Community Noise Exposure Near Oil and Natural Gas Well Sites

Noise from Unconventional Oil and Natural Gas Development Human Exposure Research in a Cyclical Industry Part 3.

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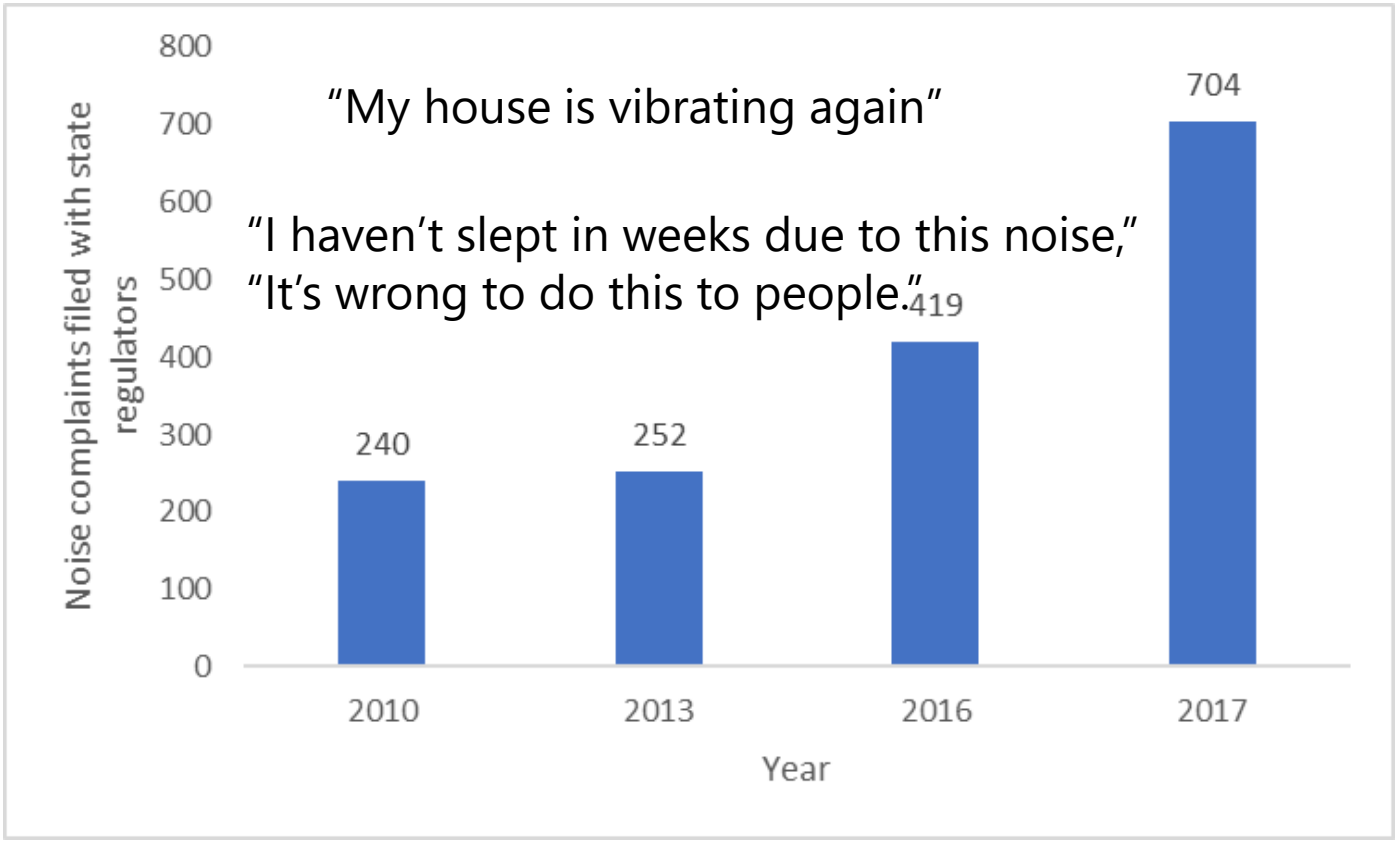
Overview

- Noise Complaints
- Noise measurements near oil and gas well sites and compressors in Colorado, West Virginia, and Pennsylvania relevant to residential exposure
- Threshold Exceedance and Characterization of Noise near O&G sites

Noise is the biggest source of oil and gas complaints in Colorado

"Noise is continuous"



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JOHN INGOLD | The Denver Post
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UPDATED: April 4, 2020 at 12:58 p.m

Noise complaints in Pennsylvania

- 45% of Pennsylvania residents interviewed about living near O&G sites reported noise as a stressor (Ferrer 2013).
- 70% of 23 survey respondents reported noise from O&G sites 495 to 7217 feet from their homes to be “extremely bothersome” and considered the noise damaging to their health (Richburg and Slagley 2017).

Nearby residents attribute health symptoms to noise

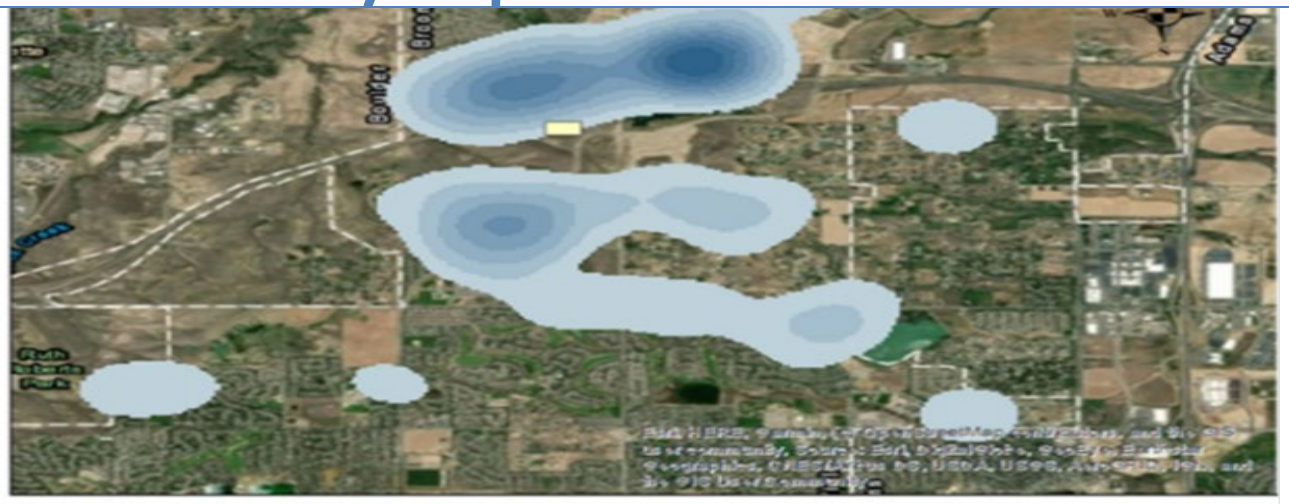


Figure 2. Number of self-reported health symptoms attributed to noise exposure from a multi-well O&G site between November 2019 to June 2020

Weisner, M.L. (2020). Health Symptoms and Noise. City and County of Broomfield, Department of Public Health and Environment.

Summary of A-weighted noise measurements, no sound walls 2006-2014

State and Source	Distance from center of site (feet)	Truck Traffic	Site Preparation	Drilling	Hydraulic Fracturing	Hydraulic Fracturing and Well Completions	Compressor Stations
Fort Worth Texas, Beherns and Associates, 2006	100			75-87			
Fort Worth Texas, Beherns and Associates, 2006	200			71-79			
Fort Worth Texas, Beherns and Associates, 2006	300			65-74			
Fort Worth Texas, Beherns and Associates, 2006	400			60-71			
Fort Worth Texas, Beherns and Associates, 2006	500			56-68			
Fort Worth Texas, Beherns and Associates, 2006	600			54-59			
West Virgina, McCawley, 2013	625	56-73	58-69	54	47-60	55-61	
Garfield County Colorado, Witter et al. 2011	625			75-80			
Fort Worth Texas, Beherns and Associates, 2006	700			51-55			
Fort Worth Texas, Beherns and Associates, 2006	800			51-54			
Wyoming, Ambrose and Florian 2014	984			52.5			
Wyoming, Ambrose and Florian 2014	459						50.9
Maryland Institute for Applied Environmental Health 2014	<1000						35.3-94.8
Maryland Institute for Applied Environmental Health 2014	1000-2000						35.3-77.6
Maryland Institute for Applied Environmental Health 2014	2000-2500						35.3-80.3
Maryland Institute for Applied Environmental Health 2014	>3500						35.3-74.1
Wyoming, Bureau of Land Management, 2006	5280						58-75
Wyoming, Bureau of Land Management, 2006	6600						54

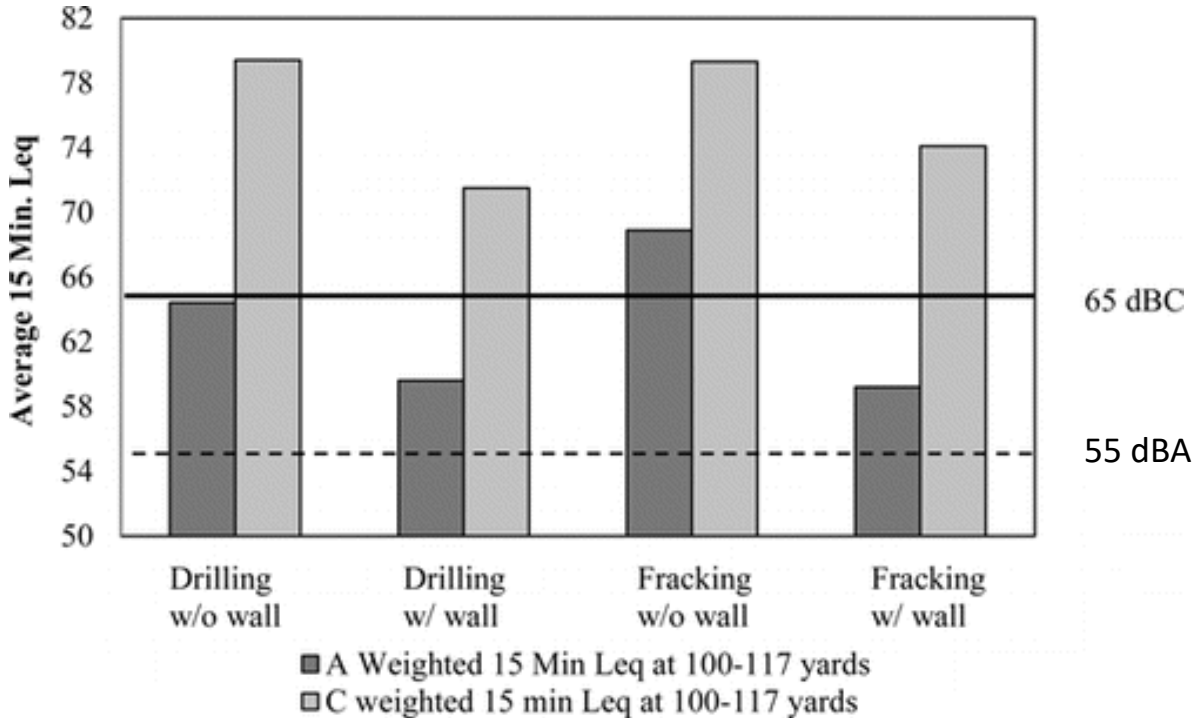
Hays, J., McCawley, M., & Shonkoff, S. B. C. (2017). Public health implications of environmental noise associated with unconventional oil and gas development. *Science of The Total Environment*, *580*, 448–456.https://doi.org/10.1016/j.scitotenv.2016.11.118

Outdoor and Indoor Measurements in Pennsylvania

Location and noise source	Outside daylight instantaneous noise levels (dBA)	Outside day–night levels (L_{dn}, dBA)	Inside day–night levels (L_{dn}, dBA)
Valencia, PA (well pad)	48.4–56.5	57.3–61.5	37.5–42.3
Finleyville, PA (well pad)	45.0–61.0		
Yellow Creek/Evans City, PA (processing plant)	48.3–56.0	53.5–69.4	50.1
USEPA limits		≤55	≤45

Richburg, CM, Slagley, J. Noise concerns of residents living in close proximity to hydraulic fracturing sites in Southwest Pennsylvania. *Public Health Nurs*. 2019; 36: 3– 10. https://doi.org/10.1111/phn.12540

Measurements with and without a sound wall in Colorado



Cameron Radtke, Daniel A. Autenrieth, Tiffany Lipsey & William J. Brazile **Noise characterization of oil and gas operations. Journal of Occupational and Environmental Hygiene, 2017, 14 (8).** https://doi.org/10.1080/15459624.2017.1316386

Low frequency noise is dominant

Table 6. Dominant octave center band frequencies during each phase of operation.

Operation Phase	Dominant Octave Center Band Frequency
Drilling	63 Hz
Hydraulic Fracturing	125 Hz
Completion	125 Hz
Production	16–31.5 Hz

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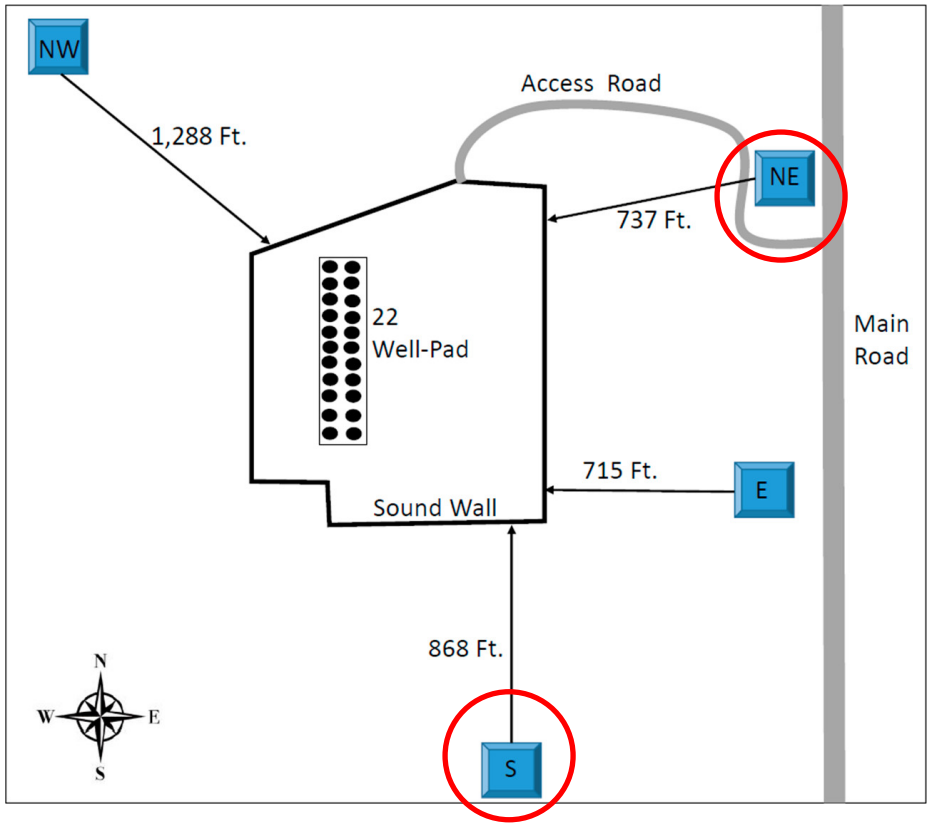
Multi-well site monitored from drilling through production July 2017-March 2018

- 22 wells, oil tanks, and separators
- 4 vapor recovery units
- Electrically powered drill rigs
- 9.8 m (32 ft) sound wall
- Modern low noise equipment
- Pre-production noise levels of 42.8 dBA and 55.8 dBC

Allshouse, W. B., McKenzie, L. M., Barton, K., Brindley, S., & Adgate, J. L. (2019). Community Noise and Air Pollution Exposure During the Development of a Multi-Well Oil and Gas Pad. *Environmental Science & Technology*, *53*(12), 7126–7135.https://doi.org/10.1021/acs.est.9b00052



Map of the 22-well pad under construction with a sound wall. The Northwest (NW), Northeast (NE), East (E), and South (S) sampling sites
A-weighted, and C-weighted noise during drilling operations. The NE and S locations collected
these variables during hydraulic fracturing, flowback, and production. In addition, a weather station and camera were installed
at the NE site to record wind speeds and trucks driving to the pad on the access road.

DOI: (10.1021/acs.est.9b00052)

Noise Monitoring Sites

Daniel Glick, Kelsey Ray, and Ted Wood; Greeley Residents sue state oil and gas commission over neighborhood drilling rules; Colorado Independent, November 18, 2016 http://www.coloradoindependent.com/162589/greeley-residents-lawsuit-cogcc

1-minute equivalent Continuous Noise Level (L_{eq})

- Larson Davis Spark 703+ Dosimeter
- Larson Davis Spark 706RC Dosimeter
- 10.6 mm microphone/preamp
- windscreens

Analysis for A- and C-weighted noise

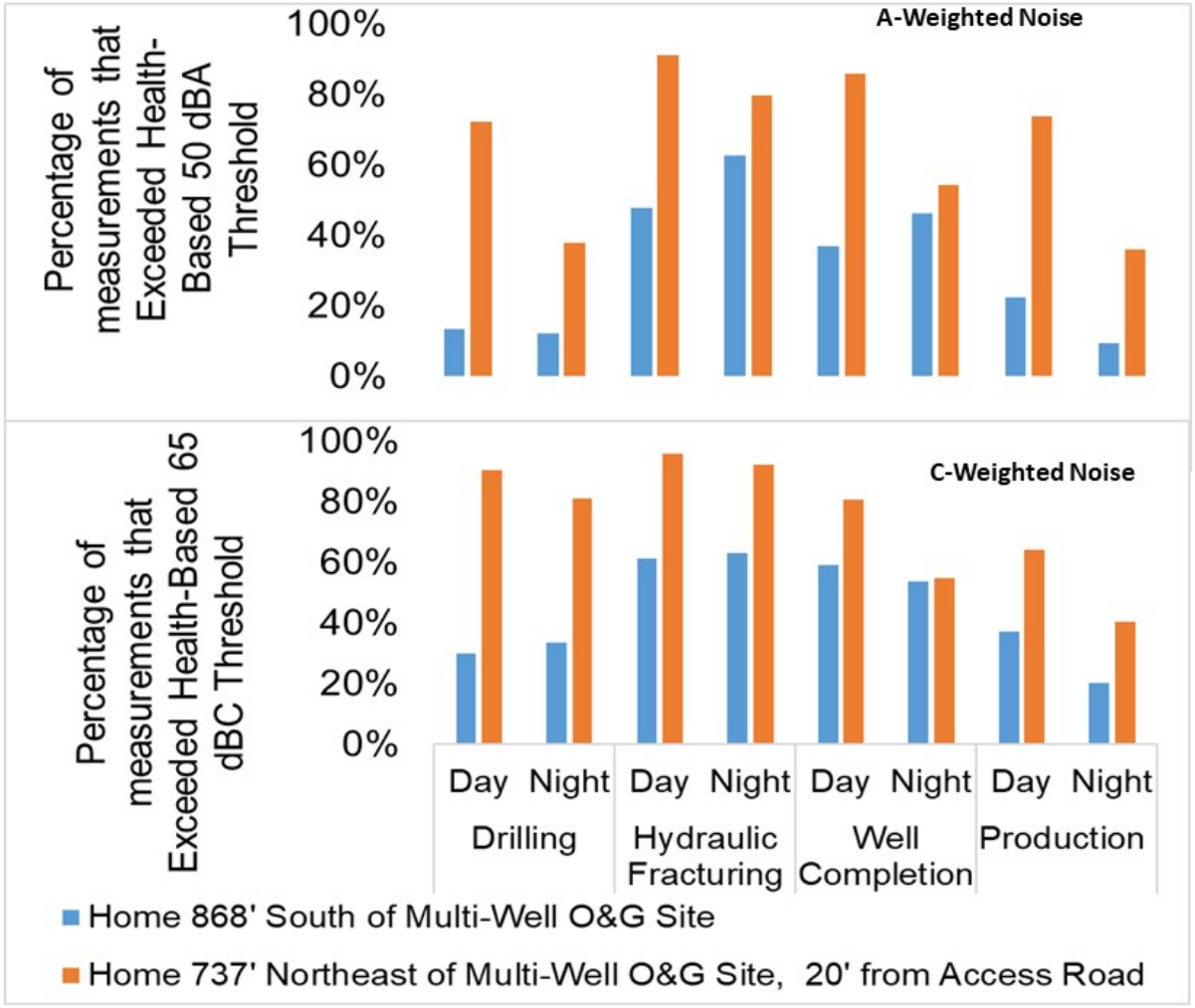
- Well development phases (drilling, hydraulic fracturing, flowback, production)
- Daytime (7:00am – 7:00 pm)/Nighttime (7:00 pm – 7:00 am)
- A-weighted noise compared to 50 dBA WHO guideline
- C-weighted noise compared to COGCC 65 dBC limit

Descriptive Statistics for A- and C-weighted noise levels

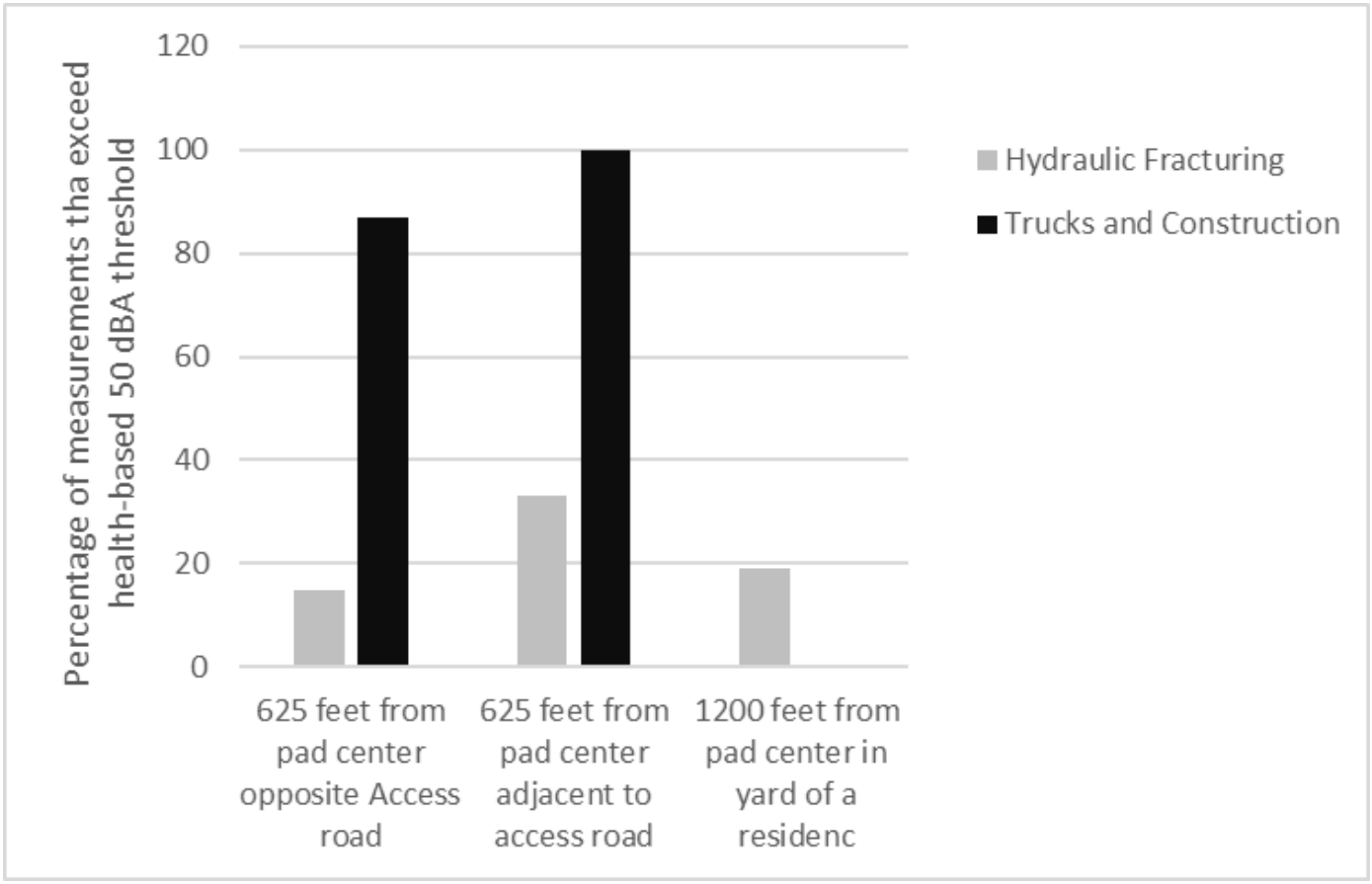
			A-weighted[a]				C-weighted[b]			
averaging time	phase	location	N	minimum	L_{eq}[c]	maximum	N	minimum	L_{eq}[c]	maximum
1 min	drilling	Northeast[d]	57 594	38.3	57.3	90.4	57 586	57.1	77.1	106.4
		South[e]	25 851	37.2	49.0	78.9	25 854	52.4	66.7	96.6
		Northwest[f]	57 433	35.9	49.1	74.5	57 426	54.5	70.8	96.4
		East[f]	22 323	38.4	52.2	75.2	25 791	56.2	75.3	98.5
	hydraulic fracturing	Northeast[d]	39 959	40.2	55.7	76.7	39 972	60.4	71.1	98.2
		South[e]	39 983	37.5	56.3	93.4	39 995	57.5	71.1	106.5
	flowback	Northeast[d]	64 721	39.2	58.2	91.9	70 283	57.5	78.6	107.6
		South[e]	70 254	36.6	61.6	92.5	64 765	55.5	82.2	106.2
	production	Northeast[d]	63 669	37.6	53.4	79.0	59 255	55.8	72.7	101.0
		South[e]	65 466	36.5	54.9	92.3	62 887	54.0	78.9	106.7

[a]Noise measured on the A-weighted scale in decibels (dBA). [b]Noise measured on the C-weighted scale in decibels (dBC). [c]The equivalent continuous noise level (L_{eq}) over all measurements collected at a given location during a particular phase. [d]The *Northeast* site was located along the well pad access road. [e]The *South* site refers to a home where monitoring was conducted during drilling, hydraulic fracturing, flowback, and production. [f]The *Northwest*, and *East* sites refer to one of two homes where monitoring was conducted during drilling only.

Both A- and C-weighted noise exceeded thresholds day and night

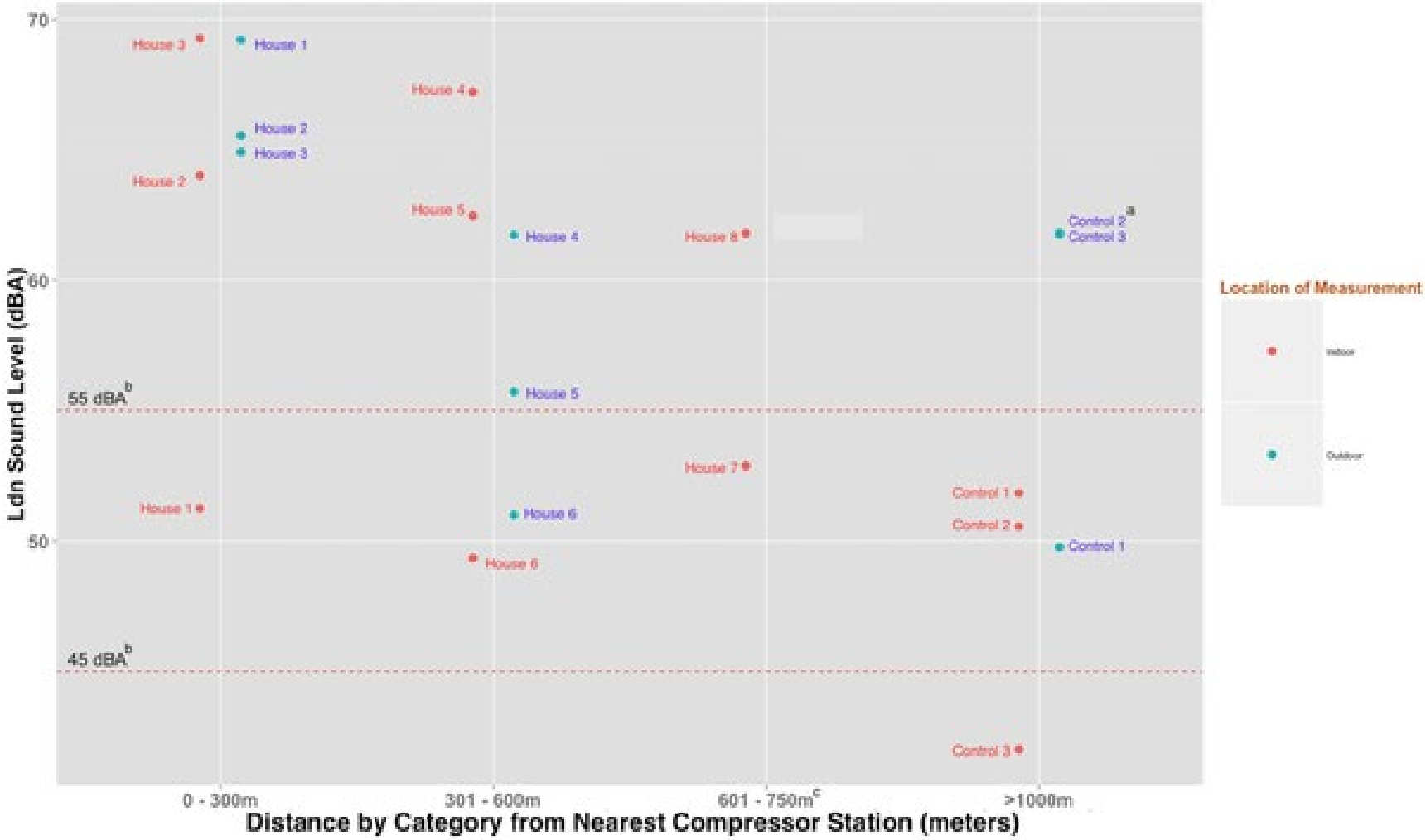


Thresholds exceeded oil and gas well pads with no sound wall in West Virginia



McCawley, M. (2013). *Air, noise, and light monitoring results for assessing environmental impacts of horizontal gas well drilling operations (ETD-10-project)*. West Virginia Department of Environmental Protection. https://www.cdc.gov/niosh/nioshtic-2/20049534.html

Fig 2. Twenty-four hour A-weighted noise levels indoors and outdoors (Ldn, indoor, Ldn outdoor) for each home (dBA) by distance.



Boyle MD, Soneja S, Quirós-Alcalá L, Dalemarre L, Sapkota AR, et al. (2017) A pilot study to assess residential noise exposure near natural gas compressor stations. PLOS ONE 12(4): e0174310. https://doi.org/10.1371/journal.pone.0174310
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0174310

Summary

- People living near oil and gas well sites complain about noise and many report the noise is disturbing their sleep and affecting their health.
- Noise measurements collected around well sites and compressor stations in Colorado, West Virginia, Wyoming, Pennsylvania and Texas indicate that residents living near these sites may experience both A- and C- weighted noise levels day and night that exceed thresholds during all phases of development.
- The noise is characterized by low-frequency bands and highest during hydraulic fracturing/flowback and near access roads and compressor stations.
- Sound walls may not be effective in mitigating residential noise exposures.