is an enforceable standard for drinking water and only a voluntary action level for indoor air, they believe this will draw public attention and resources away from the greater public health risks of radon in indoor air. They cited anecdotal information suggesting that some private well owners were investing resources to reduce radon in drinking water without addressing radon risk from indoor air exposure, which could be reduced at lower cost. They also noted that because of the transfer coefficient between water and air, a drinking water concentration of 300 pCi/L appears to pose a greater risk than the current recommended action level for radon in indoor air of 4 pCi/L. This makes it difficult to explain to the public that the risks from radon in air are greater than risks from radon in drinking water and substantial staff time is spent responding to individual inquiries resulting from this confusion.

- States suggested that any regulatory framework should be flexible enough to allow resources to be targeted to the highest risk exposure (i.e., indoor air first). They believed

[9] State representatives suggested that since the remaining drinking water risk is due to inhalation of volatized radon gas (and radioactive progeny), EPA could set a standard that stayed within the traditional risk range based on ingestion risk, and leave the inhalation risk to be addressed as part of the larger issue of indoor air exposure, of which it constitutes only a small part.

that it was not an effective use of resources at this time to address any but the highest water exposures, given the relative magnitudes of water and air exposure.

- Some States further indicated that State voluntary programs are doing all they can to address indoor air risk with available resources, and believed that SDWA AMCL/MMM option would only be useful if it provided resources to enhance current programs.

- Some radon program representatives shared the concerns of drinking water program representatives over the perceived inequity and potential tort liability of reducing air exposure in some homes to offset higher drinking water exposure in different homes. They noted that the parts of a state with high indoor air levels may not be the same as those with high drinking water levels.

- When asked what level they would support for a drinking water MCL, radon program representatives gave specific recommendations for the MCL ranging from 4,000 pCi/L to 40,000 pCi/L in water. The lower end of this range corresponds to the background level in outdoor air, while the upper end corresponds to the current action level for indoor air programs of 4 pCi/L (equivalent to 40,000 pCi/L of radon in water). State representatives suggested that the appropriate regulatory level for water should be developed using a holistic approach with indoor air based on the combined risk from indoor air and drinking water.

- Some radon program representatives expressed concern for the possible health risks from radon gas emitted from water treatment (aeration) units, or from improperly handled residuals (e.g., from an ion exchange unit). One representative mentioned that vendors have developed an individual air stripping unit for private wells. He suggested that the risks from such units might be higher than the risk of leaving the radon in the water, particularly if the well (and unit) were located in an enclosed area. (Note: EPA has analyzed the risks from off-gas emissions from aeration units at public water systems and found them to be *de minimis*, see Section II.A).

- State radon program representatives believe that it would be more effective to provide additional funding for indoor air abatement under the IRAA, rather than trying to address indoor air through MMM programs (without additional funding) under SDWA.

VI. References

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List of Attendees

Association of State Drinking Water Administrators (ASDWA) Conference Call

September 16, 2003

Representatives from the following States:

Alaska	Massachusetts
Arizona	Minnesota
California	Missouri
Delaware	New York
Georgia	North Carolina
Idaho	North Dakota
Indiana	Ohio
Kansas	Pennsylvania
Louisiana	Rhode Island
Maine	Vermont
Maryland	Virginia

Representatives from the following organizations:
-ASDWA
-EPA-IED/ORIA (EPA's Indoor Environments Division and Office of Radiation and Indoor Air)
-EPA-OGWDW/OST (EPA's Office of Ground Water and Drinking Water and Office of Science and Technology)
-EPA-OPEI (EPA's Office of Policy, Economics, and Innovation)
-OMB (Office of Management and Budget)

Council of Radiation Control Program Directors (CRCPD) Meeting

September 24, 2003

Representatives from the following States:

Florida	Nevada
Idaho	New York
Kansas	Ohio
Maine	Pennsylvania
Massachusetts	Utah

Representatives from the following organizations:
CRCPD
EPA-IED/ORIA
EPA-OGWDW/OST
EPA-OPEI
EPA-Region 4
OMB
ASDWA

APPENDIX A: Association of State Drinking Water Administrators (ASDWA) Conference Call Meeting Notes – September 16, 2003

Radon in Drinking Water Meeting Minutes
September 16, 2003 (1:00 – 2:30 PM)

MEETING ATTENDEES:

ASDWA[10] (via phone):	Matt Corson, Jim Taft
EPA[11]:	Becky Allen, Nancy Chiu, Ann Codrington, Ann Johnson, Ephraim King, Richard Reding
EPA (via phone):	Tom Kelly, Dave Rowson, Anita Schmidt
OMB[12] (via phone):	Jim Laity
States (via phone):	Alaska, Arizona, California, Delaware, Georgia, Idaho, Indiana, Kansas, Louisiana, Maine, Maryland, Massachusetts, Minnesota, Missouri, New York, North Carolina, North Dakota, Ohio, Pennsylvania, Rhode Island, Vermont, Virginia.

Members from CRCPD[13] also participated in the call via phone.

MEETING OBJECTIVE:

To review EPA's presentation to ASDWA and receive states' comments on four summary questions.

MEETING SUMMARY:

The meeting opened with Ephraim King giving a brief introduction, noting that a similar conversation will be held with air representatives later in the month. Next, Becky Allen reviewed the slides and restated the following summary questions:

- What is your view of each single drinking water standard (4000 pCi/L, 1000 pCi/L, and 300 pCi/L) with respect to the following?
  - Public health protection impacts
  - Burden
  - Implementation

[10] Association of State Drinking Water Administrators
[11] Environmental Protection Agency
[12] Office of Management and Budget
[13] Conference of Radiation Control Program Directors

- Anticipated stakeholder reaction

- What challenges do you see in successfully adopting and implementing any of these options?

- If a single drinking water standard would eliminate the statutory incentive to undertake a Multi-Media Mitigation (MMM) program, what are your views with respect to the following?
  - Public health protection impacts
  - Burden
  - Implementation
  - Anticipated stakeholder reaction

- What other thoughts do you have regarding a single drinking water standard?

During the review, the following question was raised:

Rhode Island:

- Currently, as stated in the statute, indoor air quality should be no more than background levels (0.4 pCi/L); thus a 1,000 square foot house would be required to reduce radon levels to 0.4 pCi/L. Can the statute language be changed so that background levels are reflective of a shower instead of a 1,000 square foot home? If so, using the rule of thumb that 10,000 pCi/L of radon in air is equivalent to 1 pCi/L of radon in water, the quantity of radon in a shower would be 4,000 pCi/L.

Response: This issue was tabled for later discussion because the meeting was not held to discuss regulatory content.

Next, New York presented the general comments from the States:

1. The majority of states want a single drinking water MCL.
2. The MCL standard should be above 300 pCi/L_{water}, and most states would prefer an MCL level of 4000 pCi/L_{water} (or background level).
3. All states agree that indoor air exposure is a serious health risk; however, health risk from indoor air exposure should be addressed through indoor air programs, not drinking water programs, and adequate funding for indoor air programs should be provided.
4. With regards to equity, 2 different MCL levels within states would increase difficulties regarding public health perceptions.
5. Because outdoor and indoor air presents the greatest exposure risk to individuals, creating an MCL for radon of 300 pCi/L_{water} would actually decrease the benefit to public health because people would still be exposed via inhalation at a large monetary cost. This is because reducing radon levels in water minimally decreases radon in air. Therefore, money needed to fund public protection would be better spent towards decreasing radon levels in the air.

The fifth point was discussed further, and it was noted that indoor air and water radon levels have no correlation. Additionally, it did not appear that the cost:benefit relationship was taken into consideration when proposing the MCL. Respondents asked if EPA could revisit the risk assessment taking the above issues into account. EPA responded that Congress would have to amend the statute. EPA's recommendation of 300 pCi/L_{water} was derived based on the 10^{-4} to 10^{-6} individual cancer risk, as historically done. It was then asked if the 10^{-4} to 10^{-6} risk was mostly contributed from breathing. EPA responded yes, noting that 10% of the overall risk was attributed to water consumption.

The conversation then was open to the states to address the summary questions. Individual state discussion points are presented below.

California:

- Stated that if an MMM program is included in the rule, CA would opt out because they do not have the ability to run an MMM program.

Virginia:

- Stated that an MMM program with a level 4,000 pCi/L_{water} would cost the state less, while setting the MCL at 300 pCi/L_{water} would cost a lot with little benefit.
- Added that an MCL of 300 pCi/L_{water} makes sense as an overall exposure value from the literature; however, it is not supportable given that there is no correlation between air radon levels versus water radon levels.

Alaska:

- Stated there is not enough science to support an MCL of 300 pCi/L_{water}, but an MCL of 4,000 pCi/L_{water} can be scientifically upheld.
- Emphasized that air, not water, was the problem.
- Noted it would be difficult to gain the support of the stakeholders, and an MCL of 300 pCi/L_{water} would burden the state program.

Vermont:

- Asked the attendees what if there was no MMM program associated with the proposed rule. The MMM program appears to be the driving force between the states' decisions.
- In a 1986 study, 123 out of 366 small water systems tested would have levels over 1,000 pCi/L_{water}. Eighty percent would have levels over 300 pCi/L_{water}. Ten systems (3%) would have levels greater than 4,000 pCi/L_{water}.

New York:

- Stated 60% of upstate wells (> 1000) would violate an MCL of 300 pCi/L_{water}, and 12 would violate an MCL of 1000 pCi/L_{water}.

Rhode Island:

- Stated that out of 144 wells sampled, 2 had radon levels less than 300 pCi/L_{water}. Gravel and high volume wells have low radon levels and MMM programs would be feasible, whereas bedrock wells (~50%) have levels greater than 4,000 pCi/L_{water}.

California:

- Questioned if there was any way to perform a risk analysis for radon excluding smokers due to the way smokers are defined (an individual who has smoked 100 or more cigarettes in a lifetime).
- Stated 300 wells (~60%) were above 300 pCi/L_{water}. Noted that small systems (e.g., ones in the foothills) are already burdened with arsenic and uranium regulations and implementing an MCL of 300 pCi/L_{water} would be daunting.

EPA asked if there were any views on 1,000 pCi/L_{water} versus 4,000 pCi/L_{water}.

Pennsylvania:

- Noted 50 systems had radon levels greater than 4,000 pCi/L_{water} and 1,900 had levels greater than 300 pCi/L_{water}.
- Did not believe that an MCL of 300 pCi/L_{water} offered more protection than an MCL of 4,000 pCi/L_{water}.
- Emphasized the need to separate water and air programs, noting that Pennsylvania had a very effective indoor radon reduction program.

New York:

- Emphasized the economic costs of reducing radon levels to 300 pCi/L_{water} versus 4,000 pCi/L_{water} and added that there is no real change to public health by decreasing the MCL.
- Also argued that it was an equity issue and that problems would be created if some water systems within a state had lower standards than others. Environmentalists in New York want equal protection in all systems.

The conversation was then redirected to the third summary question on eliminating the statutory incentive to undertake an MMM program and the following points were made:

Georgia:

- Stated that they favored a single MCL value and that an MMM program would be extremely difficult to implement due to record keeping and the burden of measuring MMM program results.

New York:

- Stated the decision to participate in an MMM program depends on the individual state's program structure (i.e., are air and water in the same program or division?). Usually, air and water are separate divisions; however, in New York they are connected, and therefore, New York would opt for an MMM program.

California:

- Noted the issue is centered on resources for California because State Indoor Radon Grant (SIRG) only funds 1 person.

Louisiana:

- Stated that a radon program is not in effect for the entire state due to low radon levels; therefore, starting an MMM program would be a huge burden and the state would opt not to do it.

Rhode Island:

- Stated air and water programs are part of the same division; however, an MMM problem may cause problems with the licensing process and funding allocation.

Alaska:

- Stated there is no indoor air program for radon in Alaska, and an MMM program would not be implemented.

Massachusetts:

- The state's air and water programs are separate, and they would prefer to divert radon water funding to the air program.
- Noted an MCL of 300 pCi/L_{water} would be problematic for the state and expressed support for a higher MCL.

Idaho:

- Stated that 70-80% of its water systems would be impacted, and that an MMM program would be inherently problematic because of: (1) coordination between the air and water divisions and (2) funding.
- Added that a low quantitative MCL goal does not translate into a decrease in public health burden, but instead may increase compliance problems.

EPA then asked if there were any additional comments from the Office of Management and Budget (OMB) or the Office of Radiation and Indoor Air (ORIA). Dave Rowson (ORIA) said that the states had articulated their points well. OMB concurred and had no additional comments.

Arizona:

- Stated there was common theme in the states' comments, which was the need to separate air and water issues. For the MMM program to be worthwhile, it should be placed under the air statutes and receive separate funding.

Louisiana:

- Stressed new rules may cause problems with compliance and would prefer new rules with fewer complications.

Rhode Island:

- Concurred with Louisiana, indicated that no state would set levels more stringent than EPA.
- Also added that they needed a consistent national message on the risks from indoor air, instead of mixed state messages.

Massachusetts:

- Emphasized the need to lower air risk.

Alaska:

- Stated that public comments made 3 years ago when the proposal was made were similar to those today. Asked if EPA was going to respond to any of those comments in the context of the Final Rule.

EPA stated that today's meeting was to answer the summary questions, and it was not the Agency's intent to revisit any previous comments.

Virginia:

- Stated that radon is a complex problem that may be viewed like TMDLs; it may be a good idea to look at the cumulative risks. It also appears that the radon proposal is mired down in details and that 90% of cancers attributed to radon are related to air exposure. Because of this, it appears that by implementing the MCL, one is trying to save an individual from stomach cancer (radon exposure via water) only to have them develop lung cancer (radon exposure via air). Therefore, air problems should be handled before water exposures because air presents a greater risk. Congress should promulgate a separate air requirement and then revisit radon in drinking water.

Georgia:

- Stated that State Revolving Fund (SRF) funds are maxed out, and the state cannot contribute to an MMM program.

Virginia:

- Concurred with Georgia.

EPA thanked the states for their contribution and ended the meeting.

APPENDIX B: Council of Radiation Control Program Directors (CRCPD) Meeting Notes – September 24, 2003

Radon in Drinking Water Meeting Minutes
September 24, 2003 (10:00 – 12:00 Noon)
Washington, DC

MEETING ATTENDES:

CRCPD[14]:	Ron Fraass
EPA-IED/ORIA[15]:	Tom Kelly, Dave Rowson, Anita Schmidt, Susie Shimek
EPA-OGWDW/OST[16]:	Becky Allen, Nancy Chiu, Ann Codrington, Ephraim King
EPA-OPEI[17]:	Ann Johnson
EPA-Region 4:	Todd Rinck
ASDWA[18] (via phone):	Matt Corson, Jim Taft
OMB[19]:	Jim Laity
State Representatives:	Florida Idaho Kansas Massachusetts Maine New York Nevada Ohio Pennsylvania Utah

MEETING OBJECTIVE:

The purpose of this meeting was to give states an opportunity to express their opinion on options for a single drinking water MCL for radon. EPA consulted with CRCPD as part of the 2003 Appropriations process in which Congress asked the Agency to consult with state drinking water,

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[14] Council of Radiation Control Program Directors.
[15] Environmental Protection Agency's Indoor Environments Division and Office of Radiation and Indoor Air.
[16] Environmental Protection Agency's Office of Ground Water and Drinking Water and Office of Science and Technology.
[17] Environmental Protection Agency's Office of Policy, Economics, and Innovation.
[18] Association of State Drinking Water Administrators.
[19] Office of Management and Budget

air, and radiation programs and to evaluate options for a single standard for radon in drinking water.

MEETING SUMMARY:

Tom Kelly of EPA-IED, called the meeting to order and introduced Ron Fraass of CRCPD.

Ron Fraass welcomed everyone to the meeting.

The meeting then opened with Tom Kelly giving a brief introduction, explaining the objectives of the meeting.

- The main reason for the meeting was to find out views of the state representatives about proposing a single MCL standard, as opposed to an MCL along with an AMCL with MMM, as EPA is required to do under the current statute.
- He added that the main question for professionals in the field would be to assess the implications of having a single MCL standard.

Next, Becky Allen of EPA-OGWDW, presented an overview of the issues around this proposed regulation and the cost and benefit numbers for the various MCL levels put forth by EPA. She also restated the following summary questions, and stated that EPA is interested in finding out states' reaction to them:

- What is your view of each single drinking water standard (4000 pCi/L, 1000 pCi/L, and 300 pCi/L) with respect to the following?
  - Public health protection impacts
  - Burden
  - Implementation
  - Anticipated stakeholder reaction

- What challenges do you see in successfully adopting and implementing any of these options?

- If a single drinking water standard would eliminate the statutory incentive to undertake a Multi-Media Mitigation (MMM) program, what are your views with respect to the following?
  - Public health protection impacts
  - Burden
  - Implementation
  - Anticipated stakeholder reaction

- What other thoughts do you have regarding a single drinking water standard?

The meeting was then opened for state representatives to express their opinions on options for a single MCL. In particular, representatives were asked to respond to the 4 questions put forth in Becky Allen's presentation.

The following are summaries of the views expressed by various state representatives:

Pennsylvania:

- Stated that they would prefer to have a single MCL because that would be less confusing to the public and easier to implement, compared to an AMCL with the MMM option. Also, given the three options for a single MCL laid out by EPA, Pennsylvania would prefer 4,000 pCi/L.
- He added one impact of this standard would be its implications for real estate and the effect of any standard on the allowable levels of radon for all drinking water in the state. He projected that at 4,000 pCi/L, there would be approximately 50 public water systems (PWS) out of compliance and this would be a bigger problem if the MCL were made any more stringent.

Massachusetts:

- Stated that one of the unintended consequences of this proposed rule would be that it might encourage people to make poor choices because of the economics of treating water at home as they move away from public water systems. Also, given that EPA is proposing a regulation for radon in water, and no regulation for radon in indoor air, might give the impression to the general public that radon in water is more dangerous than radon in air. This may lead to residents making poor choices in terms of mitigation and lead to further unintended negative consequences.
- The state recommends having a single MCL also, but at a higher level, in the region of 10,000 – 15,000 pCi/L.
- He added since the legal framework in the Safe Drinking Water Act (SDWA) does not allow EPA to set an MCL above 4,000 pCi/L, it might be worthwhile to consider setting an MCL as part of the Indoor Radon Abatement Act (IRAA). Since the ultimate goal of this rule is to control radon in indoor air, the state felt that setting an MCL for water as part of IRAA would circumvent the need to do this under SDWA and therefore would give EPA the flexibility to choose a reasonable MCL similar to the radon in indoor air action guide.

EPA's response:

- Responding to this suggestion, Dave Rowson of EPA-IED, commented that they have a statutory obligation under SDWA to set an MCL at or below 4,000 pCi/L. However, IRAA might provide more latitude for EPA but their impression is that they do not have the authority to set an MCL under IRAA.
- Ephraim King of OGWDW, suggested that setting the standard under IRAA may be a potential option for Congress to consider.
- He added that the proposed 1999 rule requires EPA to set a standard for radon in water and that it is not a discretionary proposition for EPA.

Jim Laity, of OMB:

- Added that EPA has an obligation to set a standard, but might have the discretion to choose the appropriate standard.

Florida:

- Stated that setting any MCL would be interpreted as a positive action for public health.

Kansas:

- Stated that they also support a single MCL of 4,000 pCi/L.
- They felt that a form of MMM is already being performed in those states, including Kansas, that currently have an on-going State Indoor Radon Grant (SIRG) program. Hence, they do not see any loss from having a single MCL for drinking water without adding the MMM element for indoor air.

New York:

- Concurred with Kansas about the existence of an MMM program in New York.

EPA's response:

- Dave Rowson responded that if EPA were to set a single MCL, then there would be no requirement for an MMM program. However, notwithstanding the experience in Kansas and New York, all states do not have an existing MMM program and the issue is what will be the impact on these states of setting a single MCL and no option for an MMM program.

Pennsylvania:

- Questioned whether there would be additional funding sources for an MMM program. They felt that there would be a need for increased funding if they have to implement an MMM program.

New York:

- Concurred that they would also need additional funding if they are asked to implement an MMM program.

Massachusetts:

- Added that without the MMM program, they envision re-targeting some of their resources to areas of the state that have higher radon concentrations in indoor air. If they have to implement an MMM program, however, their resources would be spent on compliance issues, without the corresponding improvements in public health.

Maine:

- Stated that they have been getting risk reduction from radon for a long time and have a standard of 20,000 pCi/L for all PWS. He felt that the proposed national standard might interfere with their existing standard in Maine. If a single MCL is implemented and the federal standard is more stringent than the state standard, then the problem for the state would be that it might lose a significant part of their PWS customers.
- He also added that implementing the proposed MCL for water and no corresponding statutory requirement for indoor air, might give an incorrect perception to citizens that radon in air is not a significant problem. He added there should be a direct correlation between the two mediums and any standard for water should be followed with a standard for air.

Pennsylvania:

- Added that because of the lack of a standard for indoor air, the US Department of Housing and Urban Development (HUD) is not planning on taking action for controlling radon in homes.

Nevada:

- Stated that at first, they were happy to see the AMCL as an available option rather than just have the MCL as the only option, as they felt that it might be a stringent option for everyone to implement. They viewed the AMCL as an enhancement to their current radon in air program. But the problem with having an MMM program with the AMCL is that most western states do not have a regulatory mechanism to implement the MMM program and Nevada doesn't see a regulatory mechanism being developed in the near future to do that. Hence, they now prefer to have a single MCL as the only option as long as the MCL is more in line with the radon in indoor air action level and takes into account the availability of current radon mitigation technologies.

Ohio:

- Stated that they have a serious problem with radon in indoor air, with about 50 percent of the homes in the state above 4 pCi/L, with the average level at approximately 7.1 pCi/L and some as high as 3,000 pCi/L. However, radon in water does not seem to be such a serious problem in Ohio with no identified public water systems at or above 4,000 pCi/L.
- They recommend a single standard, and 4,000 pCi/L could be a usable standard for the state. But they would prefer a standard somewhere in the region of 10,000 pCi/L because it is closer to the actual risk levels comparable to elevated indoor air levels. He also added that he has some reservations with the risk numbers estimated by EPA for this proposed rule and would be happy to discuss them some other time.
- With respect to the issue about stakeholder reaction, Ohio was concerned that it would be hard to explain to stakeholders that the higher level allowed under the AMCL option (with an MMM program) would have less risk than the MCL option.
- He added that Ohio is a state that licenses radon mitigators and they currently perform approximately 4,000 mitigations per year.
- He also added that the state felt there is no significant correlation between radon in indoor air and drinking water and that Ohio's radon mitigation program is targeted to areas with higher radon in indoor air. But if they had to implement a radon in water standard, their research shows that those would be other areas of the state and not those currently targeted for high radon in indoor air.

Massachusetts:

- Commented that they feel there is some direct correlation between radon in indoor air and radon in well water. He agreed with Ohio, however, that under the proposed rule with the AMCL and the MMM option, resources would be spent on MMM programs in areas where radon levels are not the highest and thus would shift their focus away from areas that need the most targeted attention.
-

Maine:

- Concurred with Massachusetts that an MMM program would mean that the targeting of radon mitigation would be flawed with certain parts of the state having to live with high radon levels.

New York:

- Commented that they would also have trouble with an MMM program as the state currently does not certify radon mitigators.
- They would also prefer a single MCL of 4,000 pCi/L or above. At 4,000 pCi/L, they estimate that there would be approximately 20 systems that would need mitigation.
- They also felt that there is no direct correlation with radon in indoor air and radon in water.

Utah:

- Stated that they are concerned with the financial burdens of implementing the proposed rules. They feel that EPA should implement a single MCL and the level should be as high as possible. The rest of money appropriated for this purpose should be given to the states to implement a radon in indoor air program. This, they felt, would give the highest overall risk reduction.

Nevada:

- Expressed some concerns with EPA's estimated cost of the program of $378 million for 72 lives saved, at an MCL of 300 pCi/L. He felt that the cost figure might be too high for saving 72 lives and that that amount of money could save a great deal more lives if applied to radon in air.

Ephraim King of EPA-OGWDW, asked two clarifying questions:

- He first wanted to find out whether the notion that the existence of a drinking water MCL might take away resources from setting an indoor air standard is common to most states.
- Second, whether the 4,000 pCi/L level that states seem to vote for was only due to the fact that EPA put that as the highest option on the table. Given a free hand to choose any MCL, what would the states recommend?

States' response:

- Responding to the second question, **Nevada, Pennsylvania, Kansas,** and **Ohio** reiterated that they would prefer a single MCL and ideally higher than 4,000 pCi/L, somewhere in the region of 20,000 pCi/L or more.
- With respect to the first question, **Pennsylvania** and **Nevada** commented that they feel having to implement an MMM program for indoor air would divert attention and resources from cleaning radon in water.

Tom Kelly asked another clarifying question:

- He asked the states to consider whether EPA should follow a different procedure to set the MCL.
- He suggested one option could be to re-evaluate the radon in indoor air action level (which was based on technical feasibility) from the current level at 4 pCi/L, and reduce it

to a lower number to reflect current technical feasibility. EPA could then use the new air action level to set an appropriate MCL for water that is based on risk reductions. This would mean that the radon in water standard would probably be more than the 4,000 pCi/L which is the current highest level suggested by EPA. Also, it would directly tie the water standard to the indoor air action level.

- He asked the states whether this would be a better solution from the public health perspective because the focus would not be on reducing radon risk in water only, which is not the biggest contributor of the total risk of exposure to radon. It would also address the risk factors associated with radon in indoor air and therefore be more in line with the risk reduction goals of EPA.

Massachusetts:

- Responded that the radon risk is different from other risks. He drew the analogy that risk from radon is similar to risk from gravity and some exposure to that risk is unavoidable. Instead of promulgating rules for radon in drinking water, EPA should use the indoor air action level as the guiding principle, since it is more realistic and achievable from the states' viewpoint.

Florida:

- Stated that the radon in water risk is a significant contributor to the total risk for humans, and the question is how much of that risk are we willing to accept. The MCL should be set based on that premise.

Jim Laity of OMB:

- Asked since most states seem to think that the radon in indoor air action level is a more useful and realistic goal and ultimately the risk from radon exposure comes from radon in air, would it make sense to think about expressing the radon in water in "air equivalent units"? That is, in its communication with the general public, should EPA use risk equivalent units for expressing radon in water in terms of radon in indoor air, and would that alleviate some of the problems and confusion in the public that the states are seeing?

States' response:

- **Florida, Pennsylvania**, and **New York** responded that currently they have to explain some of these equivalency issues between radon in indoor air and radon in water to the public, and any more complication to that would add to the general confusion about the various units for measuring radon.

Idaho:

- Stated that their problem with MMM in Idaho is that it is extremely difficult for Idaho to collect data from MMM mitigators. Similar to problems in New York, Idaho does not certify MMM mitigators and therefore would face an uphill task to collect data on MMM if the AMCL is implemented.
- Inquired about the utility of discussing an MCL higher than 4,000 pCi/L when EPA does not have the authority to set anything above that limit.

Kansas:

- Agreed with Idaho's statement that collecting MMM data would be difficult because Kansas does not currently certify MMM mitigators either.

EPA's response:

- Dave Rowson of EPA-IED, clarified that EPA's interpretation of the current statute is that they cannot set an MCL above 4,000 pCi/L, but EPA would like to find out from the states and other stakeholders their preference for an MCL. That is the reason EPA suggested a number like 20,000 pCi/L for illustrative purposes so that the states can weigh in and help EPA report back to Congress about their preferences.

New York:

- Reminded that one should keep in mind that the risk from radon in water and in indoor air is additive and residents would have to mitigate if the radon in indoor air is more than the action level, and also mitigate if radon in water is more than the MCL.

Nevada:

- Responding to Idaho's question about the usefulness of discussing radon in water levels more than 4,000 pCi/L, stated that 4,000 pCi/L is tied to national goals for radon in ambient levels. But given that many states feel that it might not be possible to reach those national ambient level goals, there might be a need to discuss what the appropriate level should be.
- Stated that a single MCL sufficiently high enough to be justifiable (4,000 pCi/L or greater), given the majority of risk is in indoor air, would alleviate inherent problems with the current proposal. Those problems include justification and explanation to the consumer for two standards, lack of funding for MMM, and the lack of a mechanism and additional funding for results data collection under MMM.
- In addition, it should be noted by EPA that although not covered by the rule, a low MCL is going to result in significant unnecessary costs to the homeowner with a private well as lenders apply federal and state drinking water standards on those homeowners. Ultimately the cost of any regulation comes from the consumer and sometimes from those not intended to be regulated.

Utah:

- Stated that, in line with the recommendations of Massachusetts, they would also recommend that EPA take the proposed rule out of SDWA and put it back into the Toxic Substances Control Act (TSCA) and set up as an appropriate action level. Along with this, EPA should have a requirement that the public water systems have to report the actual radon levels in their water through Consumer Confidence Reports.
- This would allow the consumers to participate in the decision-making process as they can then decide if they want their public water systems to lower the radon levels in the water if it is higher than the action level. This would mean that consumers make the decision of whether they want their PWS to meet the action levels without government intervention.
- Finally, he commented that public water systems are more likely to listen to their consumers than to government representatives.

EPA thanked the states for sharing their views and ended the meeting.

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