Orphaned and Abandoned Oil and Gas Wells: Public Health, Climate, Water and Prioritizing the Approaches to Remediation

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Physicians, Scientists, and Engineers for Healthy Energy (PSE) is an energy science and policy research institute focused on the public health, climate and environmental dimensions of energy production and use.

We...

Generate
Translate
Disseminate

Science and put it into the places where it is used to ensure responsible energy policy decision-making
Abandoned Wells in the US: Numbers and Climate

- **3-4 million**: The estimated number of abandoned wells in the US (USEPA; Williams et al. 2020)
- **~2.1 million**: The estimated number of O&A wells that are unplugged (USEPA)
- **~57,000-69,000**: The estimated number of known orphaned wells. There are likely hundreds of thousands more that are undocumented
- **~24 million metric tons CO2e**: The estimated CO2e emitted from abandoned wells in the US. This is more than all of the CO₂ emissions from all NYS power plants in 2017 (Assumptions ~280k MT methane (USEPA); using the 20-year GWP of methane (~86).
Median benzene concentration in string and bradenhead gas from Wyoming = 140 ppm (140,000 ppb) (DiGiulio & Jackson (2016).)

Garcia Gonzales, et al. 2020

Exploration, well pad, and infrastructure construction
No articles identified in review

Drilling of the well and construction of associated facilities
POMs including:
- Naphthalene
- Phenanthrene
- Fluorene
- Indeno(1,2,3-cd)pyrene
- Benzo(g,h,i)perylene
- Dibenz(a,h)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- Benzo(a)anthracene
- Chrysene
- Acenaphthylene

Well stimulation and completion
- 2,2,4-trimethylpentane
- Benzene
- Ethylbenzene
- n-Hexane
- Hydrogen sulfide
- Methyl chloride
- Naphthalene
- POMs
- Toluene
- Xylenes

ONG production and processing
- 1,3-butadiene
- 2,2,4-trimethylpentane
- Benzene
- Cumene
- Ethylbenzene
- Formaldehyde
- n-Hexane
- Hydrogen sulfide
- Mercury
- Methanol
- Styrene
- Toluene
- Xylenes

Storage and impoundments
- 2,2,4-trimethylpentane
- Benzene
- Ethylbenzene
- Hydrogen sulfide
- Methanol
- n-Hexane
- Styrene
- Toluene
- Xylenes

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CEMENT CHANNELING

PRESSURE BUILDS UP

CONDUCTOR PIPE
SURFACE CASING
PRODUCTION CASING

FRESH WATER AQUIFER ZONE
SHALLOW PRODUCING ZONE
INTERMEDIATE PRODUCING ZONE
TARGET PRODUCING ZONE

CASING
CEMENT
FORMATION
Abandoned wells and well infrastructure have the potential to leak into confined spaces. With enough methane and/or NMVOC buildup, explosions can occur. For example:

- Ross Dress for Less Explosion from abandoned well (Los Angeles, CA, 1985)
- Home construction on top of an abandoned well; leak caused explosion (Trinidad, CO, 2007)
- Improperly abandoned pipeline explosion (Firestone, CO, 2017, pictured at right)
Getting the Most Bang for the Buck: Climate, Health and Water Resources.

- High emitting wells (gas and liquid)
- Wells in proximity to human populations
- Wells in proximity to groundwater resources, especially those that meet definition of USDW under the SDWA
Thank you.

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