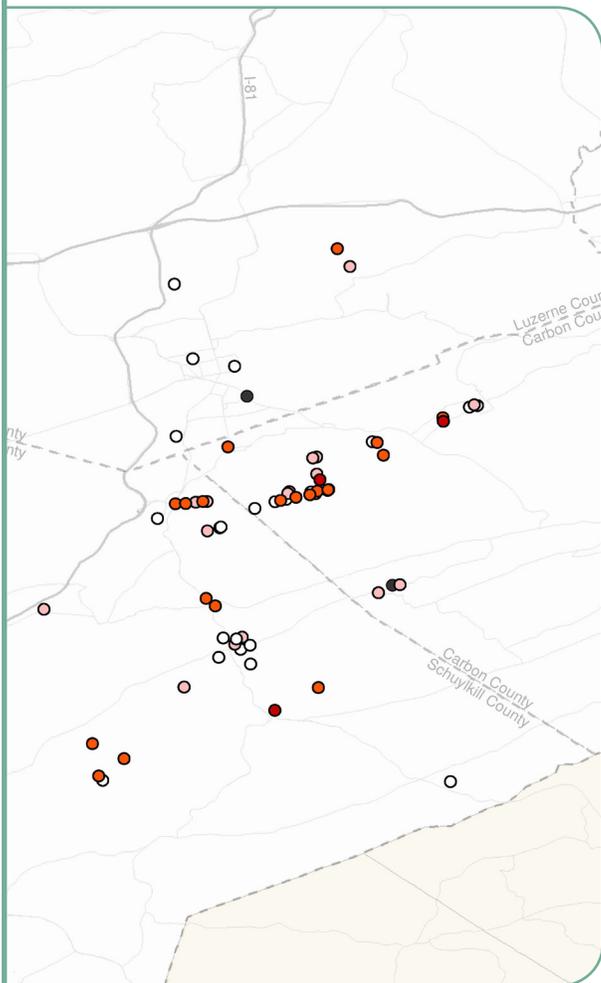


Review of Radiological Environmental Data

Measured in the Polycythemia Vera Investigation Study Area in Carbon, Luzerne, and Schuylkill Counties, Pennsylvania



This fact sheet summarizes the findings of the Agency for Toxic Substances and Disease Registry (ATSDR) public health report on an initial set of radiological environmental sampling results. These results were collected from the Polycythemia Vera (PV) tri-county cluster area in Carbon, Luzerne, and Schuylkill Counties in Pennsylvania.

Environmental samples from the cluster area were collected as a component of the overall research investigation into the PV disease cluster:

- Indoor air was analyzed for radon.
- Soil, sediment and water samples were analyzed for metals, organic compounds, and radioactive substances.

This ATSDR public health report focuses on an initial set of the radiological environmental sampling information. Additional reports evaluating other environmental and health information from the PV investigation will be released at a later date.

The Agency for Toxic Substances and Disease Registry (ATSDR), a federal public health agency, finds elevated levels of radon gas in indoor air in some homes and slightly elevated levels of radium in soils and recommends residents have their homes tested for radon gas.

Background

In 2004, using state cancer registry records, the Pennsylvania Department of Health (PAHOH) found a PV cluster in northeast Pennsylvania. PV is part of a disease group called myeloproliferative neoplasms (MPN), which is a group of slow-growing blood cancers where the bone marrow makes too many red blood cells, white blood cells, or platelets.

In 2006, ATSDR was asked to help study PV patterns in the area. From 2007-2008, ATSDR reviewed medical records, conducted genetic testing, and confirmed this PV cluster.

In 2009, Congress funded ATSDR to continue this investigation. ATSDR is overseeing 18 projects with PAHOH, the Pennsylvania Department of Environmental Protection (PADEP), and various universities and private organizations. These projects are based on recommendations from an expert panel. The panel identified four areas for investigation: epidemiology, genetics, toxicology, and environmental studies.

Health Consultation Document: Review of Radiological Samples

In this component of the overall PV cluster investigation, ATSDR asked the PADEP to collect and analyze environmental samples from within the tri-county area. PADEP collected these environmental samples in 2011 and 2012. ATSDR then evaluated public health exposures to the radiological elements found in these environmental samples. Samples were collected from:

- Residential yards (soil)
- Streams near industrial areas (sediment)
- Private drinking water wells, streams, mine pool drainage and monitoring wells (water)
- Inside people's homes (indoor air)



How does ATSDR determine if there is danger to human health?

What is radioactivity? Radioactivity or radioactive decay is a natural, spontaneous process in which an atom of one element decays or breaks down to form another element emitting energy in the form of particles or waves in the process.

Exposure Pathways

ATSDR must first find out whether there is a way that people could come into contact with a hazardous substance (a completed exposure pathway to that substance). Without contact with a hazardous substance, a person cannot be harmed.

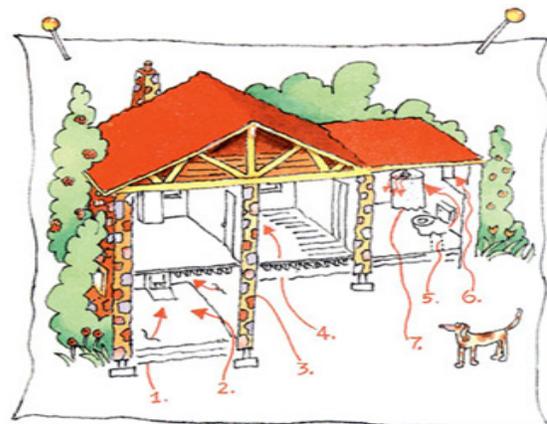
For this evaluation, ATSDR determined that there is a completed exposure pathway of public health concern for residents who come in contact with radon gas found in the indoor air and groundwater in the area. A completed exposure pathway also exists for residents exposed to the radiological elements radium 228 and radon (which arises from radium 226) detected in area soils. These radiological elements are found naturally in the environment but their levels may also be enhanced because of manmade activities.

What is radon gas? Radon is a radioactive gas produced by the radioactive decay of the element radium 226.

Radon in Your Home

Radon travels through:

1. Cracks in solid floors
2. Construction joints
3. Cracks in walls
4. Gaps in suspended floors
5. Gaps around service pipes
6. Cavities inside walls
7. The water supply



"A Citizen's Guide to Radon. U.S. EPA/OAR/IED (6609J) EPA 402-K-12-002, May 2012. <http://www.epa.gov/radon/pubs/citguide.html>

Assessing Health Effects

Exposure to radiation does not always result in harmful health effects. Whether a health effect occurs depends on the amount, the type and the length of time a person is exposed to the radiological elements. How a person is exposed to radiological elements (drinking, touching or breathing), and the person's characteristics (such as age, genetic factors) are also important factors.

What did ATSDR find out about the safety of the tested water, soil and air?

Radon gas in indoor air and water

Some houses had elevated levels of radon gas in indoor air. Radon gas was also found in private well water at some homes. Radon can be inhaled from the air or ingested from water. Breathing radon increases the chances of lung cancer. Drinking water with high levels of radon gas may be associated with stomach cancer. However, this risk is much less than the risk of lung cancer from breathing radon gas.

Radium in soils

ATSDR found slightly elevated levels of radium in soils from the study area. This element is naturally occurring and found in soils outside the study area too. ATSDR did not see a public health concern related to direct contact with soils or by eating garden produce grown in soils when just one of these occurs. However, when combining these two soil exposure pathways, ATSDR estimated a dose above a screening level indicating additional evaluation was necessary. This combined dose is about 3.5 times higher than the estimated averages for radiological doses from soils nationally. These levels in soil are not likely to make a person sick. However, because we are interested in understanding more about the PV cluster in this area, these soil results may warrant further study.

What is radium? Radium is a naturally occurring radioactive metal. Radium is a natural element formed by the decay of uranium (U) and thorium (Th) in the environment. It occurs at low levels in virtually all rock, soil, water, plants, and animals.

What recommendations did ATSDR make?

Radon in indoor air

ATSDR recommends all residents have their homes tested for radon gas. Houses with radon levels of 3.5 picocuries per liter (pCi/L) or higher should be retested. Testing should be done in multiple locations within the home including the basement, especially if the basement is occupied.

If the retest indicates elevated levels of radon, residents should contact the PADEP Radon Hotline at 1-800-237-2366. Residents should ask for information on how to reduce their exposures to radon gas.

Radon in water

People in homes with high levels of radon in their drinking water should contact the PADEP Radon Program for assistance. Your home's water supply can be treated in one of two ways; point-of-use (at the faucet) or point-of-entry (main water supply into the home). Point-of-entry treatment for the whole home can effectively remove radon from the water before it enters your home's water distribution system. Point-of-entry treatment usually employs either granular activated carbon or GAC filters, water softeners, or aeration systems. While GAC filters usually cost less than aeration systems, filters can collect radioactive materials and may require a special method of disposal.



Both GAC filters and aeration systems have advantages and disadvantages that should be discussed with your state radon office or a water treatment professional (<http://www.epa.gov/radon/pubs/consguid.html#radoninwater>). Similarly, point-of-use systems can be used and function like the point-of-entry systems. In this case, the systems are much less expensive and only treat the water that is used from the faucet.

Radium in soils

ATSDR recommends that in those areas where radium in soils seems to be elevated, additional sampling may be helpful to further understand this exposure pathway. ATSDR will discuss the potential for a future collaboration with the U.S. Geological Survey to further evaluate levels of radiological contaminants in environmental media in the study area.

Is PV related to radiation exposures?

There is strong scientific evidence of a relationship between high exposures to some of the radioactive elements found in these environmental samples and certain types of cancers. Specifically, radon gas in air is associated with lung cancers, and radium is linked to bone cancers at concentrations thousands of times higher than levels found in this set of samples. However, ATSDR reviewed the medical literature and found only one peer-reviewed scientific article relating radiation exposure as a risk factor for PV. At this time, without additional information, ATSDR cannot determine if the PV disease cluster in the tri-county area is related to the radiological exposures observed in this first set of environmental sampling information. However, future investigators may wish to study this question further.

Next Steps

When the results from all of the ongoing research projects under this investigation are available, ATSDR will review this information and will plan a public forum to share and discuss the results with interested stakeholders.

ATSDR will continue to discuss the potential for a future collaboration with USGS to further evaluate levels of radiological contaminants in environmental media in the study area.

For more information:

Visit ATSDR's Web page on PV:

http://www.atsdr.cdc.gov/sites/polycythemia_vera

Call ATSDR's toll-free PV information line: 1-866-448-0242 or email jcx0@cdc.gov, which will connect you to Dr. Elizabeth Irvin-Barnwell, ATSDR Division of Toxicology and Human Health Sciences.

Contact Lora Siegmann Werner, ATSDR Region 3, by phone at 1-215-814-3141 or by email at lkw9@cdc.gov.