

Geologic Hazards

Earthquake

General

Earthquakes are very rare in Pennsylvania and have caused little damage, with no reported injuries or casualties. Earthquakes that do occur in Pennsylvania happen deep within the earth’s crust. This is because the Commonwealth does not lie on an active fault. In most cases, these earthquakes are non-measurable events. Nonetheless, earthquake standards are a valuable consideration when determining building codes. The Richter Scale below describes the magnitude of earthquakes.

**Table C.10
The Richter Scale**

Descriptor	Richter Magnitude	Earthquake Effects	Worldwide Annual Average
Micro	Less than 2.0	Micro-earthquakes, not felt.	About 8,000/day
Very Minor	2.0-2.9	Generally not felt, but recorded.	About 1,000/day
Minor	3.0-3.9	Often felt, but rarely cause damage	49,000 (estimated)
Light	4.0-4.9	Noticeable shaking of indoor items, rattling noises. Significant damage unlikely.	6,200 (estimated)
Moderate	5.0-5.9	Can cause major damage to poorly constructed buildings over small regions. At most slight damage to well-designed buildings.	800
Strong	6.0-6.9	Can be destructive in areas up to about 100 miles across in populated areas.	120
Major	7.0-7.9	Can cause serious damage over larger areas.	18
Great	8.0 or greater	Can cause serious damage in areas several hundred miles across	1

Source: U.S. Geological Survey (USGS)

History

No significant earthquakes have been recorded in Perry County. Parts of southeastern Pennsylvania, such as Lebanon and Berks Counties, have experienced minor earthquakes with minimal damage.

Vulnerability

Perry County has a low vulnerability to earthquakes. No significant earthquakes have been documented in County history.

Probability

The probability of an earthquake affecting Perry County is extremely low, with a probability of occurrence once every 30 years or less. While Perry County does not lie on a major fault line, it is still possible the County could experience minor, unrecorded quakes with minimal to no damage.

Maximum Threat

Because Perry County does not rest on a major fault, no single area is at greater risk of an earthquake than another.

Secondary Effects

The secondary effects of an earthquake can range from nominal to severe, based on its location and magnitude. Even minor quakes have the potential to cause power outages, hazardous material spills, dam failures, traffic accidents, and landslides. The economic impact from widespread structural damage to property, facilities, and infrastructure can also be severe. The health and safety of citizens and essential personnel in the affected area can be adversely affected. A limited disruption of critical government services may occur.

Landslides

General

Landslides are a natural movement of the earth downward and outward of a slope forming materials reacting to the force of gravity. Slide materials may be composed of natural rock, soil, artificial fill or a combination of these materials. The term landslide is generally associated with rock falls, rockslides, block glide, debris slide, earth flow, slump and other such terms. Also, landslides can result from heavy storms and earthquakes. Although there are no recorded deaths or injuries from landslides in Pennsylvania, this does not mean they will not occur. By most accounts, the worst damage caused by landslides usually affects utilities, pipelines, roadways, and buildings.

History

Landslide history is not as well documented as other hazards, primarily because landslides are not always seen. Landslides have occurred throughout Pennsylvania and have caused minor to major damage. While no significant landslides have been documented in Perry County, landslides are a considerable geologic hazard that can occur in any area under specific local conditions. The Pennsylvania Department of Transportation estimates it spends \$10 million annually on repair contracts for roadways damaged by landslides throughout the Commonwealth.

Vulnerability

The total number of landslides and their damage in Pennsylvania is unknown. Reporting of landslides varies widely from county to county. Landslides are most often seen in Allegheny, Armstrong, Beaver, Tioga, and Washington Counties. Most landslides occur as a result of heavy precipitation. Also contributing to this is the removal of vegetation, changing the slope of a hillside, and earthquakes. Perry County has a low level of landslide incidents.

Probability

There is a relatively low probability that a landslide will significantly affect Perry County. History shows a frequency of occurrence once every 30 years or less. These landslides have primarily been the result of a period of heavy rains, which caused material to become unstable. While susceptibility and probability may be low in Perry County, minor landslides resulting in little to no damage may occur more frequently.

Maximum Threat

Although unlikely in Perry County, landslides are most likely to occur along high-volume traffic areas, especially where the road travels through a cut in the topography.

Secondary Effects

Similar to earthquakes, the secondary effects from a landslide can include traffic disruptions and accidents. These events can also lead to power outages and hazardous material spills.

Radon

General

Radon is a naturally occurring, colorless, odorless, inert, radioactive gas. It forms as a product of the natural decay of uranium. Radon and its radioactive products are dangerous to health. Alpha particles are a probable cause of lung cancer. Studies done in Pennsylvania since 1984 show that indoor radon levels are dependent on the radon-emanation properties of soil and rock where a home is built. The table below, completed by the Pennsylvania Department of Environmental Protection (DEP), Bureau of Radon Protections, suggests guidelines to reduce radon exposure levels to 0.02 Working Levels (WL) or less. Conversions from WL to pCi/L are usually approximate. A level of 0.02 WL is usually equal to about 4 pCi/L in a typical home.

**Table C.11
Radon Guidelines**

If your home measures*	Suggested Action**	Time Frame for Plan
more than 5.0 WL	Residents should either promptly relocate or undertake temporary remedial action to lower levels as far below 5.0 WL as possible. Smoking in high areas discouraged.	Within 2-3 days

1.0 to 5.0 WL	Residents should undertake temporary remedial action to lower levels as far below 1.0 WL as possible. Smoking in high areas discouraged.	Within 1 week
0.5 to 1.0 WL	Residents should undertake temporary remedial action to lower levels as far below 0.5 WL as possible.	Within 2 weeks
0.1 to 0.5 WL	Residents should undertake temporary remedial action to lower levels as far below 0.1 WL as possible. Higher exposure levels require action to be taken in a shorter period of time.	3 weeks to 3 months
0.02 to 0.1 WL	Residents should undertake temporary and/or permanent remedial action to lower levels below 0.02 WL. Higher exposure levels require action to be taken in a shorter period of time.	4 to 15 months
<p>* Assumes continuous 24-hour exposure in living area.</p> <p>** Home testing should be conducted at the end of the indicated time frame to determine if remedial action has reduced the radon danger exposure levels below the indicated value. If remedial action has not been successful, residents should be aware of the risks associated with continuous exposure at the indicated levels.</p>		

Source: Pennsylvania Department of Environmental Protection

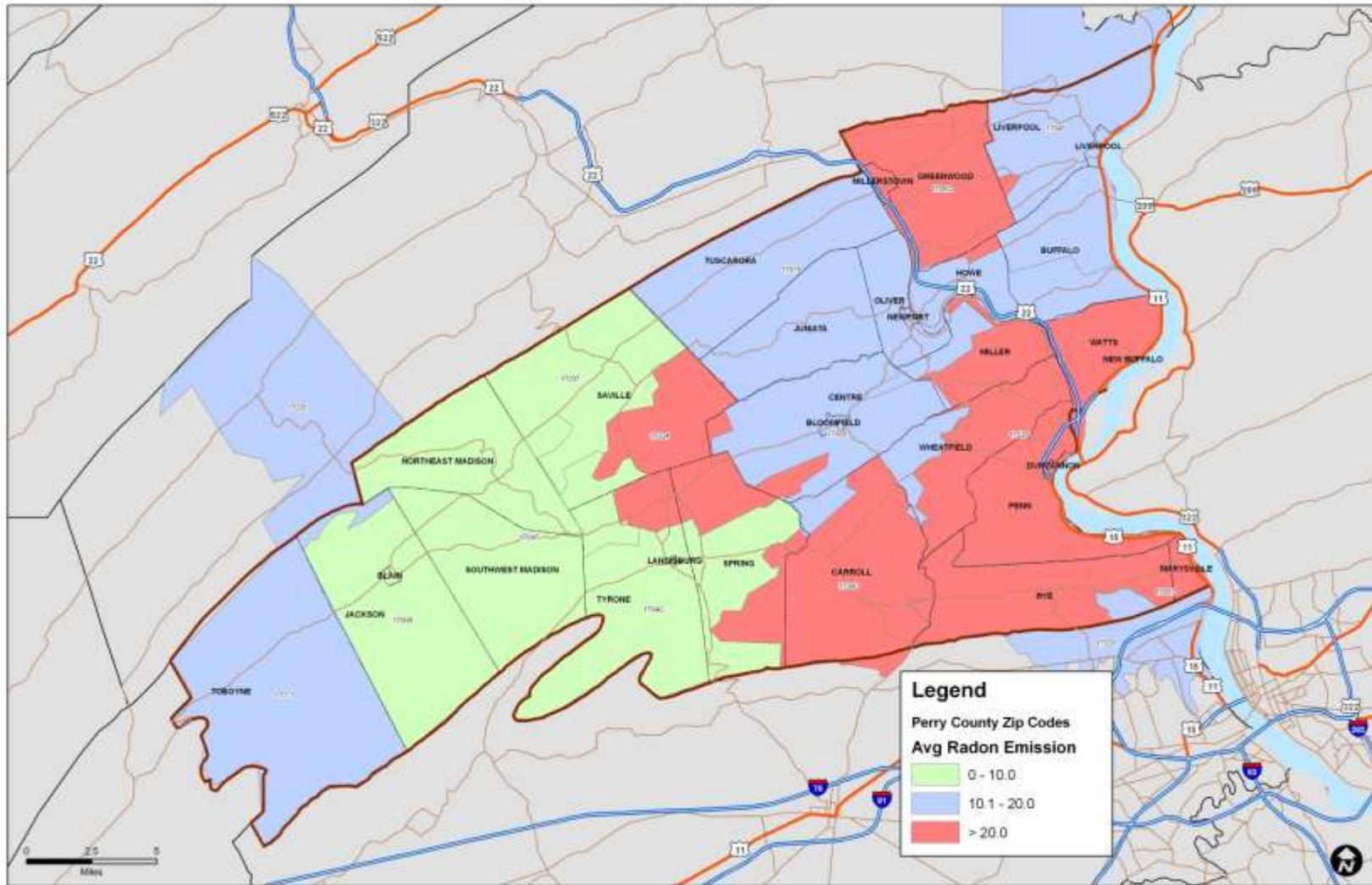
History

In 1984, the Pennsylvania Radon Bureau responded to the highest level of Radon danger levels ever reported in the Commonwealth with a massive radon monitoring, educational, and remediation effort. As of November 1986, over 18,000 homes had been screened for radon and approximately 59 percent were found to have radon daughter levels in excess of 0.02 Working Level guidelines. Radon danger levels (concentration of decay products of radon in the uranium chain) ranged up to 13 Working Levels (WL) or 2600 pCi/L (pico Curies per liter) of radon gas. While individual instances of radon are not well documented, no individual location can be assumed safe unless proven so by testing.

Vulnerability

The following map illustrates the average radon levels for the zip codes of Perry County, measured by the Pennsylvania Department of Environmental Protection. The EPA recommends that homeowners take action to reduce their home indoor radon levels if their home's test is 4pCi/L (pico Curies per liter) or higher.

Perry County Radon Zones



Source: PA Department of Environmental Protection

Probability

There is a high probability for radon emission in Perry County. No area should be assumed safe until tests have proven so. The EPA recommends homeowners take action to reduce their home indoor radon levels if their home's test is 4 pCi/L (pico Cures per liter) or higher.

Maximum Threat

All Perry County municipalities, except for the Ickesburg zip code area of 17037 are at risk for radon gas emission with average results greater than 4.0 pCi/L. Only areas that have been tested and found safe can be assumed to not be susceptible to the effects of radon gas emission.

Secondary Effects

Radon often goes undetected and unnoticed because it is colorless and odorless, and many homes have never undergone testing. Because of this, the secondary effects are more difficult to identify and track. However, radon is known to have adverse short- and long-term effects on the health and safety of persons affected, and is widely believed to be a probable cause of lung cancer

Subsidence and Sinkholes**General**

Subsidence is caused by the removal of ground water or other resources from the ground. Sinkholes are a natural hazard caused by erosion underground. The difference between subsidence and sinkholes is that subsidence is a manmade hazard, while sinkholes are naturally occurring. The United State Geological Survey states that sinkholes are a characteristic of karst topography that results from dissolution and collapse of carbonate rock, such as limestone and dolomite. It is characterized by closed depressions or sinkholes, caves, and underground drainage.

History

Sinkholes are a problem throughout Pennsylvania. The United States Geological Survey states that sinkholes have been most dangerous and frequent in Florida, Texas, Alabama, Missouri, Kentucky, Tennessee, and Pennsylvania. While the U.S. Geological Survey has no recorded sinkholes in Perry County, this does not mean one does not exist. Perry County's volumes of limestone rock make it susceptible to sinkholes.

Vulnerability

Subsidence and sinkholes strongly correlate to the distribution of carbonic rock. However, not all areas underlain by carbonate bedrock, such as limestone, are at risk. According to the PA Department of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey, no sinkholes exist in Perry County. Yet, because of the limestone rock formations located in Perry County, there is still the possibility that subsidence or a sinkhole could occur.

Probability

The potential for subsidence or sinkholes to occur in Perry County is relatively low. Often, these events occur once every 30 years or less with a low impact. There is even less potential for a severe event.

Maximum Threat

Although extremely unlikely, much of Perry County is susceptible to sinkholes, due to its geological makeup. Maximum threat would occur in areas that are underlain with carbonate rock, such as limestone.

Secondary Effects

Sinkholes occur without warning and can damage homes, community facilities, and critical infrastructure, such as road networks, and can cause traffic disruption, accidents, and pipeline breaks. Accidents and pipeline breaks can introduce hazardous materials into the affected area.