Dr. Donald Langmuir's Test Results for Radon in Granite

The MIA has called upon several of the country's leading scientists in geology and geochemistry to assist in preparing a response to the allegations in this article that radon gas emissions from granite countertops may be hazardous. On reading the article, our consultants reacted with such comments as "ludicrous", "a fabulous collage of nonsense", "politically motivated", "unethical", and "bizarre".

Donald Langmuir, PhD, Professor Emeritus of Chemistry and Geochemistry at the Colorado School of Mines and President of Hydrochemical Systems Corp., both in Golden, Colorado, has prepared a response on behalf of the Marble Institute of America that evaluates and refutes these allegations. His report appears in full in this Special Bulletin. Dr. Langmuir received his BA (with honors), and his MA and PhD degrees in geochemistry from Harvard University. He served as a geochemist with the Ground Water Branch of the U.S. Geological Survey's Water Resources Division and subsequently taught and conducted research for 11 years at Pennsylvania State University, with temporary appointments at Rutgers University, the Nevada Desert Research Institute, and the University of Sidney, Australia. Dr. Langmuir has been a full professor at the Colorado School of Mines since 1978.

What is Radon?

Radon is a naturally occurring gas generated by the decay of trace amounts of uranium found in the earth's crust throughout the world. It is an unstable gas that quickly breaks down and dissipates in the air.

Radon is measured in units called picocuries per liter (pCi/L). A picocurie is one trillionth (10 -12) of a curie, which is the amount of radioactivity emitted by a gram of radium. The U.S. Environmental Protection Agency (EPA) has established 4 pCi/L as the standard for indoor air; 20 pCi/L represents the maximum amount of exposure to radium that is now allowed by U.S. regulations.

The following is Dr. Langmuir's report:

Date: September 1, 1995
To: Marble Institute of America
From: Donald Langmuir, PhD, Professor Emeritus of Geochemistry, Colorado School of Mines, & President, Hydrochem Systems Corp.
Subject: The article 'Granite and Radon' published in Solid Surface

I am appalled and dismayed that any journal would accept a pseudo-science article such as this for publication. If this article had been submitted to a reputable scientific journal, the editors and reviewers would have demanded that the author supply scientific evidence to support his/her many unfounded and unsupported assertions and conclusions. Lacking such evidence they would have rejected it for publication. As a separate point, I am very suspicious of a paper that has no named

author. Who is responsible for this attack on granite countertops? Is it someone who stands to benefit economically?

Two of the scientific experts who the author (or authors?) cites repeatedly in the bibliography as sources of the arguments have become aware of the 'Granite and Radon' paper. They agree with me that the author's conclusion that a granite countertop could emit a high and dangerous concentration of radon to a home is both totally fallacious and ludicrous. In fact, as you will see below, the amount of radon released from a typical granite countertop is certain to be completely negligible and well below detection by any known method of radioactive analysis. I would be delighted to have a granite countertop in my home!

As to my credentials to evaluate and refute 'Granite and Radon', I have been conducting funded university research and publishing in peer reviewed journals on the geochemistry of radioactive elements for nearly 20 years at Penn State University and the Colorado School of Mines. In recognition of this expertise, I was nominated by the National Academy of Sciences and appointed to serve as a member of the U.S. Nuclear Waste Technical Review Board by President Reagan in 1989, and reappointed to that position for a second four-year term by President Bush in 1992.

It is worth noting that the stone industry, whether advertising countertops, building materials or monuments, terms many stones 'granites' that are not true granites to a geologist. A true granite, which is often grey or pink, is chiefly comprised of a potassium aluminum silicate mineral (K-feldspar or potassium feldspar) and quartz (silica or SiO2). Rocks called granites by the industry also include magnesium silicates (e.g. peridotites and serpentines) and a host of other chemically different rock-types, most of which contain much less uranium than does true granite.

As admitted by the author of 'Granite and Radon', there have been no direct measurements of radon release from granite countertops. Model calculations suggested by Dr. Richard Wanty, using a standard, scientifically accepted approach and conservative assumptions, indicate that the radon release from a granite countertop is orders of magnitude below detection by any known analytical method. Incidentally, Dr. Wanty, who is a geochemist with the U.S. Geological Survey, co-authored or co-edited four of the expert references cited in the author's bibliography. He has performed research and published on the geochemistry of radioactive elements for sixteen years, and studied radon as apublic health issue since 1986. Dr. Wanty's worksheet reproduced below may be used to calculate the concentration of radon that would be released from a granite countertop. The worksheet is shown with an example calculation, assuming a ten-foot by seven-foot granite countertop.

The EPA standard, which is not to be exceeded in indoor air, is 4 picoCuries per liter of air (4 pCi/L). Eisenbud 1 indicates that the average contributions of radon from various sources to indoor air are 1.5 pCi/L from the soil (under and around the house), 0.01 pCi/L from public water supplies (0.4 pCi/L) from private wells), 0.05 pCi/L from building materials, and 0.2 pCi/L from outdoor air. These values are for the average house which is ventilated such that over one hour the air is changed 0.5 to 1.5 times. The vanishingly small amount of radon in household air that might be released from a granite countertop (0.00000074 pCi/L) as computed below, has been calculated assuming no exchange of indoor and outdoor air, which would further trivialize its significance. Note also that the radon content of outside air is 270,000 times greater than that released by the countertop.

There are certain properties of rocks that can increase their radon emanation efficiency, or in other words increase the release of radon from a given weight of rock. These are rock properties that maximize the exposure of internal or external rock surfaces to water or air, allowing any radon gas to escape. The author of 'Granite and Radon' argues that such properties, which include rock porosity, fissuring and mylonitization, will increase radon releases. This is probably true, however, a granite with such properties would be too brittle to make into a countertop, and too open to take a polish, and so would not be marketable as a countertop - unless the rock pores were first filled with a chemical sealant. Such sealing would also eliminate any possible radon release problems.

In summary, to show how laughable are the concerns expressed in 'Granite and Radon', the typical granite countertop in our example will release 7.4 x 10 -7 pCi/L of air. This corresponds to 2.7 x 10 -8 atom decays per second (dps). This represents 0.85 decays per year. In other words, less than one atom of radon is produced by the countertop in one year. This is hardly worth getting excited about. I would suggest that a good way to reduce our exposure to the radon present in outdoor air, would be to build an air-tight house out of granite countertops!