Table 2. Hazard Chemicals and Opacities in the Fracking Disclosure for CNX Well NV110AHSM (37-125-29004)

Text in red are very high hazards determined by the EPA, text in orange are high hazards. Dashes indicate where data was not available.

Ingredient	CAS Number	% HF Fluid	Human Toxicity	Environmental Toxicity	Chemical Notes
Water	7732-18-5	83.59357%	-	-	
Crystalline Silica in the form of Quartz	14808-60-7	16.32358%	carcinogenicity, genotoxicity mutagenicity and systemic toxicity from repeat exposure		
Chemstream-Polymer-00001	-	0.04332%	-	-	trade secret
Chemstream-Alkane-00001	-	0.02166%	-	-	trade secret
Hydrogen chloride	7647-01-0	0.02044%	oral toxicity, skin and eye irritation, inhalation toxicity, systemic toxicity from repeat and single exposures	acute aquatic toxicity, persistence	
Ethoxylated alcohols (C12-16)	68551-12-2	0.00722%	eye irritation, skin irritation	chronic aquatic toxicity, acute aquatic toxicity	unknown or variable composition
CHEMSTREAM-Polymer-10002	-	0.00262%	-	-	trade secret
Glutaraldehyde	111-30-8	0.00217%	inhalation toxicity, genotoxicity mutagenicity, skin and eye irritation, oral, reproductive, and dermal toxicity, endocrine disruption, neurotoxicity from single exposure, systemic toxicity from repeat exposure, skin sensitization	acute aquatic toxicity, chronic aquatic toxicity, exposure	
CHEMSTREAM-Polymer-10001	-	0.00131%	-	-	trade secret
Mineral Oil	64742-47-8	0.00122%	genotoxicity mutagenicity, carcinogenicity	acute and chronic aquatic toxicity, bioaccumulation	unknown or variable composition
Didecyl dimethyl ammonium chloride	7173-51-5	0.00064%	skin and eye irritation, endocrine disruption, reproductive and developmental toxicity, systemic toxicity from repeat and single exposure, skin sensitization	acute and chronic aquatic toxicity	
Quaternary Ammonium Compounds	68424-85-1	0.00064%	skin and eye irritation, developmental toxicity	acute and chronic aquatic toxicity, bioaccumulation	unknown or variable composition
Hydrotreated distillate	-	0.00047%	-	-	unknown or variable composition

Ethanol	64-17-5	0.00032%	oral and inhalation toxicity, carcinogenicity, endocrine disruption, reproductive toxicity, systemic toxicity from repeat exposure, eye irritation	exposure, persistence	
Ethoxylated alcohol	-	0.00028%	-	-	unknown or variable composition
Methyl alcohol	67-56-1	0.00023%	genotoxicity mutagenicity, oral, dermal, reproductive, developmental, and inhalation toxicity, endocrine disruption, neurotoxicity from repeat and single exposure, systemic toxicity from repeat and single exposure, eye irritation	exposure, persistence	
Citric acid	77-92-9	0.00021%	genotoxicity mutagenicity, eye irritation, skin irritation	exposure	
Fatty nitrogen derived amides	-	0.00016%	-	-	unknown or variable composition
Ethylene glycol	107-21-1	0.00012%	genotoxicity mutagenicity, endocrine disruption, developmental toxicity, neurotoxicity from single exposure, systemic toxicity from repeat and single exposure, skin and eye irritation	exposure	Drinking Water Standards and Health Advisory chemical
Surfactant Mixture	9004-96-0	0.00010%	eye irritation	acute aquatic toxicity	
N,N-Dimethylformamide	68-12-2	0.00006%	carcinogenicity, genotoxicity mutagenicity, endocrine disruption, reproductive and developmental toxicity, systemic toxicity from repeat and single exposure, skin and eye irritation	persistence, exposure	
2-Butoxyethanol	111-76-2	0.00004%	genotoxicity mutagenicity, endocrine disruption, neurotoxicity from single exposure, systemic toxicity from repeat and single exposure, skin and eye irritation	exposure	
Cinnamaldehyde	104-55-2	0.00004%	genotoxicity mutagenicity, dermal, reproductive, and developmental toxicity, endocrine disruption, systemic toxicity from repeat exposure, skin sensitization and irritation	chronic aquatic toxicity, acute aquatic toxicity, exposure	
Isopropanol	67-63-0	0.00004%	neurotoxicity from single exposure, eye irritation	persistence, exposure	
Poly(oxy-1,2-ethanediyl), .alpha.-(4-nonylphenyl)-.omega.-hydroxy-, branched	127087-87-0	0.00004%	endocrine disruption, skin and eye irritation		unknown or variable composition
Tar Bases, quinoline derivs, benzyl chloride-quat	72480-70-7	0.00004%	-	-	unknown or variable composition

Table 3. Studies on Fracking and Public Health in Pennsylvania

Study	Main findings	Health effects	Time period studied	Sample size	Counties studied
Buchanich, Jeanine M., Evelyn O. Talbott, et al. 2023. "Bureau of Epidemiology Hydraulic Fracturing Epidemiology Research Studies: Asthma Outcomes." University of Pittsburgh and Pennsylvania Department of Health. https://paenv.pitt.edu/assets/Report_Asthma_outcomes_revised_2023_July.pdf	Found strong evidence to suggest an increased risk in the fracking production phase for all buffer distances (0.5-10 miles) for all 3 asthma event types: severe (initiation or increase of systemic corticosteroid medications among patients with asthma), emergency department severe, and hospitalization severe compared to those with no wells within 10 wells of the patient's residence	asthma	2011-2020	46,676	Allegheny (excluding the City of Pittsburgh), Armstrong, Beaver, Butler, Fayette, Greene, Washington, Westmoreland
Buchanich, Jeanine M., Evelyn O. Talbott, et al. 2023. "Bureau of Epidemiology Hydraulic Fracturing Epidemiology Research Studies: Birth Outcomes." University of Pittsburgh and Pennsylvania Department of Health. https://paenv.pitt.edu/assets/Report_Birth_outcomes_Revised_2023_July.pdf	Small for gestational age effects: moderate/strong association with fracking production phase, higher odds ratio starting at 2 miles; preterm birth: limited association during the drilling phase, lower odds ratio starting at 5 miles; low birth weight: limited association in the drilling phase, moderate association with cumulative well count, strong association in the production phase, higher odds ratio starting at 5 miles	babies born with low birth weight or small for gestational age	2010-2020	185,849	Allegheny (excluding the City of Pittsburgh), Armstrong, Beaver, Butler, Fayette, Greene, Washington, Westmoreland
Buchanich, Jeanine M., Evelyn O. Talbott, et al. 2023. "Bureau of Epidemiology Hydraulic Fracturing Epidemiology Research Studies: Childhood Cancer Case-Control Study." University of Pittsburgh and Pennsylvania Department of Health. https://paenv.pitt.edu/assets/Report_Cancer_outcomes_2023_August.pdf	Children who lived within 1 mile of a fracking well had 5-7 times the chance of developing lymphoma compared to children who lived in a place with no wells within 5 miles	cancer: lymphoma	2010-2019	507	Allegheny (excluding the City of Pittsburgh), Armstrong, Beaver, Butler, Fayette, Greene, Washington, Westmoreland
Trickey, Kevin S, Zihan Chen, and Prachi Sanghavi. 2023. “Hospitalisations for Cardiovascular and Respiratory Disease among Older Adults Living near Unconventional Natural Gas Development: A Difference-in-Differences Analysis.” The Lancet Planetary Health 7 (3): e187–96. https://doi.org/10.1016/S2542-5196(23)00009-8.	Pennsylvania ZIP codes that started fracking in 2008–10 were associated with more hospitalizations for cardiovascular diseases in 2012–15 than would be expected in the absence of fracking compared to non-fracked NY control region	heart attack, heart failure, and ischemic heart disease	2002-2015	N/A - used rates	Bradford, Susquehanna,Tioga
Clark, Cassandra J., Nicholaus P. Johnson, Mario Soriano, Joshua L. Warren, Keli M. Sorrentino, Nina S. Kadan-Lottick, James E. Saiers, Xiaomei Ma, and Nicole C. Deziel. 2022. “Unconventional Oil and Gas Development Exposure and Risk of Childhood Acute Lymphoblastic Leukemia: A Case–Control Study in Pennsylvania, 2009–2017.” Environmental Health Perspectives 130 (8): 087001. https://doi.org/10.1289/EHP11092.	Children (2-7 yrs) with at least one fracking well within 2 km of their birth residence during the primary window had 1.98 times the odds of developing Acute Lymphoblastic Leukemia (ALL) in comparison with those with no fracking wells. Children with at least one vs. no fracking wells within 2 km during the perinatal window had 2.80 times the odds of developing ALL	cancer: acute lymphoblastic leukemia	2009–2017	405	All of PA (excluded from mapping due to small number of cancer cases compared to health controls and the ambiguity of cancer participant locations)
Bushong, Anna, Thomas McKeon, Mary Regina Boland, and Jeffrey Field. 2022. “Publicly Available Data Reveals Association between Asthma Hospitalizations and Unconventional Natural Gas Development in Pennsylvania.” PLOS ONE 17 (3): e0265513.	Positive association was seen between an increase in asthma hospitalization admission rates and fracking in rural counties	asthma	2005–2014	N/A - used rates	Association seen in 42 rural counties

https://doi.org/10.1371/journal.pone.0265513.					
Hill, Elaine L., and Lala Ma. 2022. “Drinking Water, Fracking, and Infant Health.” Journal of Health Economics 82 (March): 102595. https://doi.org/10.1016/j.jhealeco.2022.102595.	Fracking operations near mothers’ homes raised levels of contaminants in drinking water and raised the incidence of preterm birth and low birth weight	preterm birth, babies born with low birth weight	2003-2015	325,439	All of PA
Gorski-Steiner, Irena, Karen Bandeen-Roche, Heather E. Volk, Sean O’Dell, and Brian S. Schwartz. 2022. “The Association of Unconventional Natural Gas Development with Diagnosis and Treatment of Internalizing Disorders among Adolescents in Pennsylvania Using Electronic Health Records.” Environmental Research 212 (September): 113167. https://doi.org/10.1016/j.envres.2022.113167.	Association found between a composite of fracking activity and new onset internalizing disorders in female adolescents in the subset of study years with more widespread fracking activity (2010-2016)	depression and anxiety	2008-2016	7,974	Geisinger Clinic primary northeastern catchment area
Denham, Alina, Mary D. Willis, Daniel P. Croft, Linxi Liu, and Elaine L. Hill. 2021. “Acute Myocardial Infarction Associated with Unconventional Natural Gas Development: A Natural Experiment.” Environmental Research 195 (April): 110872. https://doi.org/10.1016/j.envres.2021.110872.	Long- term exposure to fracking operations was associated with increased acute myocardial infarction (heart attack, 1.4-2.8%) hospitalization rates and increased male heart attack death (5.4%) rates in patients > 45 y.o. compared to a no-fracking region across state lines in NY	heart attack related hospitalizations and death	2005-2014	2,840	Counties with any Marcellus Shale coverage
Blinn, Hannah N., Ryan M. Utz, Lydia H. Greiner, and David R. Brown. 2020. “Exposure Assessment of Adults Living near Unconventional Oil and Natural Gas Development and Reported Health Symptoms in Southwest Pennsylvania, USA.” PLOS ONE 15 (8): e0237325. https://doi.org/10.1371/journal.pone.0237325.	Self reported health assessments revealed respiratory, neurological, and muscular symptoms compared to three estimates of exposure: cumulative fracking well density (CWD), inverse distance weighting (IDW) of wells, and annual emission concentrations (AEC) from wells within 5 km of respondents’ homes	eyes, ears, nose, throat; neurological and muscular symptoms	2012–2017	104	Washington, Greene, Beaver, Butler, Allegheny, Bedford, Fayette, Westmoreland
McAlexander, Tara P., Karen Bandeen-Roche, Jessie P. Buckley, Jonathan Pollak, Erin D. Michos, John William McEvoy, and Brian S. Schwartz. 2020. “Unconventional Natural Gas Development and Hospitalization for Heart Failure in Pennsylvania.” Journal of the American College of Cardiology 76 (24): 2862–74. https://doi.org/10.1016/j.jacc.2020.10.023.	Three of four phases (pad preparation, stimulation, and production, not drilling) of fracking activity were associated with hospitalization for heart failure (HF), older patients with HF appear particularly vulnerable	heart failure	2008–2015	5,839	Geisinger Clinic primary northeastern catchment area
PA Department of Health. 2020. "Ewing’s Family of Tumors, Childhood Cancer and Total Cancer Standard Incidence Ratio Results for Washington, Fayette, Greene and Westmoreland Counties in Pennsylvania." https://www.health.pa.gov/topics/Documents/Environmental%20Health/Ewings%20Tumors%20SW%204%20Counties.pdf	Inconclusive despite 9 preschoolers and students in the Canon- McMillan school district being diagnosed with rare cancers in the 2018-2019 school year. From 2006-2017, 31 people in four counties in southwestern Pennsylvania were diagnosed with Ewing’s sarcoma. This represents a 40% jump from 1995-2005, a period prior to the arrival of drilling and fracking activities in the area	cancer: Ewing's sarcoma	1985-2017	31	Washington, Fayette, Greene, Westmoreland (excluded from map due to ambiguity of results)
Casey, Joan A., Holly C. Wilcox, Annemarie G. Hirsch, Jonathan Pollak, and Brian S. Schwartz. 2018. “Associations of Unconventional Natural Gas Development with Depression Symptoms and Disordered Sleep in Pennsylvania.” Scientific Reports 8 (1): 11375. https://doi.org/10.1038/s41598-018-29747-2.	Increased antenatal anxiety or depression in mothers in highest quartile of fracking activity exposure	anxiety/ depression	2009-2013	7,715	Geisinger Clinic primary northeastern catchment area

Denham, A., M. Willis, A. Zavez, and E. Hill. 2019. “Unconventional Natural Gas Development and Hospitalizations: Evidence from Pennsylvania, United States, 2003–2014.” Public Health, Travel Health, 168 (March): 17–25. https://doi.org/10.1016/j.puhe.2018.11.020.	Increased hospitalizations for diseases of the genitourinary system (urinary tract infections, kidney infections, and kidney stones) were strongly and positively associated with cumulative fracking density	gastrourinary and skin hospitalizations	2003-2014	N/A - used rates	All of PA
Brown, David R., Lydia H. Greiner, Beth I. Weinberger, Leslie Walleigh, and Dale Glaser. 2019. “Assessing Exposure to Unconventional Natural Gas Development: Using an Air Pollution Dispersal Screening Model to Predict New-Onset Respiratory Symptoms.” Journal of Environmental Science and Health, Part A 54 (14): 1357–63. https://doi.org/10.1080/10934529.2019.1657763.	Self reported health assessments revealed 72% of people studied reported at least one respiratory symptom such as sore throat, cough and shortness of breath, sinus problems, and wheezing that began or worsened after the onset of fracking drilling activity and could not be plausibly attributed to pre-existing or current medical conditions, or practices such as smoking	respiratory symptoms	2012-2017	87	Washington
Environmental Health News. 2021. "Fractured: The body burden of living near fracking." https://www.ehn.org/fractured-series-on-fracking-pollution-2650624600.html	Very high (>US 95th percentile) levels of fracking chemicals in the urine of families living within 5 miles of fracking wells. Chemicals included benzene, toluene, naphthalene, and 15 others. Families that lived closer to fracking operations had higher levels than those living further away	high bioaccumulation of chemicals that are known to have negative health impacts, including reproductive harm and cancer risk	2019	20	Washington, Westmoreland
Beleche, Trinidad, and Inna Cintina. 2018. “Fracking and Risky Behaviors: Evidence from Pennsylvania.” Economics & Human Biology 31 (September): 69–82. https://doi.org/10.1016/j.ehb.2018.08.001.	Counties with fracking activities had higher rates of gonorrhea and chlamydia infections (up 7.8% and 2.6%, respectively)	STIs (gonorrhea and chlamydia)	2003-2012	N/A - used rates	Association in counties with fracking activity
Casey, Joan A., David A. Savitz, Sara G. Rasmussen, Elizabeth L. Ogburn, Jonathan Pollak, Dione G. Mercer, and Brian S. Schwartz. 2015. “Unconventional Natural Gas Development and Birth Outcomes in Pennsylvania, USA:” Epidemiology, September, 1. https://doi.org/10.1097/EDE.0000000000000387.	Survey found a link between living closer to more and bigger fracking wells and increased symptoms of depression	depression	2014-2015	4,762	Geisinger Clinic primary northeastern catchment area
Hill, Elaine L. 2018. “Shale Gas Development and Infant Health: Evidence from Pennsylvania.” Journal of Health Economics 61 (September): 134–50. https://doi.org/10.1016/j.jhealeco.2018.07.004.	Introduction of fracking drilling increased low birth weight and small for gestational age incidence by 25% and 18%, respectively among mothers living within 2.5 km of a well	babies born with low birth weight or small for gestational age	2003-2010	N/A - used percentages	All of PA
Koehler, Kirsten, J. Hugh Ellis, Joan A. Casey, David Manthos, Karen Bandeen-Roche, Rutherford Platt, and Brian S. Schwartz. 2018. “Exposure Assessment Using Secondary Data Sources in Unconventional Natural Gas Development and Health Studies.” Environmental Science & Technology 52 (10): 6061–69. https://doi.org/10.1021/acs.est.8b00507.	Increased asthma exacerbations with exposure to fracking-related compressors, impoundments, and flaring events	asthma	2005-2013	70,000	Geisinger Clinic primary northeastern catchment area
Peng, Lizhong, Chad Meyerhoefer, and Shin-Yi Chou. 2018. “The Health Implications of Unconventional Natural Gas Development in Pennsylvania.” Health Economics 27 (6): 956–83. https://doi.org/10.1002/hec.3649.	Higher rates of hospitalizations for pneumonia (> 65 y.o.) in counties with drilling and fracking operations compared to those without. Also found higher average hospitalization rates for other air pollution-sensitive diseases (acute	pneumonia (and other respiratory diseases)	2001-2013	N/A - used rates	Counties with fracking before 2013

	myocardial infarction, chronic obstructive pulmonary disease, asthma, and upper respiratory infections), but those links were not as strong statistically				
Willis, Mary D., Todd A. Jusko, Jill S. Halterman, and Elaine L. Hill. 2018. “Unconventional Natural Gas Development and Pediatric Asthma Hospitalizations in Pennsylvania.” Environmental Research 166 (October): 402–8. https://doi.org/10.1016/j.envres.2018.06.022.	Fracking exposure metrics were associated with increased odds of pediatric asthma-related hospitalization among young children while controlling for 180 pre-existing respiratory health risks	asthma	2003-2014	15,837	Rural counties located on the Marcellus Shale
Busby, Christopher, and Joseph J. Mangano. 2017. “There’s a World Going on Underground—Infant Mortality and Fracking in Pennsylvania.” Journal of Environmental Protection 08 (04): 381–93. https://doi.org/10.4236/jep.2017.84028.	Fracking associated with early (0 -28 days) infant mortality	infant mortality	2007-2010	82,558	Bradford, Susquehanna, Lycoming, Wyoming and Tioga, Washington, Westmoreland, Fayette, Butler, Greene
Currie, Janet, Michael Greenstone, and Katherine Meckel. 2017. “Hydraulic Fracturing and Infant Health: New Evidence from Pennsylvania.” Science Advances 3 (12): e1603021. https://doi.org/10.1126/sciadv.1603021.	Greater incidence of low birth weight within 1 km and 3 km of fracking activity	babies born with low birth weight	2004-2013	> 1.1 million	All of PA
Weinberger, Beth, Lydia H. Greiner, Leslie Walleigh, and David Brown. 2017. “Health Symptoms in Residents Living near Shale Gas Activity: A Retrospective Record Review from the Environmental Health Project.” Preventive Medicine Reports 8 (September): 112–15. https://doi.org/10.1016/j.pmedr.2017.09.002.	Health assessments from adults in communities with intense fracking revealed most frequently reported symptoms of sleep disturbance, headache, throat irritation, stress/anxiety, cough, shortness of breath, sinus problems, fatigue, wheezing, nausea, each occurring in over 20% of the sample	sleep disturbance, headache, throat irritation, stress/anxiety, cough, shortness of breath, sinus problems, fatigue, wheezing, nausea	2012-2015	51	Washington primarily (3 participants in Butler and 1 in Bedford. Bedford county excluded from map)
Tustin, Aaron W., Annemarie G. Hirsch, Sara G. Rasmussen, Joan A. Casey, Karen Bandeen-Roche, and Brian S. Schwartz. 2017. “Associations between Unconventional Natural Gas Development and Nasal and Sinus, Migraine Headache, and Fatigue Symptoms in Pennsylvania.” Environmental Health Perspectives 125 (2): 189–97. https://doi.org/10.1289/EHP281.	Those residing near intensive fracking well activity were significantly more likely to experience chronic rhinosinusitis (at least three months of nasal and sinus symptoms), migraine headaches, and higher levels of fatigue than residents who did not live near such activity	chronic rhinosinusitis, migraine headaches, and fatigue	2014	7,785	Geisinger Clinic primary northeastern catchment area
Casey, Joan A., Dana E. Goin, Kara E. Rudolph, Brian S. Schwartz, Dione Mercer, Holly Elser, Ellen A. Eisen, and Rachel Morello-Frosch. 2019. “Unconventional Natural Gas Development and Adverse Birth Outcomes in Pennsylvania: The Potential Mediating Role of Antenatal Anxiety and Depression.” Environmental Research 177 (October): 108598. https://doi.org/10.1016/j.envres.2019.108598.	Pregnant women who live near active fracking operations were at a 40% increased risk of giving birth prematurely and at a 30% increased risk for having obstetrician-labeled high-risk pregnancies (hypertension, high pre-pregnancy body mass index, and asthma)	preterm birth	2009-2013	10,946	Geisinger Clinic primary northeastern catchment area
Finkel, M.L. 2016. “Shale Gas Development and Cancer Incidence in Southwest Pennsylvania.” Public Health 141 (December): 198–206. https://doi.org/10.1016/j.puhe.2016.09.008.	Number of urinary bladder cancer cases was higher than expected in counties with fracking activity	cancer: urinary bladder	2000-2012	N/A - used percentages	Allegheny, Fayette, Beaver, Greene, Washington, Westmoreland
McDermott-Levy, Ruth, and Victoria Garcia. 2016. “Health Concerns of Northeastern Pennsylvania Residents Living in an Unconventional Oil and Gas Development	Residents described their health concerns about their changing community as a result of fracking, their feelings of stress and	self-reported stress	2014-2015	27	Wyoming

County." Public Health Nursing 33 (6): 502–10. https://doi.org/10.1111/phn.12265.	powerlessness related to these changes, and the limited response of their local policymakers and protective agencies				
Rasmussen, Sara G., Elizabeth L. Ogburn, Meredith McCormack, Joan A. Casey, Karen Bandeen-Roche, Dione G. Mercer, and Brian S. Schwartz. 2016. "Association Between Unconventional Natural Gas Development in the Marcellus Shale and Asthma Exacerbations." JAMA Internal Medicine 176 (9): 1334. https://doi.org/10.1001/jamainternmed.2016.2436.	Living near fracking operations during all 4 phases of development significantly increases asthma attacks, and those who lived near a higher number of, or larger, active gas wells were 1.5-4 times more likely to suffer from asthma attacks compared to those who lived farther away	asthma	2005-2012	35,508	Geisinger Clinic primary northeastern catchment area
Jemielita, Thomas, George L. Gerton, Matthew Neidell, Steven Chillrud, Beizhan Yan, Martin Stute, Marilyn Howarth, et al. 2015. "Unconventional Gas and Oil Drilling Is Associated with Increased Hospital Utilization Rates." Edited by Jaymie Meliker. PLOS ONE 10 (7): e0131093. https://doi.org/10.1371/journal.pone.0131093.	Cardiology inpatient prevalence rates were significantly associated with number of fracking wells per zip code and their density, while neurology inpatient prevalence rates were significantly associated with density of wells. Hospitalizations for cancer, skin conditions, and urological problems also rose significantly	cardiology, dermatology, neurology, oncology, and urology hospitalizations	2007-2011	N/A - used rates	Bradford, Susquehanna, Wayne
Rabinowitz, Peter M., Ilya B. Slizovskiy, Vanessa Lamers, Sally J. Trufan, Theodore R. Holford, James D. Dziura, Peter N. Peduzzi, et al. 2015. "Proximity to Natural Gas Wells and Reported Health Status: Results of a Household Survey in Washington County, Pennsylvania." Environmental Health Perspectives 123 (1): 21–26. https://doi.org/10.1289/ehp.1307732.	Health symptoms reported by residents increased in frequency as distance between household and fracking wells decreased. Among persons living < 1 km from drilling and fracking operations compared to those living > 2 km, rashes and upper respiratory problems were more prevalent	rashes and upper respiratory problems	2012	492	Washington (38 rural townships)
Stacy, Shaina L., LuAnn L. Brink, Jacob C. Larkin, Yoel Sadovsky, Bernard D. Goldstein, Bruce R. Pitt, and Evelyn O. Talbott. 2015. "Perinatal Outcomes and Unconventional Natural Gas Operations in Southwest Pennsylvania." Edited by Jaymie Meliker. PLOS ONE 10 (6): e0126425. https://doi.org/10.1371/journal.pone.0126425.	Lower birth weight (21 g) and higher incidence of small for gestational age associated with proximity to fracking. The more exposure (number of fracking wells) a pregnant woman had, the higher her risk for a smaller-than-normal baby	babies born with low birth weight or small for gestational age	2007-2010	15,451	Butler, Washington, Westmoreland

Table 4. Pennsylvania-Based Research that Supports Increased No-Drill Zones

Study	Health effects	Radius from well
Buchanich, Jeanine M., Evelyn O. Talbott, et al. 2023. "Bureau of Epidemiology Hydraulic Fracturing Epidemiology Research Studies: Asthma Outcomes." University of Pittsburgh and Pennsylvania Department of Health. https://paenv.pitt.edu/assets/Report_Asthma_outcomes_revised_2023_July.pdf	asthma	>10 miles
Buchanich, Jeanine M., Evelyn O. Talbott, et al. 2023. "Bureau of Epidemiology Hydraulic Fracturing Epidemiology Research Studies: Birth Outcomes." University of Pittsburgh and Pennsylvania Department of Health. https://paenv.pitt.edu/assets/Report_Birth_outcomes_Revised_2023_July.pdf	babies born with low birth weight or small for gestational age	2-5 miles seems protective
Buchanich, Jeanine M., Evelyn O. Talbott, et al. 2023. "Bureau of Epidemiology Hydraulic Fracturing Epidemiology Research Studies: Childhood Cancer Case-Control Study." University of Pittsburgh and Pennsylvania Department of Health. https://paenv.pitt.edu/assets/Report_Cancer_outcomes_2023_August.pdf	cancer: lymphoma	> 1 mile
Clark, Cassandra J., Nicholaus P. Johnson, Mario Soriano, Joshua L. Warren, Keli M. Sorrentino, Nina S. Kadan-Lottick, James E. Saiers, Xiaomei Ma, and Nicole C. Deziel. 2022. “Unconventional Oil and Gas Development Exposure and Risk of Childhood Acute Lymphoblastic Leukemia: A Case–Control Study in Pennsylvania, 2009–2017.” Environmental Health Perspectives 130 (8): 087001. https://doi.org/10.1289/EHP11092.	cancer: acute lymphoblastic leukemia	> 2 km
Hill, Elaine L., and Lala Ma. 2022. “Drinking Water, Fracking, and Infant Health.” Journal of Health Economics 82 (March): 102595. https://doi.org/10.1016/j.jhealeco.2022.102595.	preterm birth, babies born with low birth weight	> 1 km
Blinn, Hannah N., Ryan M. Utz, Lydia H. Greiner, and David R. Brown. 2020. “Exposure Assessment of Adults Living near Unconventional Oil and Natural Gas Development and Reported Health Symptoms in Southwest Pennsylvania, USA.” PLOS ONE 15 (8): e0237325. https://doi.org/10.1371/journal.pone.0237325.	eyes, ears, nose, throat; neurological and muscular symptoms	> 5 km
Brown, David R., Lydia H. Greiner, Beth I. Weinberger, Leslie Walleigh, and Dale Glaser. 2019. “Assessing Exposure to Unconventional Natural Gas Development: Using an Air Pollution Dispersal Screening Model to Predict New-Onset Respiratory Symptoms.” Journal of Environmental Science and Health, Part A 54 (14): 1357–63. https://doi.org/10.1080/10934529.2019.1657763.	respiratory symptoms	> 2 km
Environmental Health News. 2021. "Fractured: The body burden of living near fracking." https://www.ehn.org/fractured-series-on-fracking-pollution-2650624600.html	high bioaccumulation of chemicals that are known to have negative health impacts, including reproductive harm and cancer risk	> 5 miles
Hill, Elaine L. 2018. “Shale Gas Development and Infant Health: Evidence from Pennsylvania.” Journal of Health Economics 61 (September): 134–50. https://doi.org/10.1016/j.jhealeco.2018.07.004.	babies born with low birth weight or small for gestational age	> 2.5 km
Currie, Janet, Michael Greenstone, and Katherine Meckel. 2017. “Hydraulic Fracturing and Infant Health: New Evidence from Pennsylvania.” Science Advances 3 (12): e1603021. https://doi.org/10.1126/sciadv.1603021.	babies born with low birth weight	> 3 km, greater effects > 1 km
Weinberger, Beth, Lydia H. Greiner, Leslie Walleigh, and David Brown. 2017. “Health Symptoms in Residents Living near Shale Gas Activity: A Retrospective Record Review from the Environmental Health Project.” Preventive Medicine Reports 8 (September): 112–15. https://doi.org/10.1016/j.pmedr.2017.09.002.	sleep disturbance, headache, throat irritation, stress/anxiety, cough, shortness of breath, sinus problems, fatigue, wheezing, nausea	> 1 km
Rabinowitz, Peter M., Ilya B. Slizovskiy, Vanessa Lamers, Sally J. Trufan, Theodore R. Holford, James D. Dziura, Peter N. Peduzzi, et al. 2015. “Proximity to Natural Gas Wells and Reported Health Status: Results of a Household Survey in Washington County, Pennsylvania.” Environmental Health Perspectives 123 (1): 21–26. https://doi.org/10.1289/ehp.1307732.	rashes and upper respiratory problems	> 1 km
Stacy, Shaina L., LuAnn L. Brink, Jacob C. Larkin, Yoel Sadovsky, Bernard D. Goldstein, Bruce R. Pitt, and Evelyn O. Talbott. 2015. “Perinatal Outcomes and Unconventional Natural Gas Operations in Southwest Pennsylvania.” Edited by Jaymie Meliker. PLOS ONE 10 (6): e0126425. https://doi.org/10.1371/journal.pone.0126425.	babies born with low birth weight or small for gestational age	> 10 miles