November 25, 2025

Secretary Debbie-Anne A. Reese
Federal Energy Regulatory Commission
888 First Street NE, Room 1A
Washington, D.C. 20426

Submitted via eFile Portal Re: Submittal of Evidence of Environmental Justice issues in response to Mountain Valley Pipeline, LLC Submits Abbreviated Application for Certificate of Public Convenience and Necessity for construction re the MVP Boost Project under CP26-14

Dear Secretary Reese,

We write to submit our research documenting that MVP LLC's proposed new Swann Compressor station (part of the "MVP Boost Project") is located in an environmental justice community and would cause further harm to a community that experiences undue environmental burdens.

In response to community concerns about the multiple pollution burdens[1] experienced by residents in eastern Montgomery County, Virginia, we developed and led the administration of the Lafayette Area Household Survey in 2022.[2] Given that air pollution impacts are most acute in close proximity to polluting facilities, we conducted the study within one mile of the parcel owned by Mountain Valley Pipeline, LLC.[3] Following best practices of community-based social science research design, this door-to-door survey canvassed every other home (half of the households). Within the one-mile radius, we surveyed 171 out of the 333 residences (51.4% of households).

[1] The community's current pollution burdens include Interstate 81; Highway 460; Norfolk Southern Railroad, which transports train cars of uncovered coal; truck traffic to a Roanoke County landfill; several small manufacturing facilities; a Love's Truck Stop; the East Tennessee methane gas transmission line; and the Mountain Valley Pipeline methane gas transmission line and gate station.

[2] This study was funded by the Virginia Tech Center for Peace Studies and Violence Prevention.

[3] Peer-reviewed research indicates that the highest risk of negative human health effects of gas compressor stations occurs within a radius of approximately one mile (Brown et al, "Understanding exposure from natural gas drilling puts current air standards to the test," *Reviews on Environmental Health*, 2014; Martin et al, "Survey of airborne organic compounds in residential communities near a natural gas compressor station: Response to community concern," *Environmental Advances,* 2021). Census block level is the smallest unit of analysis for U.S. Census data; the census block in which the proposed Swann Compressor Station is located is 38 square miles, too large to accurately assess the demographics of the residents within one mile.

The study included demographic questions to assess whether the community surrounding the proposed Swann Compressor Station site comprises an environmental justice community. We discovered heightened vulnerabilities in multiple domains:

1. **Income**. The area within one mile of the proposed compressor station qualifies as a "low-income community" and therefore as an "environmental justice community" under Virginia law (Va. Code 2.2-234). The legal threshold is 30% of households within a census block that earn less than 80% of the median income of the area. In our study area, an income under $52,216 qualifies as low income. Among our respondents, 50.3% reported earning less than $40,999 per year, and 58% reported earning under $52,999 per year. The study provides on-the-ground verification of data obtained from EJScreen, which reports that the populations of the regions immediately north and south of the proposed location of the compressor station are 48% and 50% low income, respectively.[4]
2. **Race and ethnicity.** Our findings indicate that the study area contains one or more populations of color: 20.5% of households reported having at least one person of color. The study again verifies EJScreen data, which reports that the regions immediately north and south of the proposed compressor station are 17% and 20% people of color, respectively.
3. **Age and health.** The study finds 41% of residents are vulnerable to environmental harm due to age (with 118 children and 74 senior citizens in the sample). Of surveyed households, 43% include at least one resident with a chronic illness or disability, including 41% with a lung or heart condition, making them more susceptible to harm from pollution.[5]

These demographics indicate that it is highly likely that the operation of a compressor station in this location would result in increased rates of morbidity and mortality for residents living within one mile of the facility.

We submit that MVP LLC's proposed site for Swann Compressor Station is located in an environmental justice community. This conclusion indicates the need for a full Environmental Impact Study (EIS) that includes a robust environmental justice study.

Sincerely,

---

[4] EJScreen is currently offline. A reconstructed version is available at https://screening-tools.com/epa-ejscreen .

[5] Chakraborty, J, "Disparities in exposure to fine particulate air pollution for people with disabilities in the US," *Science of The Total Environment* 842, 2022; Gao, J. et al, "Long-term air pollution exposure and incident physical disability in older US adults: a cohort study," *The Lancet Healthy Longevity,* 2024.

Aran Garnett-Deakin, Doctoral Candidate in Human Development and Family Science, Virginia Tech

Shannon Bell, PhD, Department of Sociology, Virginia Tech

Emily Satterwhite, PhD, Appalachian Studies Program, Virginia Tech

Madelyn Toman, Doctoral Candidate in Human Development and Family Science, Virginia Tech

Lafayette Area Household Survey Methods and Results Report

November 2025

Aran Garnett-Deakin, Shannon Bell, Emily Satterwhite, Madelyn Toman,
and Community and Student Collaborators[1]

Introduction

Compressor stations, which pressurize natural gas for transmission through pipelines, emit air pollutants that pose extensive health hazards for nearby residents (Davis et al. 2023; Martin et al., 2021). Compressor stations release particulate matter (PM_{10} and $PM_{2.5}$), nitrogen oxides (NO and NO_2), carbon monoxide, sulfur dioxide, formaldehyde, and volatile organic compounds (VOCs) including benzene (Martin et al., 2021; Davis et al., 2023b; Green & Crouch, 2021; Strizhenok & Korelskiy, 2019; Walter, 2020). VOCs can produce ozone, which harms plants and exacerbates respiratory illnesses (Grulke & Heath, 2020; US EPA, 2020a). In homes near compressor stations, studies have documented indoor VOC levels that exceed National Ambient Air Quality Standards (NAAQS) (Davis et al., 2023b; Caron-Beaudoin, 2022; Martin et al, 2021).

Davis et al.'s 2023 literature review of the health effects associated with living near compressor stations reports that pollutants emitted by these facilities are linked to short-term symptoms such as headaches and nausea, and long-term effects that include harm to human respiratory, cardiovascular, and neurological systems, increased lung cancer risk, and increased mortality rates. Studies link air pollution to stroke, hypertension, diabetes, negative mental health effects, and adverse effects on reproductive systems and birth outcomes (Davis et al., 2023a; Davis et al, 2023b). Even very short-term exposure to PM (hours to days) likely results in "deaths within the most vulnerable groups of the population" (Davis et al., 2023a, 9).

As a wide body of social science research has demonstrated, polluting industrial facilities are often sited in historically marginalized communities that bear a disproportionately heavy burden of environmental degradation resulting from built infrastructure (Davis et al., 2023b; Banzhaf et al., 2019; Collins et al., 2016; Emanuel et al., 2021; Mohai et al., 2009). Research indicates that counties with more socially vulnerable populations have the highest concentrations of natural gas infrastructure (Emanuel et al, 2021). Compressor stations have followed a similar pattern: when compared with other counties, the counties where compressor stations have been sited have, on average, a higher percentage of uninsured residents, a higher proportion of historically marginalized populations, higher unemployment rates, lower educational attainment, and lower population densities (Nethery et al, 2019). Developers often choose to build pipeline infrastructure in rural areas instead of urban areas to impact a smaller population; however, rural communities

[1] Irene Leech, Christina Gray, Teresa Peters, Crystal Mello, Tina Badger, Amy Shea, Camden Philips, Logan Flanagan, Griffin Lewis, Seferina Olivo, Emily Plunkett, Autumn Telles, and Ivy Young

often rank higher on the social vulnerability index and, as a result, suffer more profound impacts from the health consequences of increased pollutants (Caretta & McHenry, 2020; WHO, 2021). Pollution exposure inequities are compounded by existing vulnerabilities among exposed populations, leading to disparities in the resulting health burdens (Karn Vohra et al, 2025; Kerr et al, 2024).

In 2020, the Commonwealth of Virginia passed the Virginia Environmental Justice Act, the purpose of which is to ensure that environmental hazards are not disproportionately shouldered by any specific group. The law especially aims to protect what it terms "environmental justice communities" and "fenceline communities" (Va. Code § 2.2-235). Environmental justice communities include any low-income community or community of color, and fenceline communities are environmental justice communities that face increased health risks due to their proximity to a major source of pollution (Va. Code § 2.2-234).

Given the high concentration of polluting facilities in Eastern Montgomery County, this study examines whether the area within one mile of the proposed Swann Compressor Station meets the Commonwealth of Virginia's definition of an environmental justice community.

Background

Health Effects of Compressor Stations

In addition to the extensive short-term and long-term effects of compressor stations noted in the Introduction above (see Davis et al. 2023a and 2023b), compressor stations generate significant noise pollution that meets or exceeds EPA-recommended limits. Documented negative health effects from noise pollution include disturbed sleep, negative mental health consequences, hypertension, cardiovascular disease, and cognitive and learning impairments (Boyle et al., 2017; Richburg and Slagley, 2019; Banks and Cohen Hubal, 2025; Hays et al., 2017). Light pollution is another source of psychological distress near oil and gas infrastructure and is known to have negative human health effects, including, but not limited to, cancer, cardiovascular disease, and metabolic disorders, with the most common health effects being sleep disturbances and mood disorders (Fisher et al., 2018; Cupertino, 2022; Wicker, 2023).

According to the U.S. Agency for Toxic Substances and Disease Registry (ATSDR, 2016), natural gas compressor stations have been linked to adverse effects on human health and quality of life. The ATSDR and the Environmental Protection Agency (EPA) investigated the Brigich Compressor Station in Washington County, PA, after nearby residents reported various negative health symptoms (e.g., headache, nausea, and lethargy). Through this joint investigation, the ATSDR and EPA found that nine pollutants exceeded the recommended exposure criteria, which had the potential to threaten the health of sensitive groups, such as older adults or individuals with asthma (ATSDR, 2016). Subsequent studies have also demonstrated the impacts of natural gas infrastructure on human health, including an increased risk of heart failure (McAlexander, 2019),

asthma (Rasmussen et al., 2016), cough, mental health issues (Blinn et al., 2020), and poor sleep (Casey et al., 2018). Finally, a community survey conducted between August 2011 and July 2012 in western Pennsylvania found that higher rates of negative health impacts were associated with living in close proximity to a natural gas compressor station, with the closest proximity being associated with the highest risk (Steinzor et al., 2013).

There are currently no government requirements for measuring pipeline system emissions or for recording information such as the frequency and length of regular "blowdowns," which occur when compressor units are depressurized for maintenance, a process that releases large amounts of high-pressure natural gas into the atmosphere (Davis et al, 2023b). Standards for measuring emissions near natural gas infrastructure are insufficient for assessing human health risks; the measures that are typically used fail to account for peak exposures in close proximity to these facilities and over short bursts of time (Brown et al, 2014).

Study Rationale

In 2020, Mountain Valley Pipeline's parent company announced intentions to expand capacity of the pipeline by building additional compressor stations (Gough, 2020). In 2021, Mountain Valley Pipeline, LLC (MVP) purchased a 64.5-acre parcel of land adjacent to Highway 460 near the border of Lafayette and Elliston, Virginia. Residents of Eastern Montgomery County, Virginia (EastMont), suspected that Mountain Valley Pipeline intended to build a compressor station in their community.

EastMont already experiences significant pollution burdens, including Interstate 81; Highway 460; multiple Norfolk Southern Railroad lines, which transport train cars of uncovered coal; truck traffic to a Roanoke County landfill; several small manufacturing facilities; a Love's Truck Stop; East Tennessee methane gas transmission line; and the Mountain Valley Pipeline methane gas transmission line and gate station. Concerned community members requested assistance conducting a study of the community surrounding the property purchased by MVP to determine whether it is an overburdened environmental justice community.

Generally, the industry uses data from the U.S. Census Bureau's American Community Survey[2] to evaluate the demographics of areas where it intends to build infrastructure. According to 2022 data from this survey, the census tract encompassing our study area is 2.19% people of color, 0% Spanish-speaking, and 31.4% low-income. However, as Fjord (2018) found, data associated with census tracts and census blocks are not sufficiently granular to make an accurate determination of the environmental justice status of a community adjacent to industrial facilities (see also Bazuin & Frazier 2013 on the limitations of the American Community Survey for accurately measuring poverty levels).

[2] Beginning in 2005, the American Community Survey replaced the decennial census long-form questionnaire.

Given that the impacts of compressor stations are most acutely felt by households living in close proximity to these facilities, in 2022 researchers at Virginia Tech worked with EastMont community members to design and conduct a door-to-door demographic survey of residents living within one mile of the 64.5-acre parcel bought by MVP in 2021 (Montgomery County Tax Parcel ID Number 013751, located near the Lafayette-Elliston border, henceforth referred to as the "MVP Cove Hollow Road parcel"[3]). The Lafayette Area Household Survey was designed to answer the question: Are residents living within one mile of the MVP Cove Hollow Road parcel an environmental justice community as defined by the Commonwealth of Virginia?

Method

In Montgomery County, Virginia, census blocks—which are the smallest geographic level of data available from the U.S. Census Bureau—are 6.2 miles by 6.2 miles (38.44 square miles). Figure 1 shows the census block that includes the MVP Cove Hollow Road parcel. This scale of demographic data is not finely grained enough to determine whether the households neighboring the MVP Cove Hollow Road parcel comprise an environmental justice community.

We designed our study according to the scientific literature, which finds that health effects from air pollution are most acute within approximately one mile of gas compressor stations (Davis et al., 2023a; Brown et al, 2014). In a self-reported survey study in Pennsylvania, residents up to five miles from gas infrastructure reported negative health effects (Steinzor et al, 2013). VOC sampling in Ohio found indoor air quality of concern within 2 kilometers (1.2 miles) of a compressor station (Martin et al, 2021). Other studies document negative health effects within .8 kilometers, 2.5 kilometers, and 16 kilometers (Brown et al, 2014). NEPA guidelines often assess a 1-mile impact area from the source or the infrastructure site (Fjord, 2018).

[3] Although there is no address associated with this parcel on the Montgomery County Tax Assessor's records, in 2025 MVP's public relations materials identified the site as 6684 Cove Hollow Road, Elliston. The parcel is situated between the Roanoke River on its western border, U.S. Highway 11 and 460 on its northern border, and the Mountain Valley Pipeline right-of-way on its eastern border.

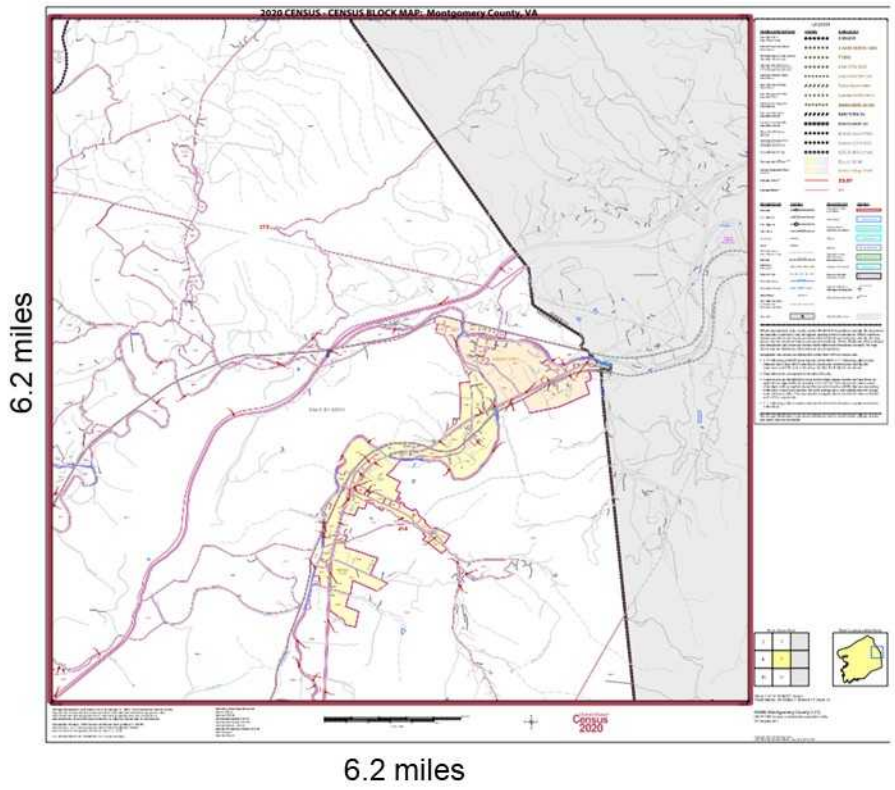

Figure 1: Census Block in Montgomery County, Virginia, that includes the site of the proposed Swann Compressor Station at Cove Hollow Road. Source: U.S. Census Bureau.

To determine the residences falling within a one-mile radius of the MVP Cove Hollow Road parcel, Mannin Dodd from New River Geographics created a Geographic Information System map (see Figure 2) and database using publicly available tax assessment data from Montgomery County, Virginia. Approximately 333 households were determined to fall within the study area. Every second housing unit was included in our sample, for a total of 171 households, or 51.4% of the residences within a one-mile radius of the MVP Cove Hollow Road parcel.

Figure 2: Study area showing one mile radius from parcel owned by MVP, LLC, on Cove Hollow Road in Elliston, Virginia. Courtesy New River Geographics.

From January to December 2022, Virginia Tech faculty, graduate students, undergraduate students, and community members worked together to develop a household questionnaire that would allow the research team to assess community vulnerabilities according to age, income, race and ethnicity, disability, and pre-existing health conditions.

The principal investigators drafted the initial survey questions based on Lakshmi Fjord's Union Hill household study (Fjord, 2018). Community researchers, graduate and undergraduate students, and faculty members met several times to pre-test and revise the survey questions together. Community researchers indicated that health questions were likely to be welcomed, especially by senior citizens, and one community researcher requested additional questions that provided broader context, including residents' perceptions of strengths and concerns in their community.

The research team consulted with attorneys who recommended adding questions about racial/ethnic identity and primary language. We hired a translator to prepare materials in Spanish and hired additional community researchers who could conduct data collection in Spanish. All students and community researchers attended a training for conducting household surveys and completed a research ethics certification through Virginia Tech's Institutional Review Board.

Throughout 2022, community member researchers and student research assistants conducted data collection. One community member researcher and one Virginia Tech research scribe visited each household in our sample. If a household was a no-answer, researchers returned up to two additional times to invite participation. If researchers were unable to reach a household after a third attempt, or if a representative of the household declined to participate, the researchers invited the household next door to participate in the study.

During the visit, community member researchers introduced themselves, explained the purpose of the study, and obtained verbal consent from the resident. If the resident agreed to participate in the survey, the community researcher conducted the survey with the participant, and the scribe documented responses with a pen and paper instrument developed for data collection. Residents were invited to share open-ended concerns as well as ask questions of the research team. Figure 3 below shows the approximate locations of the responding households.

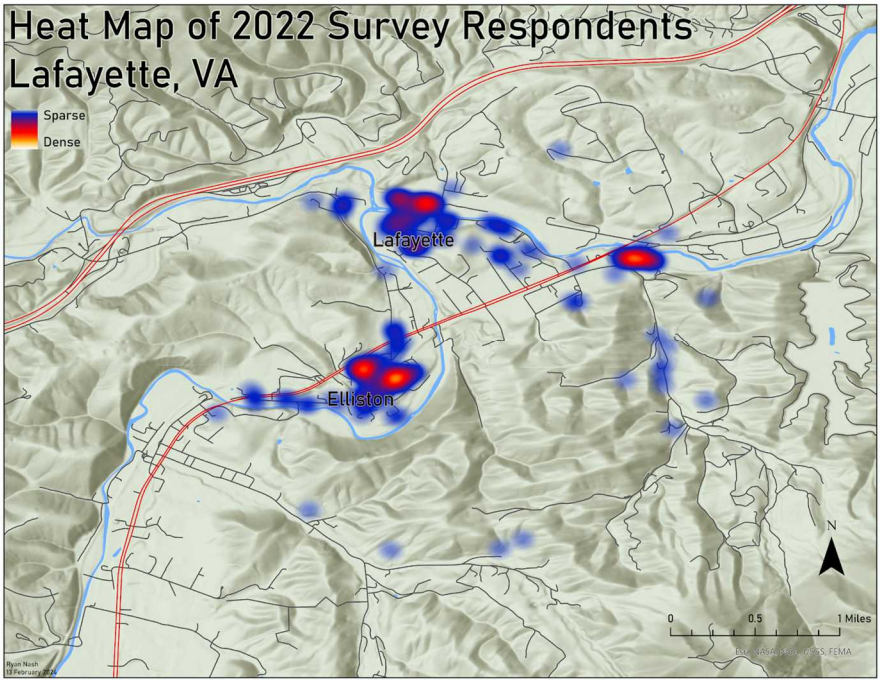

Figure 3: Heat map showing the approximate locations of survey respondents. Courtesy Ryan Nash.

Data Analysis

We used the data collected (described above) to answer the research question: *Does the area within one mile of the MVP-owned Cove Hollow Road property qualify as an environmental justice community?* We used the software program SPSS for data management and to conduct statistical analyses, which included both descriptive statistics and tests of significance.

Results

A total of 171 households completed the survey, representing a total of 484 residents. As noted above, our sample represents 51.4% of the 333 households within one mile of the proposed MVP Swann compressor station.

Residents can face increased vulnerability to emissions from compressor stations based on a number of social factors, including (though not limited to) age, existing health conditions and disabilities, income, and ethnicity (ATSDR, 2016; Steinzor et al., 2013; Chiger et al., 2025). Descriptive statistics were used to identify the percentage of residents or percentage of households in our study location that fall into known social determinants that increase vulnerability (see Figure 4).

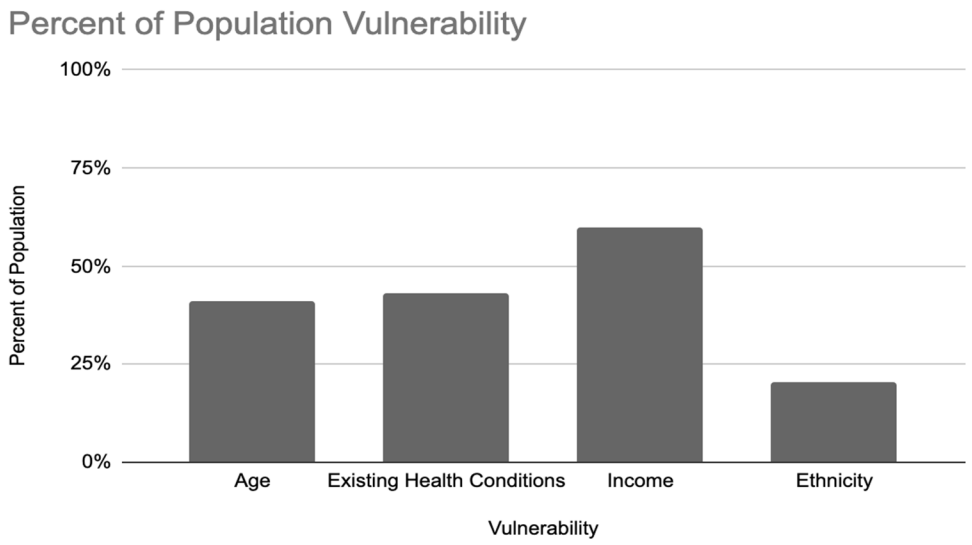

Figure 4: Percentage of Population by Vulnerabilities, Including Age, Existing Health Conditions, Income, and Ethnicity (Note: ethnicity and existing health conditions reported by household).

Age

The first vulnerability we assessed was the proportion of our respondents who were children (18 and under) or elderly (65 and over). The heightened vulnerability of these two groups to air pollution is well established in the scientific literature (Simoni et al, 2015; Garcia et al, 2021; de Bont et al 2022). Out of the 484 residents in our sample of 171 households, 118 were children and 74 were elderly, so 192 residents (39.7%) from our sample are considered more vulnerable to environmental pollutants based on their age. Six out of the 171 households did not provide the ages of individuals living in their home.

Health Conditions

Of the households in the dataset, 43% reported having one or more individuals living in the home who had existing health conditions. Participants were identified as having existing health conditions if they reported having a chronic illness and/or disability, including but not limited to high blood pressure, diabetes, neurologic conditions, asthma, long COVID, cancer, and mental health conditions. The most common health conditions reported were lung or heart conditions (41%), with mental health conditions (35%), disability (26%), asthma (23%), and cancer (21%) following.

Income

By Virginia Code, an "environmental justice community" is "any low-income community or community of color"; "low income" means having an annual household income equal to or less than the greater of (i) an amount equal to 80 percent of the median income of the area in which the household is located, as reported by the Department of Housing and Urban Development, and (ii) 200 percent of the Federal Poverty Level (Va. Code 2.2-234). According to data from the 2022 American Community Survey, 31.4% of the census block that includes Lafayette and Elliston qualifies as low-income. The proposed compressor station site is therefore within an environmental justice community according to Virginia law.

Our study indicates that the number of low-income households within one mile of the proposed compressor station site is significantly higher. Of the 127 households reporting household income, 50.4% (64) reported earning less than $40,999 per year. Another 10 reported earnings less than $52,999 per year. According to data from the 2022 American Community Survey on county income rates, the median income per household for Montgomery County was $65,270. The U.S. Department of Housing and Urban Development defines a household to be "low income" if the household's income is equal to or less than 80% of the area's median income; thus, households in Montgomery County qualify as low income if their household's income is $52,216 or lower. At least 50.4% of our respondents qualify as low income. This percentage is likely even larger (possibly as large as 58.3%) because the low-income threshold is so close to the upper limit of our next income category.

Table 1. Frequencies of average income of households across the entire sample, including missing responses and those who chose not to respond to the question.

What is the average income of this household?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	decline to answer	33	19.3	20.6	20.6
	no income at this time	2	1.2	1.3	21.9
	below $17,000	18	10.5	11.3	33.1
	$17,000-28,999	22	12.9	13.8	46.9
	$29,000-40,999	22	12.9	13.8	60.6
	$41,000-52,999	10	5.8	6.3	66.9
	$53,000-59,999	9	5.3	5.6	72.5
	$60,000-69,999	8	4.7	5.0	77.5
	$70,000-84,999	8	4.7	5.0	82.5
	$85,000-99,999	12	7.0	7.5	90.0
	$100,000-119,999	3	1.8	1.9	91.9
	above $120,000	13	7.6	8.1	100.0
	Total	160	93.6	100.0	
Missing	System	11	6.4		
Total		171	100.0		

Population of Color

Of the households that provided racial designations for household members (N=149), 20.5% of households reported having one or more residents who were not White. Twenty-two (12.9%) of households did not provide a racial designation.

Implications

The findings of our community survey reveal a highly vulnerable population living within one mile of MVP's Cove Hollow parcel near the Lafayette-Elliston border. Communities are susceptible to the negative health effects of pollution if they have pre-existing health conditions, are disabled, or if they are children or elderly. Compared to the average of the United States population, residents in Eastern Montgomery County are twice as likely to qualify for federal disability benefits. According to our survey, 43.0% of households reported pre-existing health conditions, 25.0% reported having a member of the household who was disabled, and 39.7% reported having either children or elderly individuals living in the household.

Moreover, our data suggest that the study area may have a greater proportion of people of color than Montgomery County as a whole. According to the U.S. Census Bureau, the census tract that our study area falls within is a little more than 2% people of color (2.19% people of color, 97.81% white). According to data from the 2022 U.S. Census Bureau's American Community Survey on county rates of race, the population of people of color (reported being a race or ethnicity that was not "White alone") in Montgomery County was 13.9%. In our study, however, 20.5% of households reported having at least one person of color in the household.

Crucially, our findings also indicate that our study area qualifies as a low-income community. As noted above, according to the U.S. Department of Housing and Urban Development, an income under $52,216 qualifies as low income in our study area. Among our respondents, 50.4% (64) reported earning less than $40,999 per year, and another 10 reported earning under $52,999 per year. Thus, at least 50.4% of our respondents, and possibly as many as 58.3% of our respondents, qualify as low income.

From these results, we conclude that the area within one mile of the MVP Cove Hollow Road parcel qualifies as an environmental justice community as defined by the Commonwealth of Virginia. The development of new, or the expansion of existing, energy resources or facilities at the border of Lafayette and Elliston in Eastern Montgomery County, Virginia, will have a disproportionately adverse impact on an economically disadvantaged community.

Acknowledgements
This research was funded by a grant from Virginia Tech's Center for Peace Studies and Violence Prevention.

Authors
Aran Garnett-Deakin is a Doctoral Candidate in Human Development and Family Science at Virginia Tech. She served as the project coordinator for this survey project.

Shannon Bell is Professor of Sociology at Virginia Tech. She is a member of the Science and Technical Advisory Committee for Wild Virginia.

Emily Satterwhite is Professor and Director of Appalachian Studies at Virginia Tech. She serves on the Advisory Council for POWHR (Protect Our Water, Heritage, Rights).

Madelyn Toman is a Doctoral Candidate in Human Development and Family Science at Virginia Tech.

References

Agency for Toxic Substances and Disease Registry (ATSDR). (2016). Health consultation, exposure investigation: Natural gas ambient air quality monitoring initiative: Brigich compressor station, Chartiers Township, Washington County, Pennsylvania (p. 93). US Department of Health and Human Services. http://www.atsdr.cdc.gov/HAC/pha/Brigich_Compressor_Station/Brigich_Compressor_Station_EI_HC_01-29-2016_508.pdf

Banks, J.L., Cohen Hubal, E.A. Noise: a public health problem. *J Expo Sci Environ Epidemiol* 35, 1–2 (2025). https://doi.org/10.1038/s41370-025-00748-4

Bazuin, J. T., & Fraser, J. C. (2013). How the ACS gets it wrong: The story of the American Community Survey and a small, inner city neighborhood. *Applied Geography*, *45*, 292-302. https://doi.org/10.1016/j.apgeog.2013.08.013

Blinn, H. N., Utz, R. M., Greiner, L. H., & Brown, D. R. (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. http://doi.org/10.1371/journal.pone.0237325

Boyle, M. D., Soneja, S., Quirós-Alcalá, L., Dalemarre, L., Sapkota, A. R., Sangaramoorthy, T., Wilson, S., Milton, D., Sapkota, A. (2017). A pilot study to assess residential noise exposure near natural gas compressor stations. *PLOS ONE,* https://doi.org/10.1371/journal.pone.0174310

Brown D, Weinberger B, Lewis C, Bonaparte H. (2014). Understanding exposure from natural gas drilling puts current air standards to the test. *Reviews on Environmental Health* 29(4). http://doi.org/10.1515/reveh-2014-0002

Caretta, M. A., & McHenry, K. A. (2020). Pipelining Appalachia: A perspective on the everyday lived experiences of rural communities at the frontline of energy distribution networks development. *Energy Research & Social Science, 63*, 101403. http://doi.org/10.1016/j.erss.2019.101403

Caron-Beaudoin, É., Whyte, K. P., Bouchard, M. F., Chevrier, J., Haddad, S., Copes, R., et al. (2022). Volatile organic compounds (VOCs) in indoor air and tap water samples in residences of pregnant women living in an area of unconventional natural gas operations: Findings from the EXPERIVA study. *Science of the Total Environment* 805. https://doi.org/10.1016/j.scitotenv.2021.150242

Casey, J. A., Wilcox, H. C., Hirsch, A. G., Pollak, J., & Schwartz, B. S. (2018). Associations of unconventional natural gas development with depression symptoms and disordered sleep in Pennsylvania. *Scientific Reports*, 8(1), 11375. http://doi.org/10.1038/s41598-018-29747-2

Chakraborty, J. (2022). Disparities in exposure to fine particulate air pollution for people with disabilities in the US. *Science of The Total Environment* 842. https://doi.org/10.1016/j.scitotenv.2022.156791

Chiger, A. A. et al. (2025). Improving methodologies for cumulative risk assessment: A case study of noncarcinogenic health risks from volatile organic compounds in fenceline communities in southeastern Pennsylvania. *Environmental Health Perspectives* 133(5). https://doi.org/10.1289/EHP14696.

Cupertino, M. D. C., Guimarães, B. T., Pimenta, J. F. G., Almeida, L. V. L. D., Santana, L. N., Ribeiro, T. A., & Santana, Y. N. (2022). Light pollution: a systematic review about the impacts of artificial light on human health. *Biological Rhythm Research 54*(3), 263–275. https://doi.org/10.1080/09291016.2022.2151763

Davis, C. D., Frazier, C., Guennouni, N., King, R., Mast, H., Plunkett, E. M., & Quirk, Z. J. (2023a). Community health impacts of natural gas compressor stations. White paper. February 2023. https://sites.google.com/vt.edu/2022lafayettecommunitysurvey/compressor-stations?authuser=0

Davis, C. D., Frazier, C., Guennouni, N., King, R., Mast, H., Plunkett, E. M., & Quirk, Z. J. (2023b). Community health impacts from natural gas pipeline compressor stations. *GeoHealth*, 7:11, November 2023, e2023GH000874. https://doi.org/10.1029/2023GH000874

de Bont J, Jaganathan S, Dahlquist M, Persson Å, Stafoggia M, Ljungman P. (2022). Ambient air pollution and cardiovascular diseases: An umbrella review of systematic reviews and meta-analyses. *Journal of Internal Medicine* 291(6): 779-800. https://doi.org/10.1111/joim.13467

Emanuel, R. E., Caretta, M. A., Rivers, L., & Vasudevan, P. (2021). Natural gas gathering and transmission pipelines and social vulnerability in the United States. *GeoHealth, 5(6),* e2021GH000442. http://doi.org/10.1029/2021GH000442

Fisher, M.P., Mayer, A., Vollet, K., Hill, E.L., Haynes, E.N. (2018). Psychosocial implications of unconventional natural gas development: Quality of life in Ohio's Guernsey and Noble Counties. *Journal of Environmental Psychology* 55, 90-98. https://doi.org/10.1016/j.jenvp.2017.12.008.

Fjord, L. (2018). Union Hill household study site and methods report. A community participatory action research project. *Part II: Households: Demographics, Health, Land Use, Family Heritage.*

Galán-Madruga, D., Cárdenas-Escudero, J., Cáceres, J.O. (2025). Relationship between disabilities and air quality. In: Bennett, G., Goodall, E. (eds). *The Palgrave Encyclopedia of Disability.* Palgrave Macmillan. https://doi.org/10.1007/978-3-031-40858-8_353-1

Gao, J. et al (2024). Long-term air pollution exposure and incident physical disability in older US adults: a cohort study. *The Lancet Healthy Longevity* 5(10), 100629.

Garcia, E, Rice, MB, Gold, DR. (2021). Air pollution and lung function in children. *Journal of Allergy and Clinical Immunology* 148(1):1-14. doi: 10.1016/j.jaci.2021.05.006

Green, L. C., & Crouch, E. A. C. (2021). Public health assessment of expected airborne emissions from the proposed Lambert Compressor Station, Pittsylvania County, Virginia. Green Toxicology LLC. http://www.mvpsouthgate.com/wp-content/uploads/2021/09/Public_Health_Assessment_L.pdf

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.

Hendryx, M., & Luo, J. (2020). Natural gas pipeline compressor stations: VOC emissions and mortality rates. *The Extractive Industries and Society, 7*(3), 864–869. http://doi.org/10.1016/j.exis.2020.04.011

Karn Vohra *et al.*,(2025). The health burden and racial-ethnic disparities of air pollution from the major oil and gas lifecycle stages in the United States. *Sci. Adv.* 11. DOI:10.1126/sciadv.adu2241

Kerr, G.H., A. van Donkelaar, A., R. V. Martin, R. V., Brauer, M, Bukart, K,, Wozniak, Goldberg, S. D. L., Anenberg, S. C. (2024). Increasing racial and ethnic disparities in ambient air pollution-attributable morbidity and mortality in the United States. *Environmental Health Perspectives* 132.

Macey, G. P., Breech, R., Chernaik, M., Cox, C., Larson, D., Thomas, D., & Carpenter, D. O. (2014). Air concentrations of volatile compounds near oil and gas production: A community-based exploratory study. *Environmental Health*, *13*(82), 1–18. https:/ / doi.org/ 10.1186/ 1476-069x-13-82

Martin, K. A. V., Lin, E. Z., Hilbert, T. J., Pollitt, K. J. G., & Haynes, E. N. (2021). Survey of airborne organic compounds in residential communities near a natural gas compressor station: Response to community concern. *Environmental Advances*, *5*, Article 100076. https://doi.org/10.1016/j.envadv.2021.100076

McAlexander, T. P. (2019). Associations of unconventional natural gas development with heart failure hospitalization and B-type natriuretic peptide and effect modification by heart failure phenotype [Thesis, Johns Hopkins University]. http://jscholarship.library.jhu.edu/handle/1774.2/62187

Mohai, P., Pellow, D., & Roberts, J. T. (2009). Environmental justice. *Annual Review of Environment and Resources,* 34(1), 405–430. https://doi.org/10.1146/annurev-environ-082508-094348

Mukerjee, S., Smith, L., Long, R., Lonneman, W., Kaushik, S., Colon, M., et al. (2019). Particulate matter, nitrogen oxides, ozone, and select volatile organic compounds during a winter sampling period in Logan, Utah, USA. *Journal of the Air & Waste Management Association,* 69(6), 778–788. https://doi.org/10.1080/10962247.2019.1587553

Nethery, R. C., Mealli, F., & Dominici, F. (2019). Estimating population average causal effects in the presence of non-overlap: The effect of natural gas compressor station exposure on cancer mortality. *The Annals of Applied Statistics, 13*(2), 1242–1267. https://doi.org/10.1214/18-AOAS1231

Rasmussen, S. G., Ogburn, E. L., McCormack, M., Casey, J. A., Bandeen-Roche, K., Mercer, D. G., & Schwartz, B. S. (2016). Association between unconventional natural gas development in the Marcellus shale and asthma exacerbations. JAMA Internal Medicine, 176(9), 1334. http://doi.org/10.1001/jamainternmed.2016.2436

Richburg, C. M., & Slagley, J. (2019). Noise concerns of residents living in close proximity to hydraulic fracturing sites in Southwest Pennsylvania. Public Health Nursing (Boston, Mass.), 36(1), 3–10. http://doi.org/10.1111/phn.12540

Russo, P. N., & Carpenter, D. O. (2019). Air emissions from natural gas facilities in New York state. *International Journal of Environmental Research and Public Health*, 16(9), 1591. https://doi.org/10.3390/ijerph16091591

Simoni, M., Baldacci, S., Maio, S., Cerrai, S., Sarno, G., & Viegi, G. (2015). Adverse effects of outdoor pollution in the elderly. *Journal of Thoracic Disease*, 7(1), 34–45. https://doi.org/10.3978/j.issn.2072-1439.2014.12.10

Steinzor, N., Subra, W., & Sumi, L. (2013). Investigating links between shale gas development and health impacts through a community survey project in Pennsylvania. *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy, 23*(1), 55–83. http://doi.org/10.2190/NS.23.1.e

Strizhenok, A. V., & Korelskiy, D. S. (2019). Estimation and reduction of methane emissions at the scheduled and repair outages of gas-compressor units. *Journal of Ecological Engineering, 20(1), 46–51.* http://doi.org/10.12911/22998993/93943

U.S. Environmental Protection Agency (U.S. E.P.A.) (2021). "E.J. 2020 Glossary." Retrieved 19 November 2025 from https://19january2021snapshot.epa.gov/environmentaljustice/ej-2020-glossary_.html.

Walter, C. (2020, March 19). Air pollution from Pennsylvania shale gas compressor stations—REPORT. FracTracker Alliance. http://www.fractracker.org/2020/03/air-pollution-pennsylvania-compressor-stations/

Wicker, A.P., Hildenbrand, Z.L., Schug, K.A. (2017). Chapter Fourteen - Best management practices from the "Responsible Shale Energy Extraction." Conference: Guiding Industry in Environmental Stewardship. In Kevin A. Schug and Zacariah L. Hildenbrand, eds. *Advances in Chemical Pollution, Environmental Management and Protection* 1, 2468-9289. https://doi.org/10.1016/bs.apmp.2017.09.001.

World Health Organization (WHO). (2021a). WHO global air quality guidelines: Particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide. World Health Organization. http://apps.who.int/iris/handle/10665/345329

Document Content(s)