Dear Well-Owner,

If you own and operate a domestic well in certain areas within Howard County, the Howard County Health Department, (HCHD), Bureau of Environmental Health recommends that you test your well for naturally occurring radiation. This Homeowner's Guide has been prepared to help answer your questions about testing and treating your domestic well water supply.

What are Radionuclides?

Radionuclides occur naturally as trace elements in rocks, soil, and ground water as a consequence of the radioactive decay of uranium and thorium. This decay occurs because these elements are unstable; they continually release energy into the environment until a stable, non radioactive substance is formed. This energy is part of the natural radiation to which all living creatures are exposed. Radon, radium, and uranium are the most common radioactive elements found in ground water. Other naturally occurring radionuclides tend to be environmentally immobile or have short half-lives, meaning they are far less likely to be found in significant amounts in ground water.

What is radioactivity and how is it measured?

Radioactivity is a measure of the energy released during the decay process. The energy or radiation can be in the form of a wave (for example, gamma rays) or a particle (for example, alpha and beta particles) or both. Scientists can identify the different types of radioactive elements by measuring the characteristics of this energy.

In the U.S., radioactivity is measured in units called “curies.” The level of radioactivity in water is very low and is measured in picocuries per liter, written pCi/L (one picocurie equals one trillionth of a curie or $10^{-12}$).

To assess the level of radionuclides in drinking water, the water supply is typically first tested prior to any treatment for short term gross alpha (also referred to as gross alpha particle activity (GAPA)) and gross beta (gross beta particle activity (GBPA)). These tests are cost-effective screening tools used to determine whether further isotope-specific testing for radium or uranium is warranted.

What are the standards for radionuclides in drinking water?

The U.S. Environmental Protection Agency (EPA) has set standards, or Maximum Contaminant Levels (MCLs), for radioactive substances in public drinking water supplies (Table 1). The same standards are also recommended for privately owned wells. The standards define the maximum permissible level of a contaminant legally allowed in water taking into account the public health risk, available treatment technology and costs of treatment.

What are the health risks for exposure to radionuclides?

Gross Alpha Particle Activity (GAPA). GAPA is the total measured alpha particle activity in a water sample. It may be due to radium-224, radium-226, uranium, or any combination of alpha-emitting elements. Alpha particles do not penetrate the skin but enter the body when alpha-emitters are in food, water, or air.

Gross Beta Particle Activity (GBPA). GBPA is the total measured beta particle activity in a water sample. It may be due to radium-228 or any combination of beta-emitting elements. Some beta particles are capable of penetrating the skin, however, as with alpha emitters, beta emitters are more hazardous when they enter the body through food and water.
Radium-224, -226, and -228. The isotope of radium can enter the body through food or water. Most of the radium is eliminated from the body, but some may be deposited in the bones. Some people who drink water containing radium in excess of the standard over many years may have an increased risk of getting cancer.

Total Uranium. Like radium, uranium also enters the body through eating and drinking. Exposure to uranium in drinking water may result in toxic effects to the kidney. Some people who drink water containing uranium in excess of the standard over many years have an increased risk of getting cancer.

Radon. Radon exists predominately as a gas that can enter the body through inhalation. Nationally, radon in indoor air is recognized as the second leading cause of lung cancer. The EPA recommends testing of indoor air, and remedial action is recommended if the airborne level exceeds 4 pCi/L of air. Radon enters the house predominantly from surrounding soil and rock; the contribution of radon from ground water is considered minimal in most instances (< 2%). The EPA estimates that for every 10,000 pCi/L radon that is dissolved in a drinking water supply, approximately 1 pCi/L contributes to the indoor air. To date, the EPA has not established drinking water standards for radon. A more complete discussion of radon can be found at the following website: http://www.nsc.org/issues/radon/faq.htm#water

Natural levels of radiation in drinking water are generally not considered to be a health emergency. Short-term exposure poses very little risk.

Table 1. Standards for radioactive substances in drinking water and recommended treatment methods

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Primary type of radiation</th>
<th>EPA Standard</th>
<th>Best Available Treatment Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Alpha&lt;sup&gt;2&lt;/sup&gt; (GAPA)</td>
<td>alpha particles</td>
<td>15 pCi/L&lt;sup&gt;3&lt;/sup&gt; (not including uranium)</td>
<td>Reverse Osmosis</td>
</tr>
<tr>
<td>Gross Beta (GBPA)</td>
<td>beta particles</td>
<td>4 mrem/yr&lt;sup&gt;4&lt;/sup&gt;</td>
<td>Ion Exchange Reverse Osmosis</td>
</tr>
<tr>
<td>Radium-224</td>
<td>alpha particles</td>
<td>No Standard</td>
<td>Ion Exchange Lime Softening Reverse Osmosis</td>
</tr>
<tr>
<td>Radium-226</td>
<td>alpha particles</td>
<td>5 pCi/L&lt;sup&gt;3&lt;/sup&gt; (combined Ra-226/228)</td>
<td>Ion Exchange Lime Softening Reverse Osmosis</td>
</tr>
<tr>
<td>Radium-228</td>
<td>beta particles</td>
<td>5 pCi/L&lt;sup&gt;3&lt;/sup&gt; (combined Ra-226/228)</td>
<td>Ion Exchange Lime Softening Reverse Osmosis</td>
</tr>
<tr>
<td>Total Uranium</td>
<td>alpha particles</td>
<td>30 micrograms/L&lt;sup&gt;5&lt;/sup&gt;</td>
<td>Anion Exchange Reverse Osmosis</td>
</tr>
</tbody>
</table>

<sup>1</sup> Source: EPA 40 Code of Federal Regulations 142.65
<sup>2</sup> The EPA test method for GAPA does not include contributions from radon
<sup>3</sup> Radioactive decay is measured in units of picocuries per liter (pCi/L).
<sup>4</sup> The standard for gross beta is expressed as an annual dose in millirems per year (mrem/yr). A value of 50 pCi/L is roughly equivalent to 4 mrem/yr and can be used as a preliminary screening value for gross beta.
<sup>5</sup> The standard for total uranium is expressed in micrograms per liter (ug/L). According to EPA’s Implementation Guidance for Radionuclides, (pg. 1 – 16), 1 ug/L uranium is equal to 0.67 pCi/L.
What is known about the distribution and occurrence of radionuclides in this area?

Studies by Maryland Geological Survey and Maryland Department of the Environment (MDE) have found elevated levels of natural radioactive elements in groundwater from an underground rock formation, the Baltimore Gneiss. Information obtained thus far indicates that GAP A is at levels over the recommended drinking water standards in approximately 10% of the wells tested in the Baltimore Gneiss formation in Howard County. Isotope-specific tests indicate that radium is primarily responsible for these elevated readings.

There is currently no observable correlation with well depth, yield, or age to elevated test results in the affected wells (elevated concentrations appear to occur randomly within the Baltimore Gneiss formation). Based on tests performed to date, only wells inside the Baltimore Gneiss formation are above the MCL. Variability may exist between the test results for GAP A levels found in a tested well as much as 2 to 3 times between samples taken at different times. This variability may be affected by seasonal changes, water usage and the relative error that is inherent in the analytical method.

I have an existing domestic supply well, what should I do?

Private well owners who are living within the Baltimore Gneiss formation (see map of Baltimore Gneiss) and wish to have their well water tested may contact the HCHD at 410.313.1773. Currently, there is no charge for these tests. Please ensure any test results received from a private lab are forwarded to the Health Department.

Table 2. Decision Guide for Short-Term GAP A Test Results

<table>
<thead>
<tr>
<th>If short-term Gross Alpha is…</th>
<th>Then</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5 pCi/L</td>
<td>no additional tests are needed</td>
<td>A result in this range indicates that the water meets recommended health standards.</td>
</tr>
<tr>
<td>&gt; 5 ≤ 14.9 pCi/L</td>
<td>test for radium 226/228</td>
<td>Install treatment system for radium if the results for combined radium 226/228 are greater than 5 pCi/L. Retest after treatment is installed to ensure that the contaminants are removed</td>
</tr>
<tr>
<td>≥ 15 pCi/L</td>
<td>test for radium 226/228, uranium and install treatment</td>
<td>If combined radium 226/228 &lt; 5 pCi/L, Uranium &lt; 30 µg/L, and GAP A – Uranium &lt; 15 pCi/L, treatment will not be required. IF treatment is installed, the water supply should be retested after treatment for short term GAP A to ensure that contaminants are being removed.</td>
</tr>
</tbody>
</table>
I am having a new well drilled. What type of water testing will be required?

In accordance with the Code of Maryland Regulation (COMAR) 26.04.04.09, an Interim Certificate of Potability (ICOP) is required prior to putting a new well into potable use; every new well must be tested for bacteria, nitrate, sand, and turbidity. Other parameters may be required if there is reason to suspect contaminants are present that significantly impact human health, safety or comfort. In areas underlain by Baltimore Gneiss, Howard County requires that new and replacement wells be tested for GAPA. It is suggested that you call HCHD at 410.313.1773 to determine if testing for radionuclides is required. As per Table 2 (above), testing and treatment may be required before issuance of the ICOP or Final Certificate of Potability (FCOP).

Elevated levels of radionuclides have been found in my well water. What should I do?

As per table 1 (above), radium can be effectively removed by a cation exchange (water softener) or reverse osmosis treatment system. Uranium can be removed by anion exchange or reverse osmosis. Other treatment technologies may also be effective (see EPA 40 CFR 142.65 for further information). Before choosing a water treatment system, contact a water treatment company listed under water filtration and purification equipment in the yellow pages or contact the HCHD.

Depending on other needs to address other water quality parameters, you may consider installing a whole-house unit or a point of use (at the tap) unit. Homeowners using treatment systems to reduce radionuclides should maintain the unit according to manufacturer’s instructions. After installing a water treatment system, the system should be tested for effectiveness. Be advised water softeners typically increase sodium intake between 200-400 mg/day. This may be a concern for people with sodium-restricted diets.

How can I get more information?

County: Howard County Health Department Environmental Health 410.313.1770  
http://www.co.ho.md.us/Health/HealthMain/Health_Homepage.htm

State: Maryland Department of the Environment 410.537.3784  
http://www.mde.state.md.us

Federal: USEPA Safe Drinking Water Hotline 800.426.4791

Radionuclides in Drinking Water  
http://www.epa.gov/safewater/standard/pp/radnucl.html

Radon in Drinking Water: Questions and Answers  
http://www.epa.gov/safewater/radon/qa1.html

Ionizing Radiation Fact Sheets Series: No 1  
http://www.rst2.edu/ties/radon/ramfordu/pdffiles/whatif1.pdf

Ionizing Radiation Fact Sheets Series: No 2  
## Laboratories in the Baltimore Area Who Will Collect Radiological Samples

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Phone Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aardvark Water Testing Laboratory, Inc.</td>
<td>260 Gateway Drive, Suite 3A Bel Air, MD 21014</td>
<td>410.691.2223</td>
</tr>
<tr>
<td>Cassell Testing, Inc.</td>
<td>5 North Park Drive Hunt Valley, MD 21030</td>
<td>410.252.7742</td>
</tr>
<tr>
<td>Enviro-Chem Laboratories, Inc.</td>
<td>100 Lake Front Drive Hunt Valley, MD 21030</td>
<td>410.785.9739</td>
</tr>
<tr>
<td>Envirosystems, Inc.</td>
<td>9200 Rumsey Road B 102 Columbia, MD 21045</td>
<td>410.964.0330</td>
</tr>
<tr>
<td>Fountain Valley Analytical Laboratory, Inc.</td>
<td>1413 Old Taneytown Westminster, MD 21158</td>
<td>410.848.1014</td>
</tr>
<tr>
<td>Martel Laboratories, JDS Inc.</td>
<td>1025 Cromwell Bridge Rd Baltimore, MD 21286</td>
<td>410.825.7790</td>
</tr>
</tbody>
</table>

### Radiological Testing Options:
- Short Term Gross Alpha Particle Activity
- Short Term Gross Beta Particle Activity
- Radium 226/228

**Disclaimer:** The companies listed above are licensed laboratories in good standing with the Maryland Department of Health and Mental Hygiene. The Howard County Health Department, Bureau of Environmental Health makes no claim as to the completeness of this list or the quality of work performed. If you are a qualified laboratory that wishes to be included on this list, please submit your request in writing to the department. Attn: Bureau of Environmental Health, 7178 Columbia Gateway Drive, Columbia, MD 21046