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Arsenic Treatment for the Private Well Owner

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Testing

Arsenic in drinking water is odorless, tasteless and colorless. The only way to tell if arsenic is present is to test for it. We recommend using a state certified lab. We also recommend a minimum of two tests to confirm the concentrations. Even if the initial test is low, we recommend a second test to confirm the results.

Arsenic forms-

Arsenic(As) exists in nature in two forms. One is As(III) and the other is As(V). The roman numerals represent their relative abilities to combine with other substances. The As(V) has a greater combining capacity than As(III) and because of this greater combining capacity it is more easily treated. If there are high concentrations of As(III), most treatment systems will require it be converted to As(V). The conversion will require the As to be oxidized. This can be done with the addition of an oxidant like chlorine. The addition of chlorine is done with a solution feed system.

Treatment Techniques-

The ability of the homeowner to monitor the performance of the system is one of the most critical considerations in determining the appropriate choice of a reduction technique for health related contaminants.

There are a number of ways to remove arsenic from drinking water. Three of the most common include:

- ⚡ [Adsorption](#) with [Iron Based Sorbents](#) (IBS)
- ⚡ [Ion exchange with anion resin](#)
- ⚡ [Reverse Osmosis](#) (RO)

Iron Based Sorbents work well on As(v) and do have limited ability to adsorb As (III). These systems have the following disadvantages:

- ⚡ The system performance is affected by water with an elevated pH.

- ⚡ The system will require the replacement of media once it is exhausted.
- ⚡ These systems require regular testing to provide safe operation.

The advantages are:

- ⚡ These systems require very little operator/homeowner involvement.
- ⚡ They are inexpensive alternative to [point of entry](#) (POE) reverse osmosis (RO) systems.

Ion exchange with anion resin only works on As(V) and does not require pH correction but has the following disadvantages:

- ⚡ An improperly operated and/or maintained system can dump collected arsenic back into the water. This *dumping can cause concentrations to rise well above those being removed.*
- ⚡ The capacity of the system can be decreased over time by other materials in the water.
- ⚡ The home owner must add salt to maintain system.
- ⚡ *There is no good way for the homeowner to monitor the performance of the system.*

Reverse osmosis systems work well on As(V) and have the following advantages over the other techniques:

- ⚡ *The performance of the system can be easily monitored.*
- ⚡ *Arsenic **can't** be dumped back into the water* because none is stored in the unit.
- ⚡ The equipment does not require the addition of chemicals or salt.
- ⚡ The system does not require any special skills to operate.

Conclusion-

If most of the arsenic in the water is As(V) and ingestion is the only concern, the arsenic should be treated by a [point of use](#) (POU) RO system. The RO is chosen for the following reasons -

1. *RO systems provide for performance checks* on a regular basis by the homeowner. "Smart faucets" have lights that tell the homeowner every time he draws water if the system is operating properly.
2. Arsenic is typically only considered a problem if ingested and therefore only enough water for drinking is necessary.
3. There are no operator skills required.
4. There are no chemicals to handle.

If point of entry(POE) treatment is desired, then an IBS system should be considered on low arsenic concentrations. If concentrations are high, then a point of entry RO system should be considered. Both POE systems will require knowing if As(III) is present. If most of the arsenic is As(III), then a [solution feed](#) system will need to be added to add chlorine to the system.

Experience-

Our experience in Maine has shown that most of the arsenic is As(V) and is very effectively removed with a reverse osmosis system. As when treating any health related parameter, testing of raw and treated water should be done on a regular basis after the installation of any treatment system. We recommend that initial testing be done within a week after installation again in six months and then each year there after or when there is any observable change in the quality of the water. The table below shows results from some reverse osmosis systems we have installed in Maine.

Arsenic Removal	
Raw(mg/L)	Treated (mg/L)
0.010	<0.003
0.073	<0.005
0.139	<0.003
0.083	<0.003
0.075	<0.003
0.086	<0.003
0.238	<0.005

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Bacteria Tests what do they mean?

What type of bacteria are tested for?

The most common bacteria test detect coliform bacteria. There are many types of coliform bacteria. Coliform bacteria, by itself, is generally not a health issue. The presence of coliform bacteria is only an indication that the water source has decaying organic material in it. The presence of decaying organic material suggests a potential contamination from surface water and, hence, indicates that the water source is at risk.

Fecal coliform is only present in the waste of animals. E-coli is a type of fecal coliform and is only present in the waste of warm blooded animals. A test for fecal coliform or e-coli is a better indicator of the source of the contamination. A positive test does not mean that the source is from a septic field or septic tank. The source could be the result of contaminated surface water leaking into the water or simply a dirty faucet.

What type of tests are available?

There are numerous types of bacteria tests that can be done on water. There are, however, two basic categories of tests. One determines the presence or absence of bacteria and the other produces an actual count of colonies that the bacteria grows on a plate. A description of each follows:

- **Presence / Absence** -A sample is placed in a vial with nutrients that will grow coliform bacteria. If coliform is present, the solution in the tube will change color. If e-coli is present, the solution will glow when exposed to ultraviolet light. The results will only be positive or negative. The amount of bacteria will not be determined in this type of test.
- **Count**- a sample of the water is passed through filter paper that will trap bacteria on its surface. The filter paper is then placed in a petri dish with nutrients that will grow bacteria. The bacteria will grow and form spots. Each spot is called a colony. The results are reported in colonies per volume of water filtered. The standard volume of water used in this test is 100 ml, therefore, the results will commonly be reported in colonies per 100 ml.

The bright reflection seen on what appears to be a black spot is really the iridescent glow of a coliform colony that has

You can tell the [lab](#) you want either type of test done for coliform, e-coli or fecal coliform.

What should I ask for?

[IDEXX Colilert®:](#)



Colilert from IDEXX simultaneously detects and confirms coliforms and E. coli in water samples in 24 hours or less. Simply add the Colilert reagent to the sample, incubate for 24 hours, and read results. Colilert is easy to read, as positive coliform samples turn yellow, and when E. coli is present, samples fluoresce under UV light.

developed on the media filter. This is one of the tests performed at [A&L Labs](#).



A standard coliform test that simply shows the presence of the bacteria is sufficient to determine if there is a potential problem with the water. You really don't need to know how much coliform there is because any amount of coliform indicates a contamination of the sample.

What does a positive bacteria test mean?

A positive test for bacteria is really only that -a positive test. It does not tell you where the contamination came from. The contamination could have just as easily come from a dirty faucet tip as it could have from bad well design or installation.

The information you get back with a positive test will tell you to chlorinate and retest. We often recommend a second confirmatory test after an initial bad test. We recommend this for two reasons:

- It is very easy to get a bad test and hard to get a good test.
- Secondly, chlorination can be a long process. Getting the chlorine into the well is generally much easier than getting it out. It may take days to even weeks to properly flush all the chlorine out of the well. Taking a test before all the chlorine is gone will only give you a false negative test (a test that says everything is ok when in fact it is not)

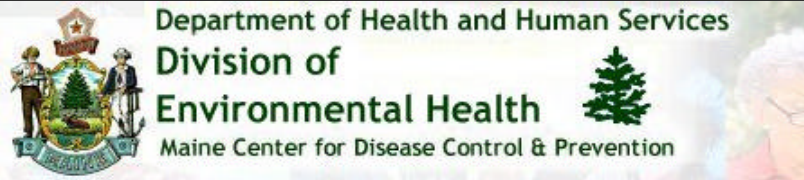
Is there a way to determine if the septic system is at fault?

Bacteria can be filtered out of water that has passed through several feet of soil. Detergent will not be filtered by the soil. Any water that reaches a well from a septic system will have detergent in it. The easiest way to determine if the source of the contamination could be from the septic system is to do a detergent test.

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Frequently Asked Questions about the 2 pCi/L recommendation for radon in air

The [Maine CDC](#) is emphasizing the 2 pCi/L as the current recommended clean up level for air in Maine. More information about radon can be found at the [Maine Radon Homepage](#).

Why is Maine emphasizing a radon cleanup level of 2 pCi/L?

Any radon exposure has some risk of causing lung cancer. The lower the radon level in your home, the lower your family's risk of lung cancer. The U.S. Congress has set a long-term goal that indoor radon levels be no more than outdoor levels; about 0.4 pCi/L of radon is normally found in the outside air. While this goal is not yet technologically achievable in all cases, most homes can be reduced to 2 pCi/L or below. The U.S. Environmental Protection Agency (EPA) recommends fixing your home if a long-term test or average of two short-term tests show radon levels of 4 pCi/L or higher. Because radon levels in most homes can be reduced to 2 pCi/L or below with today's technology, [EPA has suggested considering fixing your home at levels between 2 and 4 pCi/L](#). The Maine CDC is now recommending fixing your home if long-term test or average of two short-term tests show air results above 2 pCi/L.

Why is Maine Choosing to Emphasize the 2 pCi/L clean up level now?

Historically, much of the concern about radon came from studies of uranium miners exposure to relatively high levels of radon gas. Over the past decade, there have been several very good epidemiological studies of people exposed to radon in their homes showing an increased risk of lung cancer. In recent years there have also been attempts to pool the many studies together to provide yet stronger evidence for the link between radon exposure in the home and lung cancer. These studies, coming from North America, Europe and China, confirm that the risks of radon at levels currently considered acceptable are indeed of public health concern. For example, even at an air level of 2 pCi/L, the estimated cancer risk for a mixed population of smokers and non-smokers is 1 excess cancer for every 100 exposed people (i.e., a risk of 1 per 100). For more information about these studies, see the [Maximum Exposure Guideline for Radon in Drinking Water](#) (MeCDC 2006).

Can Mitigators Clean up to 2 pCi/L?

There have been improvements in efficiency and technology since the 4 pCi/L technology based action level was established as a in 1986. [EPA's Citizen's Guide to Radon \(EPA 2005\)](#) states, "most homes today *can* be reduced to 2 pCi/L or below." Additionally, an informal survey of Maine radon mitigators suggests that in the majority of cases 2 pCi/L is achievable.

EPA 1992. Technical Support Document for the 1992 Citizen's Guide to Radon. EPA 400-R-92-011

EPA 2005. A Citizen's Guide to Radon: The Guide to Protecting Yourself and Your Family From Radon. <http://www.epa.gov/radon/pubs/citguide.html>

MECDC (2005). Maximum Exposure Guideline for Radon in Drinking Water. Maine Center for Disease Control. Environmental and Occupational Health Program.



John Elias Baldacci
Governor

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**FREQUENTLY ASKED RADON IN AIR QUESTIONS:
REAL ESTATE TESTING GUIDELINES AND RECOMMENDATIONS**
(Should be followed if the house is for sale or soon will be)
(Revised 10/21/03)

Q: Who can do the test?

A: The Maine Radon Registration Act (22 MRSA §771 et seq.) says a Maine registered radon tester must conduct the test if the home is or soon will be for sale. **This is true for radon in water as well. It is illegal for a Realtor, home seller, or home buyer to do a radon in air or a radon in water test when the home is for sale!**

Current listings of registered testers are available from the Radiation Control Program website at www.maineradiationcontrol.org, then click on the Radon Section link; or by calling 1-800-232-0842. Most registered testers are also Home Inspectors.

Q: Where do I get the test kit?

A: The Maine registered radon tester will bring and use a radon test kit they are familiar with. You will not need to get a test kit on your own. The test kit used by the registered radon tester must be from a Maine registered radon laboratory, unless the home inspector uses a continuous radon monitor. If you want to make sure your registered tester used a test kit from a registered laboratory, current listings of registered labs are available from the Radiation Control Program website at www.maineradiationcontrol.org, then click on the Radon Section link; or by calling 1-800-232-0842.

Q: How is a radon test done?

A: The registered tester has been trained in proper testing protocols. These are the main things they will consider or do when setting a test kit.

Radon in air tests during Real Estate transactions must use at least **two short-term test kits OR one continuous monitor**.

-If your registered tester uses two test kits, they will be set four inches apart and are used at the same time. The results of both tests will be reported to you, along with the average and recommendations.

-If your registered tester uses a continuous monitor, the monitor must take and report hourly radon measurements. The average result will be reported to you, along with the hourly measurements and recommendations.

-For ANY Real Estate radon test, **the test must be at least 48 hours**, and not more than 90 days long.

-**Doors and windows in the entire house must be closed 12 hours before the test begins, and must stay closed during the entire test.** The only exception is the few seconds when people are entering or leaving the home. Having windows or doors open too long can cause **higher or lower** results.

-Exhaust fans that are not part of an approved radon mitigation system also need to be turned off before and during the test. During summer, air conditioners can be operated on re-circulate mode only. No fresh air.

-DO NOT cover sump holes, fill cracks, etc. before or during a test. Doing any of these can be considered fraud, and makes the radon test not valid. Contact the Radiation Control Program at 1-800-232-0842 for more information.

Q: Where does the test kit go?

A: The test should be in the **lowest useable** part of the house, usually the basement. A basement is useable if it has 6 feet of clearance, has stone, cinderblock, or poured concrete walls, and a mostly dry floor. In Maine, dirt floored basements with fieldstone walls are frequently used for workshops, exercise, or play. Just because the current owner does not use the basement doesn't mean a future owner won't.

- The kit needs to be **in an open area**, and **between 20 inches and eight feet off the floor**.
- The kit needs **at least four inches of space** around the sides and top.
- Keep the kit at least **a foot away from outside walls**, and **three feet away from any doors and windows**
- keep the kit **out of drafts and direct sunlight**, and **away from heat sources**.
- Do not test during stormy or windy days!!!** These weather conditions can influence test results.

Q: What do my results mean?

A: First, you need to know that there is **no 'safe' level** of radon. The action level of 4 pci/l was set because the radon level in all homes can be reduced to below this number. Most homes can have the radon level dropped to near 1 pci/l. Also, no home will ever have 'no radon' because there is radon everywhere-even out doors. The amount of radon outdoors is about one half of a pci/l (0.5 pci/l). So what do you do?

For low test results (**below 2.0 pci/l**), no further action is necessary. Consider re-testing in about 5 years, or if the house is modified (new furnace, ventilation system, addition, etc.). Changes such as these, or earthquakes, blasting nearby, or changes in the water table can change radon levels in a house.

For moderate test results (**between 2.0 and 4.0 pci/l**), remember that 4 pci/l is not 'safe'. Consider mitigation, particularly if your results are near 4 pci/l. Trying to reduce radon levels already below 4 pci/l is not as easy as reducing levels of 4 pci/l or over. Otherwise, consider re-testing in about 5 years, or if the house is modified (new furnace, ventilation system, addition, etc.).

If the test results are **4.0 pci/l or over**, you should lower the radon levels. A current list of Maine registered mitigation contractors is available from the Radiation Control Program website at www.maineradiationcontrol.org, then click on the Radon Section link; or by calling 1-800-232-0842

If one side-by-side test kit result is under 4 pci/l and the other is over 4 pci/l, the test is valid when the higher result is not more than double the lower. Average the two results and follow the above recommendations.

- When one side-by-side test kit result is less than 4 pci/l and the other is over 4 pci/l and more than double the lower result, there is a problem. The test needs to be redone.

Q: What do I do if mitigation is needed?

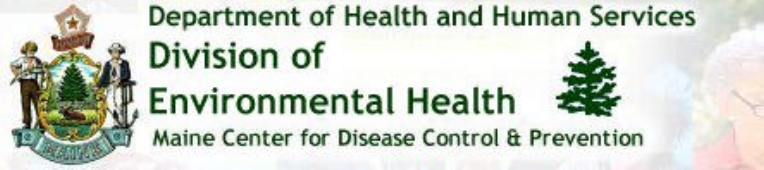
A: The Maine Radon Registration Act (22 MRSA §771 et seq.) says a Maine registered radon mitigator must install the mitigation system if the house is for sale. **This is true for radon in water as well.** For about \$1,200 the mitigator can install pipes that remove radon from under the house, called a sub-slab depressurization system. This type of system is guaranteed to reduce radon levels to below 4 pci/l, and is the most durable, reliable, and least costly radon removal method. **Mitigating radon in water problems is done differently, and is more costly.**

A current list of Maine registered mitigation contractors is available from the Radiation Control Program website at www.maineradiationcontrol.org, then click on the Radon Section link; or by calling 1-800-232-0842

Q: Where can I get more information on radon, radon testing, or radon mitigation?

A: Visit the Radiation Control Program website at www.maineradiationcontrol.org, then click on the Radon Section link; or call the Radon/IAQ Section at 1-800-232-0842 between 8 AM and 5 PM. After hours, call that number and leave a message with your name, address, phone number (from 8 to 5), and your question. Your call will be returned, and information to help you will be mailed. We have many radon handouts, including general information; information on testing, and information on fixing radon problems.

Visit our website at www.maineradiationcontrol.org, then click the Radon Section link



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Frequently Asked Questions about the 4,000 pCi/L MEG for Radon in Well Water

Maine has a new Maximum Exposure Guideline (MEG) of 4,000 pCi/L radon in well water.

What is an MEG?

The Maine Center for Disease Control, Environmental and Occupational Health Program is responsible for developing Maximum Exposure Guidelines (MEG) for private wells. The MEG for radon has been 20,000 picocuries per liter (pCi/L); this MEG was established in the late 1970s. MEGs represent levels of chemicals in water below which there are minimal risks from lifetime ingestion of water. MEGs are used by multiple entities, but are primarily designed as guidance for homeowners with wells. A chemical that exceeds an MEG may result in a recommendation to reduce exposure.

Why is Maine lowering the MEG?

The MEG of 20,000 pCi/L of radon in water represents an unacceptably high cancer risk and needs to be lowered. Radon in water is mostly of concern because it escapes into indoor air whenever water is used. For every 10,000 pCi/L of radon in water, around 1 pCi/L is added to indoor air levels. Therefore, 20,000 pCi/L of water would add 2 pCi/L to indoor air radon level. In recent years, a number of studies of residential populations have confirmed that the added cancer risk associated with radon indoor air levels of 2 pCi/L approaches 1-in-100 (i.e., for every 100 people exposed to 2 pCi/L radon over a lifetime, 1 person would be expected to develop lung cancer). As a matter of ME-CDC policy, most MEGs for cancer-causing chemicals are set at very low cancer risks levels of 1-in-100,000. Thus, the current MEG for radon is unacceptably high and needs to be lowered.

What is the new MEG?

The new MEG for radon is 4,000 pCi/L. An MEG at this level represents approximately a 3 per 1,000 cancer risk. While this risk is far greater than typically considered acceptable for an MEG, it represents a contribution of only 20% to the 2 pCi/L indoor air guideline that Maine is now emphasizing for control of radon from soil gas. Given the prevalence of indoor air radon levels at and above 2 pCi/L due to soil gas, ME-CDC believes it is difficult to justify control of radon from water when levels are less than 4000 pCi/L; rather, resources should be directed toward reducing soil gas related sources.

How does Maine's MEG compared to other New England states?

Several other states within New England use water guidelines that are similar to 4,000 pCi/L. New Hampshire recommends action at 2,000 pCi/L, Rhode Island at 4,000 pCi/L, Connecticut at 5,000 pCi/L and Massachusetts at 10,000 pCi/L. EPA has a proposed Alternative Maximum Contaminant Level of 4,000 pCi/L that would be relevant to public water supplies.

How do I interpret this new MEG?

While an MEG represents the point at which action should be considered by a homeowner, it does not necessarily mean the homeowner should install a treatment system. **The only way to know how to most effectively reduce risk is by having both an air and water radon result and possibly consulting with the [Maine Radon Program](#).**



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IMPORTANT CONSUMER NOTICE

Many consumers who are disturbed by the cost of professionally installed radon mitigation systems seek alternative methods of sealing their basements from radon entry. An internet search will yield many companies and products, some of which will claim to be cheaper and as effective or more effective in reducing the radon levels in your home. These companies and products have not been tested and proven as viable alternatives to fan based systems.

The EPA advises that sealants have not been proven to be a permanent solution for this problem.

Typically what occurs after using one of these products, is a temporary reduction in radon levels which gives the homeowner a sense of false security. Years later when the owner tests his home again (as recommended by the EPA) he finds that the radon concentration has returned to the level observed prior to the application of the sealant, and that the home's occupants had probably been exposed to this level for many years.

A fan based radon system is the most efficient, most affordable technology to date, for reducing indoor radon levels in your home. The EPA has published detailed standards and specifications for the installation of these systems, which the state of Maine has adopted and enforces. The individuals and firms who perform the installations of these systems have received training, passed an extensive written exam, and have registered with the State of Maine Radiation Control Program's Radon Section as a Radon Service Provider. Additionally, the company advertising a radon service which is not registered with our department, is in violation of Maine's Radon Registration Act.

One of the primary functions of our office is to inform the public of the major health risk of long-term exposure to elevated levels of radon in their indoor environment, and the need to reduce levels to minimize the risk of radon induced lung cancer. Our opinions are not biased toward one product or another other, but are formed by the review of empirical and scientific evidence of a product's or a technology's ability to permanently reduce radon levels.

EPA advises that sealants should only be used in conjunction with an active radon mitigation system.

If you are interested enough by any of these alternative radon reduction products or methods to the point that you are considering purchasing them, please call our Radon Section to discuss the effectiveness of the alternative method before spending your money. We would be pleased to discuss with you, your radon concerns and the best radon reduction strategy for your individual needs.