

# ORPHANED OIL AND GAS WELLS: Assessing Environmental Impacts



Curtis Shuck of the Well Done Foundation sets up measurements on an orphaned well in Powell County, Kentucky. Completed as a Silurian oil well on an unknown date, current methane emissions are less than 1 g/hour. Many oil wells, especially where open, are low emitters.

## Our Approach—Do the Most Good Efficiently

With funding from the initial phase of the 2021 Bipartisan Infrastructure Law (BIL), the Kentucky Division of Oil and Gas is plugging 627 orphaned wells across 27 counties. Even with much-needed funding, identifying and plugging orphaned wells representing the greatest environmental hazard remains challenging. The large number of wells precludes methane measurements on all wells (see map on back). To address this challenge, we are:

1. Conducting methane emission measurements on a sample set (n=75-100) that is part of the larger population of wells to be plugged. Measurements on the sample set will attempt to reflect the distribution of orphaned wells based on geologic provinces and well subtypes. Well subtypes are based on geologic age of the reservoir and type of produced hydrocarbon (oil versus gas).
2. The above framework allows us to systematically target wells for methane emissions measurements and to assess whether certain subtypes have characteristic emission ranges and tend to be low or high emitters.
3. Using geospatial analysis to assign a hazard ranking based on, for example, proximity to important human and natural resource features and location in flood zones.

## Background

The U.S. has approximately 3.5 million abandoned oil and gas wells, the majority of which occur in Texas, Pennsylvania, Kansas, and West Virginia. Kentucky has about 14,000 known abandoned, or orphaned, wells (see map on back). In Kentucky, the term 'orphaned' is used to describe wells that, after thorough investigation, have no known operator or owner with legal responsibility or the parties are financially insolvent.

Orphaned wells are potential environmental hazards as they can emit methane—a powerful greenhouse gas—and other harmful gasses, such as, volatile organic compounds and hydrogen sulfide. Oil, gas, and brine may also leak into the surrounding soil, groundwater, and surface water. Orphaned wells can impede construction, recreation, farming, and other beneficial land uses. Plugging orphaned wells thus provides a direct opportunity to remove these collective hazards.



Methane measurement on an orphaned oil well in Wolfe County. The chamber with flow meter on top is located on top of 8" casing that is open at the ground surface. The well is located within 100 yards of homes and businesses. There is no completion information (date, reservoir, depth) for the well. Methane emissions for this well were less than 1 g/hour. Such low emission rates typify many open orphaned wells in Kentucky.




## Early Results

Our preliminary measurements of 50 wells, collected in collaboration with the Well Done Foundation, ([welldonefoundation.org](http://welldonefoundation.org)) show that about 25% percent of the wells account for more than 90% of methane emissions (~900 tonnes CO<sub>2</sub>-eq/100 per year). High emitters tend to occur in gas well subtypes suggesting the potential to maximize emissions abatement using the subtype classification.

# Abandoned Kentucky O&G Wells

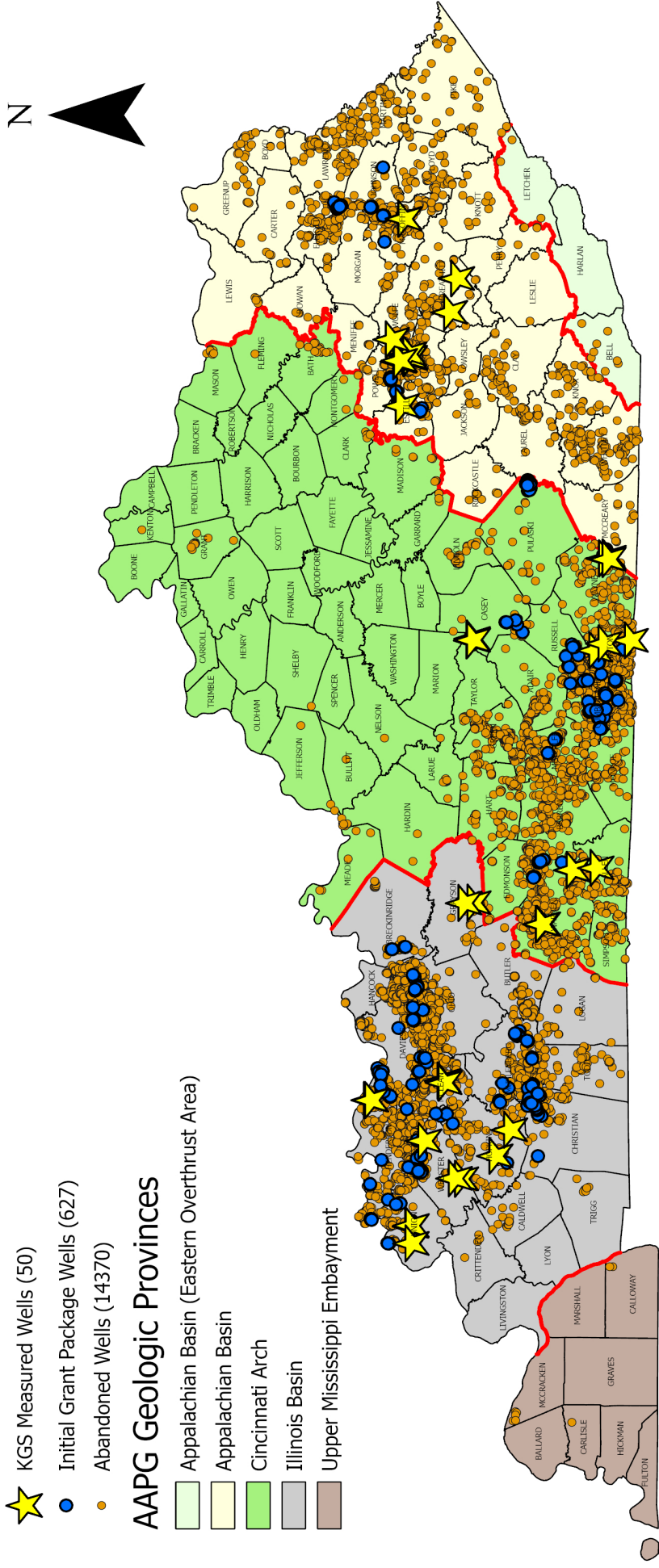
Deron Zierer, Kentucky Geological Survey

## Known Abandoned Wells

-  KGS Measured Wells (50)
-  Initial Grant Package Wells (627)
-  Abandoned Wells (14370)

## AAPG Geologic Provinces

-  Appalachian Basin (Eastern Overthrust Area)
-  Appalachian Basin
-  Cincinnati Arch
-  Illinois Basin
-  Upper Mississippi Embayment



Sources: Kentucky Division of Oil and Gas, Kentucky Geological Survey, American Association of Petroleum Geologists