



Fact Sheet

HARVARD STUDY USES NEW METHOD TO SHOW HOW CLOSE RESIDENTS LIVE TO ALISO CANYON-TYPE WELLS

A [study published in the *Journal of Environmental Health*](#) from the Center for Climate, Health and the Global Environment (Harvard C-CHANGE) at the Harvard T.H. Chan School of Public Health found that people live much closer to underground natural gas storage wells than previously thought. An estimated 20,000 homes and 53,000 people in predominantly suburban areas of PA, OH, WV, MI, NY, and CA live within a city block of active underground natural gas storage wells.

Summary:

- For the first time outside of California, researchers looked at how many people live near underground natural gas (UGS) wells in six U.S. states: PA, OH, WV, MI, NY, CA.
- The results show that more than half (~65%) of the Aliso Canyon-style gas storage wells in the United States are located in residential suburban areas—not commercial, industrial, or even rural areas like many new unconventional wells.
- The data shows that 53,000 people across six states are living within 650 ft. of UGS wells, the length of an average city block.
- 41% of the active UGS wells assessed had at least one home within 650 ft. indicating the unique land use conflicts presented by UGS systems.
- The new household-level population estimation method developed by researchers provides a clearer picture of the midstream energy infrastructure we rely upon—often hidden from sight—and shows the potential health and safety risks for people living within active gas storage fields.
- Gas storage accidents have caused fatalities, fires and explosions, exposure to noxious odors, tropospheric ozone production, and releases of greenhouse gases that accelerate climate change.
- With this study, it is now possible to observe the exact location of houses in proximity to the wells. This kind of precision wasn't available before, and the method could be useful for other environmental hazards of concern such as air pollution, noise, explosion hazards, flooding, and sea level rise, among others.

Background: This study provides new information regarding how close homes and residents are to active UGS wells that are predominantly located in suburban areas. From a public health and safety standpoint, distance from any type of stressor is an initial key determinant of risk of harm or safety. With this new method that captures physical households near wells, more accurate estimates of populations at risk can be made. The study found tens of thousands of homes and residents are likely located within a proposed UGS Wellhead Safety Zone, and in some cases within state oil and gas well surface setback distances, which determine how far away an active oil or gas well must be from a residence.

Previous [Harvard C-CHANGE research](#) set out to learn how many wells across the U.S. were operating in a similar fashion to the well in Aliso Canyon, California. Not long after we released our study, the federal government required all well facilities report on this and the actual number is closer to 4-in-5 wells or over 10,000—many of which are throughout PA, OH, WV, NY, MI, and CA.

The blowout at the Aliso Canyon natural gas storage well in 2015 was one of the worst environmental disasters in U.S history. It went on for 118 days in 2015 and 2016—25 days longer than the Deepwater Horizon oil leak in the Gulf of Mexico—and released nearly 100,000 metric tons of methane and



numerous other hazardous air pollutants. Thousands of residents in the nearby Porter Ranch evacuated after experiencing headaches, rashes, nosebleeds, and associated costs now exceed \$1 billion.

Underground gas storage wells are different from typical producing wells in that they operate at much higher pressures than producing wells, and recent obsolescence issues identified at many facilities (e.g., single point of failure well designs), have placed new scrutiny on the hazards they may pose to nearby populations. Another unique aspect of gas storage facilities is that, decades ago, they were intentionally sited on the outskirts of cities to support timely supply and demand fluctuations. In observing that these areas likely have experienced significant nearby population growth in our first study, we set out to better understand the consequences of a loss of containment event similar to Aliso Canyon by developing a new method to explicitly count how many homes and people now live very near these storage fields.

Main Takeaways

- For the first time, researchers looked at the locations of 9,384 underground natural gas storage wells in six U.S. states (PA, OH, WV, MI, NY, CA) and how many people live near them using a new spatial method.
 - A California-commissioned study recommended that regulators ensure that risk management plans take into account the population density and proximity to UGS facilities, and proposed minimum health-based and fire-safety-based setback distances between facilities and human populations.
- The findings show that 65% of underground natural gas storage wells (over 6,000) are located in suburban areas—not industrial or rural areas, according to a new method for developing population data
 - Most of these UGS wells are over 50 years old and have likely experienced population encroachment, creating a unique land use conflict issue. They are also more likely to have safety risks because they were not designed for storage and therefore likely exhibit vestiges of original construction such as single-point-of-failure wells designs and missing subsurface safety valves. Gas storage has existed for over a century in some parts of the U.S., and while reporting of incidents has not been regulated or standardized, it is estimated that failure rates are on par with other oil and gas extraction activities. A few key differences, however, are the recently identified obsolescence issues such as single-point-of-failure well designs and the relatively high operating pressures (e.g., > 1,000 pounds per square inch).
- Over 20,000 homes and 53,000 people across the six states are living within 650 ft. of UGS wells, the length of a city block. That is 10,000 more people than previous estimates using a Census-only method, which is frequently used by public health researchers.
 - This indicates that tens of thousands of people live on top of active UGS fields that are interspersed with UGS wells of similar design and vintage to the well that failed at Aliso Canyon.
 - 905 households or 2,171 people are within their state's legal setback limit, the distance required to separate wells and homes, ranging from 100 – 300 ft. The rest are living within the recently proposed gas storage wellhead safety zone from [Oak Ridge National Laboratory](#) that was based upon the potential burn radius in the rare event of explosion that are commonly applied to pipelines.



- The largest underestimation occurred in Pennsylvania, where ABODE captured nearly 50% higher populations living within 650 ft. of an active UGS well.
- The new method that was developed increases the spatial resolution of population data down to the household scale. It was accomplished by combining census, address, building, and land use data (named ABODE - Allocation By Occupied Domicile Estimate)
 - ABODE's accounting of physical households confirmed that common Census-only estimation methods can both over- and underestimate populations, and are increasingly less reliable with a smaller search radius - which are the most important spatial relationships from a public health perspective because the closer you live to a well, the higher your health risks to potential leaks.

Why It Matters

One of the recommendations from the Interagency Task Force on Natural Gas Storage Safety (formed after the Aliso Canyon leak) was to collect and analyze the proximity of UGS operations to population centers to help quantify risk. This study is a direct response to that call.

For public – This study furthers our understanding of the sprawling energy infrastructure we rely upon - often hidden from sight.

Surprisingly, a large majority of UGS wells are located in suburban residential areas, not industrial or even rural areas like many new unconventional wells.

To learn if your home is located near one of these wells in

- Pennsylvania, Ohio and West Virginia: <http://maps.fractracker.org/latest/?appid=7e9d30ddd80d4dc89fb6003723010d67>
- Michigan: <http://www.deq.state.mi.us/geowebface/>
- California: <https://maps.conservation.ca.gov/doggr/wellfinder/#openModal/-118.94276/37.10257/6>
- New York: <https://maps.fractracker.org/latest/?appid=7b3635cf558d490888af81d8bfl d4a71>

For Health and safety – There are dangers of living too close to UGS wells. Gas storage accidents have caused fatalities, fires and explosions, exposure to noxious odors, tropospheric ozone production, and releases of climate-forcing gases.

Spatially accurate population data are critical for determining health impacts from many known risk factors. This allows us to better estimate the populations that may be at risk to hazards with well-defined distance decays such as explosions, noise, air pollution, odors, sea level rise, radiation, and flooding.

For Industry – This study can inform risk management plans based on populations that live near infrastructure; this is a direct response to recommendations from the Interagency (DOE and PHMSA) Task Force on Natural Gas Storage Safety. Notably, substantial population encroachment has occurred over the previous decades in most areas assessed.

For policymakers – Many discussions are taking place around protective actions to enact more stringent setbacks—longer distances between where you can put a new well and a nearby occupied buildings. Very



few municipalities and decision makers address new housing development encroaching on existing oil and gas infrastructure (i.e., reverse setback policies), which has likely been occurring around natural gas storage systems.

The [U.S. Department of Energy](#) and the [California Council on Science & Technology](#) have both provided recommendations to reduce the potential of similar Aliso Canyon events occurring in the future.

Climate impacts - According to the Intergovernmental Panel on Climate Change, we have about one decade to cut emissions in half to avoid the worst of our climate crisis. One of the most effective actions we can take to buy more time is to reduce methane (CH₄) emissions; however, U.S. natural gas production grew 11% in 2017—the largest annual increase in production ever recorded. Improving our understanding of the hazards and exposures potentially associated with continued reliance on natural gas can improve our understanding of societal life cycle costs of growing natural gas use.

State By State

Ohio - Of the six states, OH exhibits the most concerning land use conflicts between gas storage infrastructure and nearby homes.

- Certain areas of Ohio in particular exhibit substantial hyperlocal land use conflicts between households and UGS wells—in some cases in front- and backyards.
 - Over half of UGS wells in OH have at least one home within 650 ft.
 - Over 12,000 homes and over 30,000 residents are within 650 ft. of a UGS well in OH

Pennsylvania - Likely many more Pennsylvanian's live closer to gas storage wells than in the other five states assessed.

- The largest underestimation occurred in Pennsylvania, where ABODE captured nearly 50% higher populations living within 650 ft. of an active UGS well.

West Virginia - Over half of WV facilities contain at least one well that contains at least one residence within its setback rule (i.e., exclusion area) of 200 ft.

Michigan - Exhibited the most setback conflicts of the six states assessed, but also has the most stringent setback rule of 300 ft. between well and occupied structure.

New York - Contained the most accurate address data, but had the least accurate well location data.

California - Of the over 9,000 wells examined in the six states, a well in the Playa Del Rey storage field has the most nearby homes and people: 150 homes and 341 people within 200 ft. California does not currently have a state setback rule.

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