Campus natural gas power plants pose no radon risks

February 6 2017

Cutting torches are used to take down support beams during the removal of old boilers from Penn State's power plant in preparation for the facility's conversion to natural gas in 2014. A recent study by Penn State researchers found the power plant conversion resulted in no health risks from radon, which is found in natural gas. Credit: Patrick Mansell, Penn State

When Penn State decided to convert its two power plants from their historic use of coal as a source of energy to natural gas, there was concern about radon emissions. Although radon is known to exist in natural gas, now Penn State research indicates that it does not escape from these two power plants in harmful amounts.

By converting the West Campus Steam Plant on the University Park Campus, Penn State reduced its greenhouse gas emissions at the plant by nearly 40 percent, but the University wanted to make sure that the conversion was not causing a significant increase of radon levels in the atmosphere. Penn State also operates a second power plant on the East end of campus near its football stadium.

A two-year study on the radon concentrations associated with burning natural gas, commissioned by Penn State's Office of the Physical Plant and conducted by University researchers, concluded that the plants posed no radon-related health risks. The results were published in the *Journal of the Air & Waste Management Association*.

Radon, a product of decaying uranium, is the second leading cause of lung cancer in the U.S. It is a naturally occurring radioactive gas that leaches from the Earth's crust and can concentrate in basements and other structures. Studies conducted by the U.S. Geological Survey confirmed radon's presence in natural gas, where extraction is from uranium-rich areas, such as the Marcellus Shale region.

The Penn State researchers confirmed that the natural gas utilized on campus contains an elevated concentration of radon, but the scientists could not detect elevated concentrations downwind of the two campus power plants. The reasons for that, according to Kenneth Davis, professor of atmospheric and climate science, is radon's speedy half-life of 3.8 days and the dispersion of the emissions into the atmosphere around the power plants.

Contractors remove 50-year-old boilers at Penn State's West Campus Steam Plant. The existing boilers in 2014 were deconstructed and removed for the facility's transition to natural gas. A recent study by Penn State researchers found the power plant conversion resulted in no health risks from radon, which is found in natural gas. Credit: Patrick Mansell, Penn State

"Once the radon is emitted into the atmosphere from the stacks at the power plants, it is rapidly diluted," said Davis. "Dispersion into the atmosphere is why you typically don't hear concerns about radon outside of a basement or other enclosed area. But no one had studied this issue downwind of a power plant burning a large amount of natural gas, and the University wanted to make sure that the plants weren't causing any health problems."

For the study, four sites were chosen at each of the University's two power plants. Researchers charted radon levels downwind from the plants for months, contrasting the data with upwind measurements. Radon levels also were measured in the natural gas at the power plants before combustion, and were found to be as high as 30 picocuries per liter—about eight times the acceptable level for annual exposure.

"We measured the wind direction and applied a simple dispersion model and determined how much radon we should see downwind from what was estimated to be coming out of the power plant stack," said Davis. "The numbers were well below our detection level. The measurements also showed no evidence that radon downwind was elevated due to emissions from the power plant."

Some radon exists in the atmosphere naturally, so even though the scientists found no detectable emissions from the power plants, concentrations of radon in the atmosphere around campus were not zero. But the field measurements consistently reported radon levels far below levels considered a health threat. The research suggests that power plant combustion of natural gas is not likely to pose a health hazard unless much higher gas radon concentrations or much smaller combustion dilution ratios are encountered.

The Penn State station of the SURFRAD (Surface Radiation) Network of NOAA's Earth System Research Laboratory collected radiation data while the Department of Meteorology's weather station at the Walker Building collected the wind data.

Alison Stidworthy, a former graduate student in the Department of Meteorology, now is a site manager for the New Jersey Department of Environmental Protection, led the research effort, which was the topic of her master's degree thesis. Jeff Leavey, former radon safety officer for OPP at Penn State, also contributed to the research, which was funded

by Penn State.

Provided by Pennsylvania State University