# Health & Environmental Impacts Studies

**Safe, Responsible Pennsylvania Natural Gas Development**

Research confirms natural gas is safely and responsibly developed in Pennsylvania. It is a testament of the industry's commitment to excellence and willingness to work alongside regulators and other stakeholders to ensure we are providing the energy to power society while adhering to the highest of environmental standards.

## Air Quality

*As Pennsylvania is firmly positioned as America's second largest natural gas producing state, the abundance of this resource has helped reduce emissions within our borders and across the country.*

- Air quality measurements were collected during all phases of natural gas development, including pad construction, drilling, completions, flowback and production phases.
    - "The results…show that emissions from responsible CNX natural gas development measured to date fell well below science based air quality standards that are designed to protect the public from negative health effects resulting from emissions of PM 2.5 and BTEX." CNX Radical Transparency Assessment Report - August 14, 2024.

- Appalachia – despite being the largest producer – has among the **lowest methane emission intensity of all major oil and natural gas basins in the country.**
  *Benchmarking Methane and Other GHG Emissions of Oil & Natural Gas Production in the United States, Clean Air Task Force, Ceres (June 2021)*

- Rystad Energy's analysis reveals CO2 emissions intensity levels in the Appalachian Basin are "best-in-class" in America. Rystad Energy's Scope 1 upstream emissions analysis shows Appalachia is the top region in the country, with 7.1 kg of CO2 per barrel of oil equivalent (boe) in 2020.
    - "Such a level of CO2 intensity performance **brings Appalachia to the top quartile among all oil and gas fields globally**. As the basin becomes more mature and modern ESG best practices are implemented, we anticipate Appalachia to improve further in its CO2 intensity dimension in the next three to four years." – *Emily McClain, Sr. analyst, Rystad Energy*
      *A gas boom is coming in the US: A closer look at Haynesville and Appalachia, Rystad Energy (April 2021)*

- Pennsylvania had the highest absolute decline of energy-related CO2 emissions (42.4 MMt) of any other state from 1990 to 2018, resulting in a more than **16% reduction** over this time period.
  *State Energy-Related CO2 Emissions by Year, Energy Information Administration (March 2021)*

- "Our results clearly suggest that [natural gas] is a clean source of energy. And on top of that, we can suggest a lot of gas with a very low leakage overall from the infrastructure." – Co-author Thomas Lauvaux during a 2017 Penn State webinar on the study.

*Quantifying methane emissions from natural gas production in north-eastern Pennsylvania, Barkley et al. (2017)*

- "All individual [volatile organic compound] concentrations in the monitored area were **well below health-protective levels**."
  *Air monitoring of volatile organic compounds at relevant receptors during hydraulic fracturing operations in Washington County, Pennsylvania (2016)*

- An ambient air monitoring program conducted by an independent third-party throughout all phases of development of a shale gas well site determined the data "***does not indicate that Augustine well pad air emissions contributed to elevated increases in long-term average concentrations of potential health concern for either particulate matter (PM 2.5) or the measured volatile organic compound (VOC) species.***"
  Journal of Exposure Science and Environmental Epidemiology (*December 2021*)

## Water Quality

*Water is a key component to the unconventional natural gas development process, and numerous scientific studies have proven natural gas poses no threat to area water quantity or quality.*

- "Natural gas development has had no discernable impact on water quality in the Susquehanna River Basin."
  *Susquehanna River Basin Commission - Remote Water Quality Monitoring Network (June 2019)*

- "Collectively, our observations suggest that [**shale gas development] was an unlikely source of methane** in our valley wells."
  *Methane in groundwater before, during, and after hydraulic fracturing of the Marcellus Shale, Yale University (July 2018)*

- "Based on consistent evidence from comprehensive testing, we found no indication of groundwater contamination over the three-year course of our study."
  *Duke University Study (Commissioned by NRDC) (2017)*

- "The most interesting thing we discovered was the groundwater chemistry in one of the area's most heavily developed for shale gas – an area with 1400 new gas wells – **does not appear to be getting worse with time, and may even be getting better.**"
  *Bradford Co. water quality improves; impacts rare near shale gas wells, Pennsylvania State University (June 2018)*

- "We found **no relationship between CH4 concentration or source in groundwater and proximity to active gas well sites**."
  - "Our data do not indicate any intrusion of high conductivity fracking fluids as the number of fracking wells increased in the region."
    *Monitoring concentration and isotopic composition of methane in groundwater in the Utica Shale hydraulic fracturing region of Ohio, University of Cincinnati (May 2018)*

# Public Health

*As an industry deeply committed to protecting the health, safety and environment of our communities, we support fact-based and objective scientific research, and the data shows natural gas development is not a threat to community health and safety.*

- "The drop in natural gas prices in the late 2000s, induced largely by the boom in shale gas production, **averted 11,000 winter deaths** per year in the US."
  *Inexpensive Heating Reduces Winter Mortality, National Bureau of Economic Research (March 2019)*

- "Studies tying shale development to negative public health impacts used imprecise measures, failed to consider other possible factors, and, in some cases, were poorly designed."
  *Potential Human Health Effects Associated with Unconventional Oil and Gas Development: A Systematic Review of the Epidemiology Literature, Health Effects Institute (September 2019)*

- "Overall, there are conflicting findings across studies resulting in either mixed or insufficient evidence of adverse birth outcomes associated with living near ONG operations during pregnancy."
  *A Systematic Review of the Epidemiologic Literature Assessing Health Outcomes in Populations Living near Oil and Natural Gas Operations: Study Quality and Future Recommendations, Pa. Department of Health and the Colo. Department of Public Health & Environment (June 2019)*

- "Incidence rates…were not consistently and statistically significantly higher than expected in all three time periods analyzed." "EFOT incidence rates for both males and females were lower [in Washington County] than the rest of the state for all three time periods and were not statistically significant."
  - "Childhood cancer incidence rates in the school district decreased during the last two time periods."
  - *Ewing's Family of Tumors, Childhood Cancer, and Radiation-Related Cancer Incidence Review for Washington County and Canon-McMillan School District in Pennsylvania, Pennsylvania Department of Health (April 2019)*

- "There is little potential for harm to workers or the public from radiation exposure due to oil and gas development."
  - "There is little or limited potential for radiation exposure to the public and workers from the development, completion, production, transmission, processing, storage, and end use of natural gas."
  - "There is little potential for radiation exposure to the public and workers from landfills receiving waste from the oil and gas industry."
    *DEP Study Shows There is Little Potential for Radiation Exposure from Oil and Gas Development*, Pennsylvania Department of Environmental Protection (2015)

- An average American is exposed to about 620 mrems/year; comparatively, exposure to workers at an oil and/or gas well site is expected to be less than 30 mrems. These exposure numbers "has not been shown to cause humans any harm."
  *Doses in our Daily Lives*, Nuclear Regulatory Commission