



# Expert Report of Katelyn Hall, PhD, MPH, and Tami McMullin, PhD

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Case Number ZA-2026-3203-RV

July 20, 2026

Prepared for:

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# 1.0 INTRODUCTION

Roux is an employee-owned environmental and engineering consulting company with more than 450 environmental professionals. Roux applies sophisticated scientific, technical, and managerial resources to develop and implement effective, efficient, and sustainable solutions. Roux provides advisory, compliance, and field services to a broad spectrum of both private and public sector clients nationwide and their associated law firms, including numerous Fortune 500 companies. Roux's clients span sectors in industrial; utilities and energy; real estate; financial; legal; insurance; government/municipal; environmental, social, and governance (ESG); and water resources. Roux provides a broad range of technical, consultation, regulatory, and field services related to site assessment and remediation throughout the United States. Founded over 40 years ago, Roux was built upon management and cleanup of large, complex environmental remediation projects, including Superfund and state-led sites impacted by chemical and manufacturing plants, manufactured gas plants (MGPs) and petroleum refineries and distribution terminals, and has expanded services into such areas as human health and ecological risk, commercial economic damages, natural resources valuation, industrial hygiene, health and safety, and engineered natural/sustainable systems.

Katelyn Hall, PhD, MPH, serves as a Principal Epidemiologist and Biostatistician at Roux with over a decade of experience in environmental epidemiology, public health research, biostatistical analysis, and exposure science across the non-profit, state government, federal government, and private sectors. Dr. Hall holds a Ph.D. in Epidemiology with a specialization in toxicology from the University of Colorado Denver Anschutz Medical Campus, a Master of Public Health from the Colorado School of Public Health, and a Bachelor of Science in pre-medical biology with a minor in chemistry from Harding University. Dr. Hall is a nominated council member of the International Society of Regulatory Toxicology and Pharmacology and holds an Adjunct Assistant Professor appointment in the Department of Epidemiology at the Fay W. Boozman College of Public Health, University of Arkansas for Medical Sciences. Dr. Hall is also a member of the American Public Health Association and the Council for State and Territorial Epidemiologists and has authored or co-authored more than 25 peer-reviewed publications and technical reports on topics including cannabis and public health, exposure science, systematic literature reviews, and environmental epidemiology. Prior to consulting, Dr. Hall served as an Epidemiologist and Statistical Analyst at the Colorado Department of Public Health and Environment's Environmental Epidemiology, Occupational Health, and Toxicology Branch, conducting large-scale analyses of population-level health impacts from policies, performed GRADE-adapted systematic reviews, assisted with the epidemiology and statistical evaluation of emerging environmental concerns, and helped develop the framework for systematic reviews of epidemiological literature related to oil and gas activities.

Tami McMullin, PhD, serves as a Principal Toxicologist at Roux with over 20 years of multidisciplinary experience applying risk-based frameworks to support regulatory and legislative policies involving chemical risk management, product stewardship, and public health protection. Dr. McMullin holds a B.S. in biology from the University of California, San Diego, and a Ph.D. in toxicology from the Department of Environmental and Radiological Health Sciences at Colorado State University. Dr. McMullin is a full member of the Society of Toxicology, the Risk Assessment and Occupational and Public Health Specialty Sections and a council member for the International Society of Regulatory Toxicology and Pharmacology (IS RTP). She currently serves on the U.S. Environmental Protection Agency's (USEPA) Science Advisory Board (SAB) and its Chemical Assessment and Safety Committee, including the SAB Drinking Water Committee (DWC) Contaminant Candidate List (CCL) 6 Review Committee. Additionally, Dr. McMullin has participated on other state and federal scientific committees, including Colorado's Scientific Community Technical Working Group, Society for Advancement of Risk Assessment (SRA) and the ISLI-Health and Environmental Science Institute (HESI) Risk 21 Committee, and USEPA's advisory panel evaluating the applicability of a physiologically based pharmacokinetic (PBPK) model for establishing a substance-specific reference concentration within

the Integrated Risk Information System (IRIS) Program. Dr. McMullin has held academic appointments as an Adjunct Instructor at the Colorado School of Mines and an Adjunct Professor at the University of Arkansas for Medical Sciences and has served as a visiting lecturer at Colorado State University. Prior to consulting, Dr. McMullin worked for over a decade as a regulatory and product safety toxicologist and served as the State Toxicologist at the Colorado Department of Public Health and Environment, where she led an interdepartmental program under the governor's directive to promote responsible, health-protective development of oil and gas. Finally, Dr. McMullin has published over 30 peer-reviewed studies, abstracts, or presentations spanning chemical exposure and risk, dose-response, and public health.

The combination of our public health experiences in the public, private, and academic sectors, and our education make us well-qualified to assess and synthesize the body of scientific evidence related to environmental exposures and public health outcomes. We have attached copies of our curriculum vitae (CV) in **Attachment A**.

## Scope of Assignment

Roux was retained by Alston & Bird on behalf of E&B Natural Resources to review the Case Summary & Documents for Case Number ZA-2026-3203-RV to determine if there was scientific evidence in the administrative record to support the claim that the Murphy Drilling Site located at 1211 West Adams Boulevard may jeopardize or adversely affect the public health, peace, and safety of persons residing or working on the premises or in the surrounding area, and has documented reports of repeated nuisance activities.<sup>1</sup>

## Materials Considered

The opinions stated in this report are based on the culmination of our education, training, experience, and an expert review of the referenced information and case materials. In formulating our opinions in this case, we have reviewed the publicly available case materials, including, but not limited to all documents made publicly available on the Los Angeles City Planning Case Summary & Documents website for Case Number ZA-2026-3203-RV. A list of the documents we have relied upon in the case is presented in **Attachment B**.

As additional information is made available or becomes known to us, we reserve the right to supplement this report, as necessary. All our opinions in this report are stated to a reasonable degree of epidemiological, toxicological, and scientific certainty.

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<sup>1</sup> Notice of Public Hearing for Murphy Drill Site. Los Angeles Department of City Planning. <https://planning.lacity.gov/dcpapi2/meetings/document/81033>.

## 2.0 SUMMARY OF OPINIONS

In addition to the case documents in the administrative record, our opinions are based on our experience as a practicing public health epidemiologist or toxicologist, exposure scientists, and risk communicators. Based on our analysis of the administrative record, we have reached the opinion summarized below. The bases for these opinions are further detailed in the following section.

1. The administrative record contains no scientific evidence to support the claim that the Murphy Oil Drill Site jeopardizes or adversely affects the public health or safety of persons residing or working on the premises or in the surrounding area.
2. The administrative record does not contain the scientific evidence of source-attribution or odor characterization data necessary to support that the Murphy Oil Drill Site is the source of documented reports of repeated nuisance activities.
3. Health studies in the area do not show evidence that the Murphy Oil Drill Site may jeopardize or adversely affect the public health, peace, and safety of persons residing or working on the premises or in the surrounding area and has documented reports of repeated nuisance activities.

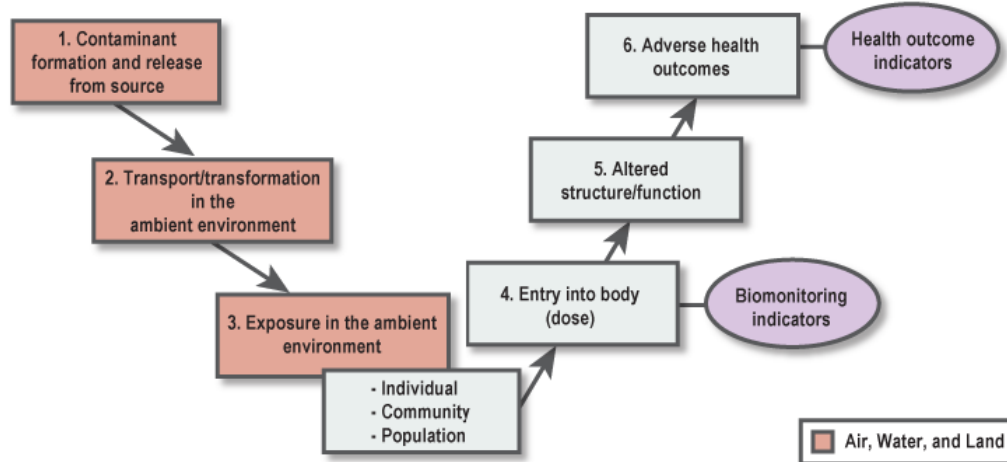
### 3.0 BASIS OF OPINIONS

**Opinion 1. The administrative record contains no scientific evidence to support the claim that the Murphy Oil Drill Site jeopardizes or adversely affects the public health or safety of persons residing or working on the premises or in the surrounding area.**

Established frameworks exist for determining, with scientific evidence, whether a source such as the Murphy Oil Drill Site adversely affects public health, and the administrative record contains no indication that any such framework was applied to this Site.

The US Environmental Protection Agency (EPA) guidance recommends following their environmental public health paradigm, which requires scientific evidence across the steps to demonstrate a complete pathway between an emitting source and a plausible health effect (Figure 1).<sup>2,3,4,5</sup>

**Exhibit 1. Environmental public health paradigm**



**Figure 1. EPA's Environmental Public Health Paradigm to Represent the Pathway from an Industrial Source like the Murphy Oil Drill Site to a Health Outcome<sup>6</sup>**

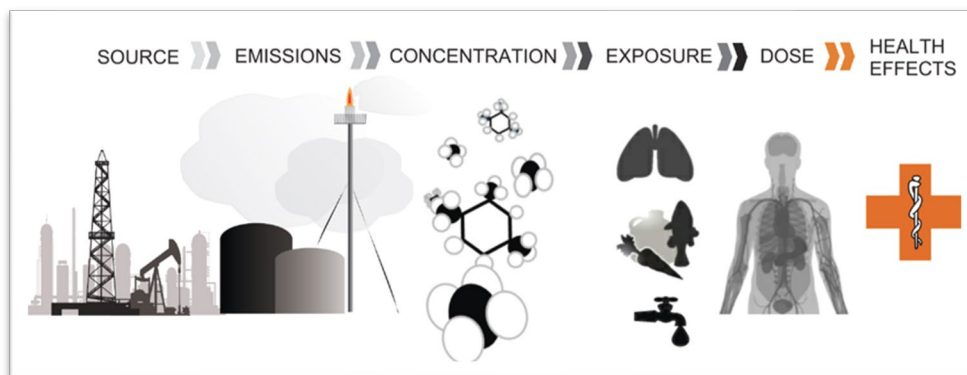
<sup>2</sup> USEPA, 2024. Interim Framework for Advancing Consideration of Cumulative Impacts. November.

<sup>3</sup> USEPA, 2004. Air Toxics Risk Assessment Reference Library. Volume 1 – Technical Resource Manual. April.

<sup>4</sup> USEPA, 2004. Air Toxics Risk Assessment Reference Library. Volume 2 – Facility Specific Assessment. April.

<sup>5</sup> USEPA, 2004. Air Toxics Risk Assessment Reference Library. Volume 3 – Community Scale Assessment. April.

<sup>6</sup> USEPA, 2026. Human Exposure and Health. July 6. <https://www.epa.gov/report-environment/human-exposure-and-health#note1>



**Figure 2. Shonkoff's 2014 Source to Health Outcome Pathway<sup>7</sup>**

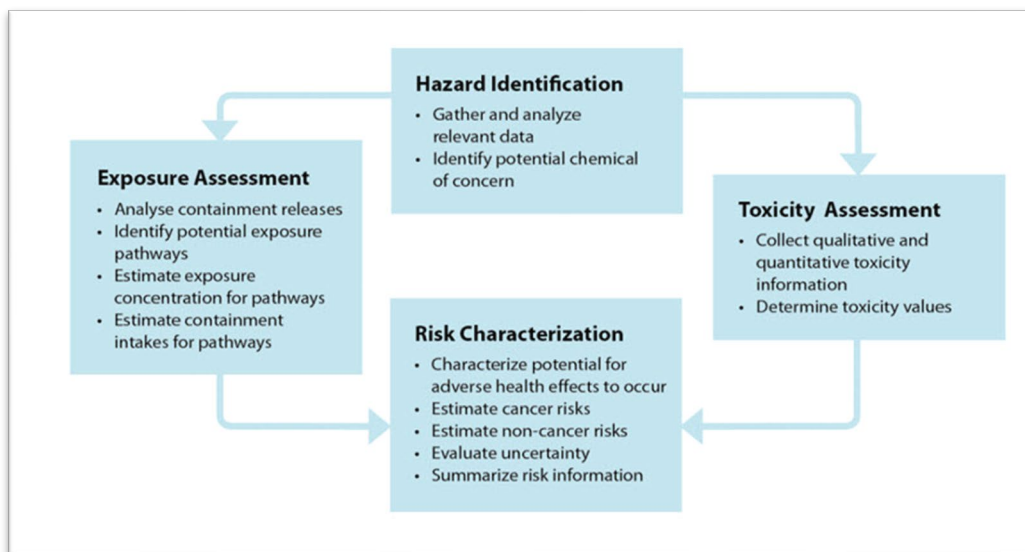
When it comes to concerns regarding adverse effects to public health from releases from a source, federal and state public health and environmental agencies use a method called a human health risk assessment (HRA). This methodology directs the type of scientific evidence needed to make determinations about potential health risks from a source, such as the Murphy Oil Drill Site. As DTSC's figure shows, an HRA is organized into four steps that require data collection and analyses at each step (**Figure 2**).

In California, the Office of Environmental Health Hazard Assessment (OEHHA) is *"the lead state agency for the assessment of health risks posed by environmental contaminants."*<sup>8</sup> OEHHA's HRA guidance documents form the standard of practice for quantifying health risks in California. According to OEHHA, the HRAs are codified in California's Health and Safety Code and are used to *"inform, support and guide regulatory and other actions,"* including other state and local agency regulatory risk management.<sup>9</sup> CA agencies, such as DTSC and South Coast Air Quality Management District (SCAQMD), use this HRA framework to guide evaluations of potential health risks associated with facility releases and provide evidentiary basis for informing regulatory or other risk management actions.

<sup>7</sup> California Council on Science & Technology. (2015, July). An independent scientific assessment of well stimulation in California, Volume II: Potential environmental impacts of hydraulic fracturing and acid stimulations. <https://ccst.us/reports/an-independent-scientific-assessment-of-well-stimulation-in-california-volume-2/>

<sup>8</sup> Department of Toxic Substances Control. (2025). Human Health Risk Assessments quick reference guide. <https://dtsc.ca.gov/brownfields/human-health-risk-assessments-quick-reference-guide/>

<sup>9</sup> California Health and Safety Code, § 59000-59017 (2019).



**Figure 2. The Four Steps of a Quantitative Health Risk Assessment (HRA).<sup>10</sup>**

A claim that the Murphy Oil Drill Site jeopardizes or adversely affects the public health or safety of persons residing or working on the premises or in the surrounding area, under the established scientific frameworks described above, would be expected to be supported by scientific evidence in the administrative record. The administrative record contains no such evidence.

The regulatory and public health agencies with jurisdiction over the Murphy Oil Drill Site possess broad authority, technical resources, and a documented practice of investigating, monitoring, and acting on facilities they determine to present a public health concern. Were the Murphy Oil Drill Site causing the widespread, ongoing odor or health impacts alleged, it would be expected that regulatory and public health response would be reflected in an investigative and enforcement record. That record is not present.

The SCAQMD, Los Angeles County Department of Public Health (DPH), and CalGEM each hold statutory authority to investigate air quality, odor, and public health conditions and to take enforcement or protective action when warranted. These agencies have exercised that authority at comparable neighborhood oil and gas facilities in Los Angeles County, and their actions in those instances generated a substantial and locatable documentary record, including site-specific health investigations, community air monitoring, inter-agency coordination, and, in appropriate cases, abatement or cessation of operations.<sup>11</sup>

The administrative record itself reflects that multiple agencies with substantial authority over the Murphy Oil Drill Site were actively engaged in oversight during the relevant period. The Murphy Oil Drill Site is regulated under multiple government agencies including the City of Los Angeles, Los Angeles Fire Department (LAFD), Los Angeles Department of Building and Safety (LADBS), California Geologic Energy Management Division (CalGEM), California Department of Toxic Substances Control (DTSC), South Coast Air Quality Management Division (SCAQMD), California Environmental Reporting System (CERS), Environmental Protection Agency (EPA), and Pipeline and Hazardous Materials Safety Administration (PHMSA).<sup>12</sup> These agencies are charged with protecting aspects of public health and safety, and several are specifically charged with

<sup>10</sup> Department of Toxic Substances Control. (2025). Human Health Risk Assessments quick reference guide. <https://dtsc.ca.gov/brownfields/human-health-risk-assessments-quick-reference-guide/>

<sup>11</sup> South Coast Air Quality Management District. (n.d.). *Community investigations*. Retrieved July 16, 2026, from <https://www.aqmd.gov/home/news-events/community-investigations>

<sup>12</sup> Murphy Drill Site Annual Inspection Reports 2024, 2025, 2026. March 11, 2026.

determining whether a regulated source poses nearby impacts to public health and safety. The record reflects that these agencies have continued to approve operating permits for the Murphy Oil Drill Site.

The record identifies enforcement activity by the South Coast Air Quality Management District (SCAQMD), and the California Geologic Energy Management Division (CalGEM).<sup>13</sup> The specific agency actions documented in the administrative record, however, concern discrete operational and equipment matters, no documented actions that constitute a finding that the Murphy Oil Drill Site caused a widespread or recurring odor or health nuisance affecting the surrounding community.

One document in the administrative record warrants specific comment with respect to health and safety: the Methane Task Force Inspection Report for the South Los Angeles Community. The Methane Task Force Inspection Report documents that the SCAQMD issued a Notice of Violation (NOV) to E&B Natural Resources Management for one methane leak detected above 50,000 ppm (API Number 403700373) documented by the joint inspections between SCAQMD and the Methane Task Force (MTF). A NOV reflects a regulatory compliance exceedance and does not provide evidence of a completed exposure pathway or an adverse health effect, which was supported by the MTF's own findings. In the Inspection Report, the MTF stated that these leaks found at the source (which includes the E&B Natural Resources leak) "*dissipated to background levels, rendering them undetectable within three inches of the source and negating the need to collect a sample or notify first responders.*" (pg. 3) This characterization indicates that the leak did not present a public exposure, adverse health risk or safety concern to workers or nearby residents.

There were no such documents located in the administrative record indicating these agencies have concluded that the Murphy Oil Drill Site is jeopardizing or adversely affecting public health or safety of persons residing or working on the premises or in the surrounding area.

## **Opinion 2. The administrative record does not contain the scientific evidence of source-attribution or odor characterization data necessary to support that the Murphy Oil Drill Site is the source of documented reports of repeated odor nuisance activities.**

Evaluating whether a recurring odor nuisance is attributable to a particular source requires at least two categories of evidence: whether the odors in fact originated at that source, and how the odors are characterized (frequency, duration, intensity, and hedonic tone (the degree of pleasantness or offensiveness)). The record is insufficient on both.

The table titled "Murphy Odor Complaint Records from SCAQMD" is the only evidence located in the administrative record pertaining to odor nuisance. It appears to be an extract from SCAQMD's internal complaint-tracking system. The record provides limited explanatory detail and does not include the categories of information that would be expected, and that SCAQMD has historically collected, in a regulatory nuisance investigation: confirmation of an odor by an inspector and its characterization, evidence of odors at multiple complainants' own locations, verification of odors at multiple complainants' own residences or workplaces, tracing of the odor to a specific source, and exclusion of other potential sources through upwind/downwind surveillance<sup>14</sup>. On the limited information the table does contain, it does not provide supporting evidence of an ongoing odor nuisance in the community attributable to Murphy Oil Drill Site activity:

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<sup>13</sup> CalGEM and SCAQMD Notice Of Violations Case Number: ZA-2026-3203-RV

<sup>14</sup> <https://www.aqmd.gov/home/news-events/community-investigations/sunshine-canyon-landfill/odor-complaints>

1. For approximately two-thirds of the complaints alleging the Murphy Oil Drill Site as the odor source, SCAQMD did not identify the Site as the actual source<sup>15</sup>. In two instances (November 13, 2025), SCAQMD attributed the odor to a different operator (Crimson Midstream LLC) rather than to E&B Natural Resources Management Corp, the Site's operator.
2. Of the nine complaints in which the recorded source was the Site or its operator, two-thirds (6 of 9) were reported on a single day, November 12, 2025, reflecting an isolated episode rather than a sustained or recurring condition.
3. The record contains no evidence that odors associated with Murphy Oil Drill Site emissions are a current nuisance; the most recent complaints attributed to the Site's operator date to November 2025.
4. The record contains no evidence that the complaints potentially linked to the Site originated from distinct individuals (each complaint could reflect the same person or household reporting repeatedly), or that the odors were reported from locations near the Site. It therefore does not establish that the complaints reflect a "considerable number of persons," as Rule 402 and Health & Safety Code § 41700 contemplate.

**Opinion 3. A health study in the area does not show evidence that the Murphy Oil Drill Site may jeopardize or adversely affect the public health, peace, and safety of persons residing or working on the premises or in the surrounding area.**

The Johnston 2021 study did not measure or evaluate any air pollutant, odor, or noise attributable to a specific oil operation, and it therefore does not, and by its design cannot, establish that operations at the Murphy Oil Drill Site cause or are likely to cause adverse effects on the public health, peace, or safety of the surrounding community. The Johnston et al. (2021) study, titled *Respiratory Health, Pulmonary Function and Local Engagement in Urban Communities Near Oil Development*, is an observational, cross-sectional community driven study of self-reported health symptoms and lung function among residents living within 1,000 meters of two oil well sites in South Los Angeles.<sup>16</sup> The study did not name its sites or operators, but described one as active and one as idle. The active site was a 28-well site in the Jefferson Park neighborhood, drawing from the Las Cienegas oil field and operating continuously throughout the January 2017 to August 2019 study period. This location has been publicly identified, separately from the study, as the Murphy Oil Drill Site.<sup>17</sup> Even accepting that identification, several methodological limitations of the study preclude a conclusion that operations at the site cause adverse health effects: 1) the study does not represent emissions or exposures from the Murphy Oil Drill Site; 2) its study design cannot support that the Murphy Oil Drill Site causes adverse health symptoms or diminished lung function; and 3) lung function measurements cannot be anchored to normal or clinically meaningful benchmarks for lung health.

**1. The study does not represent emissions or exposures from the Murphy Oil Drill Site.**

The study did not measure exposure in participants. It assigned exposure as the distance and predominant wind direction from each participant's residence relative to the well site. The study did not

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<sup>15</sup> The column labeled "Actual Source" was assumed to represent the determined source of the odor from an investigation by SCAQMD or equivalent regulatory agency. The column labeled "Alleged Source" was assumed to represent the source alleged by the reported complainant.

<sup>16</sup> Jill E. Johnston, Temuulen Enebish, Sandrah P. Eckel, Sandy Navarro, and Bhavna Shamasunder, "Respiratory Health, Pulmonary Function and Local Engagement in Urban Communities Near Oil Development," *Environmental Research* 197 (2021): 111088, <https://doi.org/10.1016/j.envres.2021.111088>.

<sup>17</sup> Lindenfeld, Jeremy. "In a Largely Black and Latino Community, Neighbors Worry About the Oil Wells in Their Midst." Capital & Main, March 3, 2023. <https://capitalandmain.com/in-a-largely-black-and-latino-community-neighbors-worry-about-the-oil-wells-in-their-midst>.

collect air quality data, air measurement of any specific emission, and did not characterize any odor, noise, or other nuisance from the active site (the Murphy Oil Drill Site). The authors acknowledge that this exposure metric is a proxy stating that *"wind direction and proximity is used as a proxy for exposure to pollution associated with the well sites and may not represent true oil-related exposure."* Because no emissions from the site and their potential subsequent air concentrations in the nearby community were measured, health outcomes cannot be attributed to the Murphy Oil Drill Site emissions as opposed to being from other explanations like freeway and traffic-related emissions, other industrial land uses, or differences between the two neighborhood populations.

There is evidence in the study's own reporting that comparisons made between the two neighborhoods (active v. idle well site) are confounded by systematic differences between the populations that have nothing to do with oil operations. The participant characteristics reported in Table 1 show that the active site neighborhood was older (33.1% of participants over age 60, versus 13.6% at the idle site), more racially and ethnically diverse (69.0% Latinx, 21.0% Black, and 10.0% Asian, versus 98.2% Latinx at the idle site), and had a higher proportion of ever-smokers (26.5% versus 15.9% at the idle site). These differences likely confound self-reported symptoms and lung function like forced expiratory volume (FEV1) and forced vital capacity (FVC) that were measured in this study. Thus, a higher prevalence of reported symptoms in the active site neighborhood may simply reflect who lives there and not be due to any other factor.

## **2. Study design cannot support that the Murphy Oil Drill Site caused or causes adverse health symptoms or diminished lung function.**

**The cross-sectional design cannot establish causation.** Because each participant's proximity, self-reported symptoms, and lung function were all recorded at a single point in time, the study cannot establish that exposure preceded the reported health effect or lung function measurements. That temporal sequence is a necessary condition for determining causation, and a cross-sectional design cannot establish it.

**The community driven approach likely introduced selection and reporting bias which could explain the reported associations.** In a community-driven study of this kind, residents that are aware of a perception that the active site may be associated with health effects tend to enroll at higher rates than those who are unaware or less concerned. That same awareness tends to influence how participants report subjective symptoms. Together these biases can create an apparent association where none exists (differential misclassification). The authors recognized this risk, stating that they *"cannot rule out potential confounding by unmeasured covariates or differential participation rates based on concerns about neighborhood health or environmental quality."* The pattern of results is consistent with such biases being present. The subjective, self-reported symptoms of irritation of eyes, dizziness, fatigue, diarrhea, backache, and rash were elevated near the active site compared to the idle, whereas the objective lung function measurements (FEV1 and FVC) showed a broadly similar pattern near both the active and the idle sites (Figure 6 in Johnston 2021). This pattern would be expected if enrollment and symptom reporting were being driven by awareness, and not physiology.

**Dichotomizing proximity at 200 meters lacks a biological and justifiable explanation.** The authors chose to dichotomize proximity at less than 200 meters and greater than 200 meters to 1,000 meters from the sites. There was no explanation for this categorization provided other than this statement, *"The selection of 200m for the main analysis was chosen based on a changing relationship observed between distance and lung function among study participants."* This statement references the Figure S1 in Attachment C. A continuous distance in meters was not presented or summarized by the groups.

**The idle, non-producing well was associated with comparable decrements in lung function.** Among residents near the idle site, which the authors note "is impacted by multiple freeways," living downwind and close (<200 m) was associated with lower lung function (FVC:  $\beta = -297$  mL, 95% CI:  $-577$  to  $-18$ ; FEV1  $\beta = -284$  mL, 95% CI  $-490$  to  $-76$ ), a magnitude similar to that seen at the active site (Figure 6 in Johnston 2021). The idle site was not producing any oil or gas during the study period and cannot plausibly be the cause of a respiratory effect. This trend points to a potential shared alternative source, plausibly traffic.

**The study performed a large number of statistical tests without correcting for multiple comparisons, so the scattered reported significant findings cannot be distinguished from random chance.** The study conducted a large number of statistical tests to examine possible connections between the proximity to the sites without using safeguards against false positives.<sup>18</sup> It modeled 17 different reported symptoms plus two lung function measures, each health endpoint was modeled against several different definitions of "exposure" (proximity or proximity and wind direction) all adding up to over a hundred separate statistical tests. The difficulty is that the study treated each test as significant at the common p value of 0.05, meaning that even if the wells had no real effect at all, roughly 1 in every 20 tests would be expected to have a p value below 0.05 or significant finding purely by chance.<sup>19,20</sup> With that many tests, it is expected to find a handful of significant results by chance alone. That is why a standard practice is to apply a statistical correction to account for this, like lowering the p value to determine statistical significance. The authors applied no corrections for these multiple statistical tests. As a result, the reported scattered significant findings are what would be expected with uncorrected multiple comparisons.

### **3. The study lung function measurements cannot be anchored to any normal or clinically meaningful benchmarks for lung health.**

This study measured lung-function using a spirometer and reported the results as absolute differences in milliliters relative to another group. For example,  $-112$  mL FEV1 and  $-128$  mL FVC for residents within 200 m versus farther away (95% CI  $-213$  to  $-10$  and  $-282$  to  $-5$ , respectively). The averages for the study population were reported as, "Mean FEV1 and FVC for males were 2773 mL and 3654 mL, respectively, and the corresponding means for females were 2220 mL and 2875 mL." The study did not express these results as a percentage of predicted value, z-score, or in relation to the lower limit of normal. Furthermore, the study never sampled or compared these measurements to an unexposed reference population or compare measured ranges to what would normally be found in a healthy population. As a result, the study provides no comparison against which the biological or clinical significance of its findings can be determined.

Lung function measured as FEV1 and FVC in mL has no single "normal" value or range. Normal FEV1 and FVC have wide variability with age, sex, weight, and height. The American Thoracic Society and European Respiratory Society recommend that spirometry be interpreted against population-based reference equations rather than as raw volumes.<sup>21</sup> Meaning a measured value (of FEV1 or FVC) is

<sup>18</sup> Johnston, J. E., Enebish, T., Eckel, S. P., Navarro, S., & Shamasunder, B. (2021). Respiratory health, pulmonary function and local engagement in urban communities near oil development [Supplemental material]. *Environmental Research*, 197, Article 111088. <https://doi.org/10.1016/j.envres.2021.111088>

<sup>19</sup> Shaffer JP. Multiple Hypothesis Testing. *Annu Rev Psychol.* 1995;46:561-584.

<sup>20</sup> Bland JM, Altman DG. Multiple significance tests: the Bonferroni method. *BMJ.* 1995;310.

<sup>21</sup> Stanojevic, S., Kaminsky, D. A., Miller, M. R., Thompson, B., Aliverti, A., Barjaktarevic, I., Cooper, B. G., Culver, B., Derom, E., Hall, G. L., Hallstrand, T. S., Leuppi, J. D., MacIntyre, N., McCormack, M., Rosenfeld, M., & Swenson, E. R. (2022). ERS/ATS technical standard on interpretive strategies for routine lung function tests. *European Respiratory Journal*, 60(1), Article 2101499. <https://doi.org/10.1183/13993003.01499-2021>

compared to the predicted value for a person of the same age, sex, height, and ancestry, and is considered abnormal only when it falls below the lower limit of normal (the 5th percentile). This is usually expressed in z-score not absolute mL. As a demonstration of magnitude and variability only, for a man of average height (aged 25-55) FVC values can range between 4.66-5.32 liters (4,660-5,320 mL a difference of 660 mL), while FEV1 values can range between 3.65-4.46 liters (3,650-4,460 mL a difference of 810 mL).<sup>22</sup> Although dependent on age and height, women tend to have lower predicted values compared to men, a difference which can increase with age. The study only reported spirometry results across the entire sample categorized by men and women and did not provide a table of the average FEV1 or FVC and their variability by proximity (<200 m v. >200 m-1,000 m) or the four proximity and wind direction groups. Therefore, these findings cannot be compared to normal variation in the population. Not appropriately reporting FEV1 or FVC in a manner to determine if lung function was actually abnormal for the groups analyzed means the study does not and cannot show whether any participant, near or far, upwind or downwind from the active site had abnormal lung function.

In summary, the Johnston 2021 study measured relative contrasts within and between two south Los Angeles neighbor communities, using an unmeasured proxy for exposure, in a design incapable of establishing causation, and reported the results in a form that cannot be anchored to any normal or clinically significant benchmark. It does not provide evidence that the Murphy Oil Drill Site may jeopardize or adversely affect the public health, peace, and safety of persons residing or working on the premises or in the surrounding area.

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<sup>22</sup> Quanjer, P. H., Stanojevic, S., Cole, T. J., Baur, X., Hall, G. L., Culver, B. H., Enright, P. L., Hankinson, J. L., Ip, M. S. M., Zheng, J., & Stocks, J. (2012). Multi-ethnic reference values for spirometry for the 3–95-yr age range: The Global Lung Function 2012 equations. *European Respiratory Journal*, 40(6), 1324–1343. <https://doi.org/10.1183/09031936.00080312>

## 4.0 SUMMARY

In summary, the record contains no scientific evidence that the Murphy Oil Drill Site jeopardizes or adversely affects the health or safety of persons residing or working on the premises or in the surrounding area. Separately, while the record reflects that odors were reported, it lacks the source-attribution and odor-characterization evidence necessary to establish that the Site is the source of a documented, recurring nuisance.

Respectfully submitted,

**ROUX ASSOCIATES, INC.**

A handwritten signature in cursive script that reads "Katelyn E. Hall".

Katelyn Hall, PhD, MPH  
Principal Epidemiologist and Biostatistician

A handwritten signature in cursive script that reads "Tami McMullin".

Tami McMullin, PhD  
Principal Toxicologist

**ATTACHMENTS**

- A. Curricula Vitae of Dr. Katelyn Hall and Dr. Tami McMullin
- B. Materials Relied On
- C. Figure S1 from Johston 2021 Study

**ATTACHMENT A**

Curricula Vitae of Dr. Katelyn Hall and Dr. Tami McMullin



## PROFESSIONAL PROFILE



### Tami McMullin, PhD

#### Principal Scientist | Toxicologist | Risk Assessor

##### CONTACT INFORMATION

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##### EDUCATION

Ph.D., Toxicology  
Department of Environmental and  
Radiological Health Sciences  
Colorado State University  
Fort Collins, CO 2005

BS, Biology  
University of California San Diego  
CA, La Jolla, CA 1998

##### PROFESSIONAL TRAININGS

OSHA 29 CFR 1910.120 40-Hour  
Safety Training

OSHA 29 CFR 1910.120 (8) 8-Hour  
Refresher Training

TWIC Clearance

Crisis Risk Communication Training,  
Center for Risk Communication

Health Impact Assessment Training

##### EXPERIENCE SUMMARY

Dr. Tami McMullin is a toxicologist and human health risk assessor with more than 20 years of multidisciplinary experience across state government, the chemical industry, academia, and consulting. Her work spans community, residential, and occupational exposure scenarios across air, water, and soil/dust, with particular depth in air toxics. She applies weight-of-evidence and systematic-review methodologies to characterize environmental exposures and health effects, with engagements spanning government agencies, industry, and community contexts. She has served as a testifying and consulting expert in regulatory hearings and litigation, providing independent scientific evaluation of exposure, dose, and health risk evidence.

##### PROFESSIONAL POSITIONS

- Principal Toxicologist, Roux, 2026 – Present
- Principal Toxicologist, CTEH, 2018 – 2025
- State Toxicologist and ATSDR APPLETREE Program Lead, Colorado Department of Public Health and Environment, 2017 – 2018
- Oil and Gas Health Information and Response Program Lead, Colorado Department of Public Health and Environment, 2015 – 2018
- Product Toxicologist, Dow Corning Corporation, 2007 – 2015
- Toxicology Specialist, Dow Chemical Company, 2005 – 2007

##### ACADEMIC & ADVISORY APPOINTMENTS

- Member, U.S. EPA Science Advisory Board (SAB), 2026 – Present
- Member, U.S. EPA SAB Chemical Assessment Advisory Committee (CAAC), 2026 – Present
- Peer Reviewer, U.S. EPA External Peer Review — Atrazine PBPK/PD Model, June 2016
- Adjunct Assistant Professor, University of Arkansas for Medical Sciences, 2024 – Present
- Member, Scientific Community Technical Working Group, Colorado Air Toxics Bill (HB22-1244), Colorado Department of Public Health and Environment, 2024 – 2025
- Adjunct Instructor, Colorado School of Mines, 2012 – 2014

##### TECHNICAL SPECIALTIES

- Public Health Regulatory and Permitting Decision Support
- Exposure Science and Exposure Assessment
- Evaluation of Historical Monitoring, Emissions, and Exposure Data
- Human Health Risk Assessment
- Air Toxics
- Pharmacokinetics, Dosimetry, and Dose Reconstruction
- Weight-of-Evidence and Uncertainty Characterization
- Risk Communication and Stakeholder Engagement
- Regulatory Toxicology and Product Safety
- Cumulative Impact and Multi-Pathway Risk Evaluation

## REPRESENTATIVE PROJECTS

### Legislation, Rulemaking, and Permitting Consulting

- Provided technical public health expertise on drafting legislation, rulemaking, and permitting across multiple state and local public health initiatives in Colorado, California, and New Mexico, in both government and private-sector consulting roles.
- Subject-matter areas have included air toxics, cumulative impacts and environmental justice, oil and gas operations, fenceline monitoring requirements, water quality standards, and chemical-specific public health standards. Consulting has covered both enacted and proposed legislation, including matters that did not advance through the legislative process.
- Provided expert scientific testimony in regulatory rulemaking and permit proceedings before state air quality and energy commissions, county boards, and air quality boards.
- Provided implementation consulting to industry stakeholders on emerging state-level regulatory programs, including air monitoring plan development, derivation of health-based exposure thresholds, and interpretation of new regulatory requirements.
- Conducted environmental justice screening analyses for industry clients in support of permit applications and commissioner deliberations, characterizing potential cumulative impact and exposure patterns in proximate communities.
- Conducted scientific evidence review of arsenic toxicology and exposure in surface and groundwater in connection with state surface water quality standard-setting.
- As program lead at CDPHE, conducted weight-of-evidence evaluation of the scientific literature on environmental exposures and health effects associated with oil and gas exploration and development, integrating community air monitoring data, epidemiologic studies, and toxicological evidence to inform setback-distance rulemaking by the state oil and gas commission.
- Developed permissible levels of pesticides and solvents in cannabis products as State Toxicologist, which informed Colorado state regulatory standards.

### Air Toxics: Oil and Gas, Refineries, and Fenceline Monitoring

- Provided technical consulting on the development of a fenceline and community air monitoring program at a refinery, including program plan development and ongoing analysis of monitoring data in a health risk context.
- Evaluated 40 CFR 63 Subpart CC (Refinery MACT) fenceline benzene monitoring data in a human health risk context for a refinery in a community designated by the state agency as disproportionately impacted.
- Provided technical consulting to industry stakeholders on implementation of Colorado Senate Bill 1189 fenceline air toxics

monitoring requirements, including air monitoring plan development and derivation of health-based exposure levels.

- Designed air monitoring and sampling studies and conducted health risk assessments characterizing community exposures to oil and gas-related VOCs across phases of extraction.
- Conducted exposure characterization and risk assessment for additional air toxics emissions from oil and gas and refinery operations, including hydrogen cyanide, hydrogen sulfide, carbon dioxide, and VOC emissions from drilling, production, and produced water facilities.

### Air Toxics: Industrial and Community Sources

- As State Toxicologist, served on the CDPHE response team for an ethylene oxide source identified through U.S. EPA's National Air Toxics Assessment, providing technical input on the design and interpretation of follow-up community air monitoring, public health risk assessment, and risk communication.
- Evaluated the toxicological, exposure, and epidemiologic evidence on ethylene oxide and human health effects, including mode-of-action analysis, dose-response evaluation, and characterization of exposure-response relationships across occupational and community settings.
- Interpreted U.S. EPA NATA / AirToxScreen modeled risk estimates in the context of available monitoring data, source characterization, and exposure assessment, including evaluation of the appropriate use and limitations of screening-level estimates.
- Synthesized the scientific literature on environmental exposures and health effects related to natural gas appliance emissions, including indoor air quality and respiratory endpoints.
- Conducted exposure characterization and risk assessment for additional industrial air emissions, including respirable silica from a cement plant and formaldehyde off-gassing from building materials.

### Exposure Characterization, Human Health Risk Assessment, and Risk Communication

Provided exposure and risk assessment and risk communication expertise for multiple public health projects. Representative projects include:

- Heavy metals at Superfund mining sites in Colorado.
- Residual lead and arsenic in soil and indoor dust at Colorado Smelter Superfund Site.
- Contaminated steel slag used as driveway material.
- Uranium contamination in drinking water.
- Community exposures associated with a chemical weapons storage facility.

- Hydrogen cyanide emissions from oil refinery.
- Hydrogen sulfide emissions.
- Carbon dioxide emissions from a well.
- Volatile organic compound (VOC) emissions from upstream oil and gas drilling and production; produced water facilities.
- Respirable silica emissions from cement plant.
- Uranium contamination in drinking water.
- Chemical weapons storage facilities.
- Formaldehyde off gassing from building materials.
- Siloxane materials in consumer and industrial products.
- Agrochemicals, including glyphosate and triazine herbicides.
- PFAS contamination in drinking water, produce, and livestock in the Security, Widefield, and Fountain areas of El Paso County. Served on the CDPHE response team, providing technical input on application of health advisory levels, risk communication to affected communities and water providers, and coordination with El Paso County Public Health.

#### Worker and Occupational Exposures

- Derived occupational exposure limits (OELs) for industrial chemicals and consumer product ingredients, including cyclic and linear volatile methyl siloxanes, applying benchmark dose (BMD) modeling, dose-response analysis, and uncertainty factor methodology.
- Developed OELs for airborne linear siloxanes for astronauts during spaceflight.
- Provided toxicology and risk communication expertise as part of a multi-year project addressing chemical vapor exposures to workers at the U.S. Department of Energy Hanford site.

#### Regulatory Toxicology and Product Safety

- Directed GLP guideline toxicity studies for industrial, consumer, and agricultural chemicals registered in U.S. and global markets under TSCA, REACH, and other frameworks, including general toxicity (acute through chronic), developmental and reproductive toxicology, endocrine disruption, and pharmacokinetics. Responsibilities included study design, protocol development, data analysis, and technical reporting.
- Authored portions of REACH registration dossiers and Globally Harmonized System (GHS) hazard classifications for chemicals submitted to the European Chemicals Agency (ECHA).
- Provided product-safety consultation to internal corporate businesses and downstream customers for chemical usage scenarios such as personal care, industrial, agricultural, and healthcare product lines.

#### Pharmacokinetics and Dosimetry

- Developed perinatal physiologically based pharmacokinetic (PBPK) modeling methods to incorporate pharmacokinetic profiles into dose selection and interpretation of developmental and reproductive toxicology studies.
- Designed kinetic testing strategies for agrichemicals using pharmacokinetic modeling to characterize species and life-stage differences in chemical disposition and toxicity.
- Developed and applied PBPK models to interpret biomonitoring data for atrazine, sulfuryl fluoride, chlorpyrifos, cyclic and linear siloxanes, and benzene in general and worker populations.

#### COMMITTEES AND MEMBERSHIPS

Society of Toxicology, 1998 – Present

Council Member, International Society of Regulatory Toxicology and Pharmacology (IS RTP), 2024 – Present

Society for Risk Analysis, 2016 – Present

Risk 21 Committee, ILSI-Health and Environmental Science Institute, 2013 – 2015

#### PUBLICATIONS

- Bamber, A., Hasanali, S.H., Nair, A.S., Watkins, S.M., Vigil, D.I., Van Dyke, M., McMullin, T.S., and Richardson, K. (2019). A systematic review of the epidemiologic literature assessing health outcomes in populations living near oil and natural gas operations: study quality and future recommendations. *Int J Environ Res Public Health*. 2019 Jun 15;16(12). pii: E2123.
- McMullin, T.S., Bamber, A., Vigil, D., Bon, D., and Van Dyke, M. (2018). Exposures and health risks from volatile organic compounds in communities located near oil and gas exploration and production activities in Colorado. *International Journal of Environmental Research and Public Health*, Jul 16, 15(7).
- McMullin, T.S., Yang, Y., Campbell, J., Clewell, H.J., Plotzke, K.P., and Andersen, M.E. (2016). Development of an integrated multi-species and multi-dose route PBPK model for volatile methyl siloxanes – D4 and D5. *Regulatory Toxicology and Pharmacology*, 74 Suppl: S1–S13.
- Wolf, D.C., Bachman, A., Barrett, G., Bellin, C., Goodman, J., Jensen, E., McMullin, T.S., Pastoor, T.P., Schoeny, R., Slezak, B., Wend, K., and Embry, M.R. (2016). Illustrative case using the RISK21 roadmap and matrix: prioritization for evaluation of chemicals found in drinking water. *Critical Reviews in Toxicology*, 46(1), 43–53.
- Simon, T.W., Simons, S.S., Jr., Preston, R.J., Boobis, A.R., Cohen, S.M., Doerrer, N.G., Fenner-Crisp, P.A., McMullin, T.S., McQueen, C.A., and Rowlands, J.C. (2014). The use of mode of action information in risk assessment: quantitative key events/dose-response framework for modeling the dose-response for key events. *Critical Reviews in Toxicology*, 44 Suppl 3, 17–43.
- Meyers, V.E., García, H.D., McMullin, T.S., Tobin, J.M., and James, J.T. (2013). Safe human exposure limits for airborne linear siloxanes

during spaceflight. *Journal of Inhalation Toxicology*, 25(13), 735–746.

McMullin, T.S., Lowe, E., Bartels, M.J., and Marty, M.S. (2008). Dynamic changes in lipids and proteins of maternal, fetal, and pup blood and milk during perinatal development in CD and Wistar rats. *Toxicological Sciences*, 105, 260–274.

McMullin, T.S., Andersen, M.E., Tessari, J.D., Cranmer, B.K., and Hanneman, W.H. (2007). Estimating constants for metabolism of atrazine in freshly isolated rat hepatocytes by kinetic modeling. *Toxicology In Vitro*, 21, 492–501.

McMullin, T.S., Nagahara, A., Lund, T., Pak, T., Handa, R.J., Hanneman, W.H., and Andersen, M.E. (2004). Evidence that atrazine and diaminochlorotriazine inhibit the estrogen/progesterone-induced surge of luteinizing hormone in female Sprague-Dawley rats without changing estrogen receptor action. *Toxicological Sciences*, 79, 278–286.

#### BOOK CHAPTERS

McMullin, T.S. and O'Brien, W. (2004). Pharmaceutical applications of PBPK modeling: Drugs. In: *Physiologically Based Pharmacokinetic (PBPK) Modeling: Science and Applications*, eds. M.B. Reddy, R.S.H. Yang, H.J. Clewell, III, and M.E. Andersen, John Wiley & Sons.

Hanneman, W.H., Andersen, M.E., Legare, M.E., French, C.T., McMullin, T.S., Broccardo, C., and Billings, R. (2004). The Exposure-Dose-Response Paradigm as it Relates to Toxicogenomics. In: *In Vitro Neurotoxicology: Principles and Challenges* (Mannfred Hollinger, Ed.), Humana Press Inc.

#### EXPERT TESTIMONY

In the United States District Court, Middle District of Florida: Joseph Pavone and Pamela Lang v. American Contract Systems, Inc. Case No. 2:24-cv-01054-KCD-NPM. Deposition testimony, June 16, 2026.

In the District Court, County of Jefferson, State of Colorado: Jordan et al. v. Terumo BCT Sterilization Services, Inc. Case No. 2020CV031457. Trial testimony, February 13, 2026.

In the Superior Court, County of Kern, State of California: Aera Energy, LLC and Chevron U.S.A. Inc. v. Gavin Newsom et al. Case Nos. BCV-22-100748 and BCV-22-100636. Trial testimony, January 29, 2026.

In the Superior Court, County of Kern, State of California: Aera Energy, LLC and Chevron U.S.A. Inc. v. Gavin Newsom et al. Case Nos. BCV-22-100748 and BCV-22-100636. Deposition testimony, January 13, 2026.

In the District Court, County of Jefferson, State of Colorado: Jordan et al. v. Terumo BCT Sterilization Services, Inc. Case No. 2020CV031457. Deposition testimony, November 5, 2025.

In the District Court, County of Jefferson, State of Colorado: Eve Isaacks, Victoria Anderson et al. v. Terumo BCT Sterilization Services, Inc. Case No. 2022CV031124. Trial testimony, March 6–7, 2025.

In the District Court, County of Jefferson, State of Colorado: Eve Isaacks, Victoria Anderson et al. v. Terumo BCT Sterilization Services, Inc. Case No. 2022CV031124. Deposition testimony, November 19, 2024.

In the District Court, County of Jefferson, State of Colorado: Ann Jordan, Bruce Howard Brown, David Gutierrez et al. v. Terumo BCT Sterilization Services, Inc. Case No. 2020CV031457. Deposition testimony, March 20, 2023.



## PROFESSIONAL PROFILE



### Katelyn Hall, PhD, MPH

#### Principal Scientist | Epidemiologist | Biostatistician

##### EXPERIENCE SUMMARY

Dr. Hall is an epidemiologist and biostatistician with over a decade of experience in environmental epidemiology, public health research, biostatistical analysis, and exposure science across the non-profit, state government, federal government, and private sectors.

- Principal Epidemiologist and Biostatistician, Roux, Burlington, MA, 2025–Present
- Adjunct Assistant Professor, Department of Epidemiology, Fay W. Boozman College of Public Health, UAMS, Little Rock, AR, 2024–Present
- Senior Epidemiologist and Biostatistician, Supervising Health Scientist, CTEH, LLC, Little Rock, AR, 2019–2025
- Epidemiology and Biostatistics Consultant, Hall Consulting, LLC, Pine, CO, 2019
- Epidemiologist and Statistical Analyst, Marijuana Health Monitoring and Research, Environmental Epidemiology, Occupational Health, and Toxicology, Colorado Department of Public Health and Environment, Denver, CO, 2014–2019
- ACOG Maternal Influenza Review Program Interviewer, Contracted Employee, Colorado Department of Public Health and Environment, Denver, CO, 2014
- Graduate Teaching Assistant, GIS for Public Health Research, Chronic Disease Epidemiology, Research Methods, Colorado School of Public Health, 2014–2016
- Emerging Infections Program-Graduate Internship, Colorado Department of Public Health and Environment, Denver, CO, 2013–2014
- Epidemiology and Biostatistics Consultant, CUPeru, Denver, CO, 2012–2014

##### TECHNICAL SPECIALTIES

Dr. Hall's strategic consulting in environmental epidemiology and biostatistics has aided both public and private sector clients in data-driven decision-making in the energy, chemical, agricultural, entertainment, waste management, and tech industries. Dr. Hall's areas of expertise include:

- |                                                |                                                   |
|------------------------------------------------|---------------------------------------------------|
| • Systematic Literature Reviews                | • General Causation Analysis                      |
| • Epidemiology Study Design                    | • Primary Data Collection                         |
| • Secondary Data Analysis                      | • Public Health Surveillance Systems              |
| • Human Exposure Metrics                       | • Environmental Data Analysis                     |
| • Health Impacts Assessments                   | • Source to Health Outcome Paradigms              |
| • Survey Design, Collection, and Analysis      | • Sensitivity and Specificity Analyses            |
| • Regression Modeling                          | • Research Methods                                |
| • Network Analyses                             | • Infectious Disease Epidemiology                 |
| • Environmental Justice Data Sources and Tools | • Infection Control Protocols and Contact Tracing |
| • Environmental Field Sampling Study Designs   |                                                   |

Dr. Hall has been an invited speaker at several scientific conferences and has published over 25 manuscripts and abstracts in technical journals and gray literature.

##### REPRESENTATIVE PROJECTS

- **Technical Director, Tontitown, Arkansas Air Sampling Study (May 2–May 12, 2025).** Dr. Hall was contracted by the Arkansas Department of Energy and Environment to design and lead an air sampling study near a landfill in Tontitown, Arkansas. The objective was to determine if there were compounds of potential concern that the landfill was likely or possibly contributing to the community. <https://adeq.state.ar.us/tontitown/pdfs/tontitown-air-sampling-study.pdf>

##### CONTACT INFORMATION

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Website: [www.rouxinc.com](http://www.rouxinc.com)

200 Summit Drive, Suite 500  
Burlington, MA 01803

##### EDUCATION

Doctor of Philosophy,  
Epidemiology, The University  
of Colorado Denver Graduate  
School, Anschutz Medical  
Campus Denver, CO, 2020

Master of Public Health,  
Epidemiology, The University  
of Colorado Denver, Anschutz  
Medical Campus, Aurora, CO,  
2014

Bachelor of Science, Pre-  
Medical Biology, Harding  
University, Searcy, AR, 2011

- **Testimony-Wisconsin Electric Power Company.** Dr. Hall provided expert epidemiology rebuttal testimony on the interpretation and use of EPA's Co-Benefits Risk Assessment health Impacts Screening and Mapping Tool (COBRA) in the context of public health at the Public Service Commission of Wisconsin Hearing (Docket No. 6630-CE-317) for the Certificate of Public Convenience and Necessity for the Oak Creek Combustion Turbine Project.
- **Testimony-Colorado Petroleum Association.** Dr. Hall provided expert epidemiology and biostatistics testimony on the scientific methods of Colorado EnviroScreen at the Colorado Air Pollution Control Division Regulation 3 hearings in Denver, Colorado on May 17, 2023.
- **Testimony, CIVITAS, Resources Inc.** Dr. Hall provided expert epidemiology and biostatistics testimony on the study design and analytic methods of the Broomfield Health Survey at the Colorado Oil and Gas Conservation Commission contested Coslette Wellpad hearings virtually on October 26, 2022.
- **Applied Public Health, Various Energy, Chemical, and Agricultural Industry Clients.** Dr. Hall provided data-driven solutions for clients that have environmental justice concerns by designing boots-on-the-ground studies, assessments of epidemiology literature, and risk communication of the science.
- **American Petroleum Institute.** Dr. Hall leveraged her experience and expertise to develop guidance documents to assist clients with navigating environmental justice concerns, cumulative impacts, and assessing the risk of chemical and non-chemical stressors on a community.
- **Epidemiology Expert Consulting, Systematic Literature Reviews.** Various Energy and Chemical Industry Clients and the Oil and Gas Health Information and Response Program Colorado Department of Public Health and Environment: Dr. Hall has developed novel methods for systematic literature reviews that apply quantitative methods to weigh the quality of the body of evidence. She has applied these reviews to general causality analyses, rulemaking support, and published systematic literature reviews. The majority of this work has covered the potential health outcomes in populations living near oil and natural gas operations, but Dr. Hall has also applied these methods to ethylene oxide and PFAS exposures and potential health effects.
- **Biostatistics Expert Consulting, Statistical Analyses, Various Energy, Agriculture, Forrest Products, and Chemical Industry Clients.** Dr. Hall serves as a technical director, developing and overseeing the statistical analysis of various air quality assessments.
- **Epidemiology Expert Consulting, Toxic Tort Litigation, Various Energy, Manufacturing, and Sterilization Clients.** Dr. Hall has provided epidemiology expertise on chemical environmental exposures and various health outcomes. She has provided consulting support on expert reports on ethylene oxides, PFAS, asbestos, and talc and numerous alleged health outcomes.
- **Project Technical Director, COVID-19 Epidemiology Services.** Various Energy, Entertainment, Packaging, Hospitality, Live Events, Emergency Response, and Food Industry Clients.
- **COVID-19 Vaccine Effectiveness Studies Reviews.** Dr. Hall directed weekly updates on the current science of U.S. and United Kingdom approved COVID-19 vaccine effectiveness. Dr. Hall technically reviewed literature and government reports and made data-driven vaccination recommendations to clients' workforces.
- **Epidemiological Tracking of COVID-19 Variants.** Dr. Hall directed a team charged with tracking emerging COVID-19 variants and their characteristics. Dr. Hall technically reviewed reports to clients containing WHO, CDC, and PHE variants of concern epidemiology and characteristics and made recommended adjustments to infection control measures based on changes in emerging variants' characteristics.
- **COVID-19 Epidemiology Services, Disease Tracking.** Dr. Hall directed a team charged with tracking the spread of COVID-19 and providing an epidemiology assessment of the risk of COVID-19 entering a workplace through community exposures to the workforce for over 100 client facilities and projects. Dr. Hall oversaw regular risk assessment reports to clients to inform their level of infection controls that included COVID-19 cases, deaths, vaccinations, and calculated risk metrics like reproductive numbers and percent of the population infectious.
- **Epidemiologist and Statistical Analyst, Public Health Impacts of Retail Cannabis Legalization, Marijuana Health Monitoring and Research Program, Colorado Department of Public Health and Environment.** Dr. Hall conducted epidemiological and statistical analyses on the public health effects of retail cannabis legalization. She analyzed secondary healthcare administrative datasets for cannabis exposures and adverse health outcomes. She analyzed national and state survey data to monitor trends in the amount and type of cannabis products used. Dr. Hall was responsible for annual systematic literature reviews of peer-reviewed publications on cannabis-related health outcomes and trends in cannabis use.
- **Contract Tracing and Infection Control Plans and Implementation.** Dr. Hall developed custom COVID-19 contact tracing plans integrated into clients' infection control plans that included novel testing and symptom monitoring strategies. Dr.

Hall directed a team of contact tracers, occupational nurses, and physicians to implement these plans 24 hours a day, seven days a week for hundreds of clients. Dr. Hall provided reporting and analysis of COVID-19 outbreaks and spread including epidemic curves and network analyses.

- COVID-19 Litigation.** Dr. Hall has provided epidemiology expertise on evaluating community level COVID-19 data, considerations for spread in the workplace and community, contact tracing, infection control protocols, and return to work practices. She has compiled expert reports for these opinions in COVID-19 related litigation on workman's compensation claims, in response to a congressional investigation, and local municipality lawsuits against energy industry.
- Epidemiologist, Cannabis User Survey on Health (CUSH), Marijuana Health Monitoring and Research Program, Colorado Department of Public Health and Environment.** Dr. Hall developed, validated, and administered a survey on frequencies and methods of cannabis use, the Cannabis User Survey on Health funded by the Council for State and Territorial Epidemiologists. Dr. Hall analyzed and published the results in a peer-reviewed publication of the findings.
- Lead Epidemiologist, E-cigarette or Vaping product use-Associated Lung Injury (EVALI) Outbreak, Colorado Department of Public Health and Environment.** Dr. Hall was responsible for managing the epidemiology response to the EVALI outbreak in Colorado. She worked closely with the CDC, FDA, and DEA in identifying, describing, reporting, and tracking new cases. Dr. Hall developed the case interviews in RedCap and administered case investigations. Dr. Hall set up an on-call team to respond to reports of cases. Dr. Hall worked with a team of toxicologists to assist with research of potential chemicals or toxins that could have resulted in the lung injuries described in the cases. Dr. Hall worked with industry and government stakeholders to collect and send products to the CDC for testing.
- Cannabis Flower, Concentrates, and Edibles Potency Beta Homogeneity and Proficiency Testing, Laboratory Services Division, Colorado Department of Public Health and Environment.** Dr. Hall developed a statistical protocol for cannabis flower, concentrates, and edibles homogeneity and proficiency testing based on the ISO 15328 protocols and pilot studies by the Colorado Department of Agriculture. She applied these results to Colorado cannabis flower, concentrate, and edible potency beta homogeneity and proficiency testing. She completed reports of the statistical analysis of the homogeneity and proficiency testing results to the participating laboratories, the Colorado Department of Agriculture, the Laboratory Services Division, the Colorado Department of Public Health and Environment, and the Marijuana Enforcement Division.
- Lead Epidemiologist, Cannabis Use and Snow Sport Injuries, Colorado Department of Public Health and Environment, Vail Valley Medical Center.** Dr. Hall analyzed cannabis use as a predictor of snow sports injuries from data collected at Vail Valley Medical Center during the 2013-2014 snow season. She applied regression models that showed cannabis use prior to injury led to an increased risk of a collision vs. a fall resulting in a snow sport injury. Dr. Hall reported cannabis use was related to not wearing a helmet and snowboarding.
- Geospatial Analysis of Age-Adjusted Pertussis Rates, Poverty, and Vaccine Exemption Rates in Colorado, Colorado Department of Public Health and Environment, Colorado School of Public Health (2007–2014).** Dr. Hall examined CDPHE's Colorado Electronic Disease Reporting System (CEDRS) pertussis cases from 2007 to 2014 with percent below poverty at the census tract level and school vaccine exemption rates at the school district level. She created maps and performed statistical and geospatial analyses to assess associations.
- ACOG Maternal Influenza Review Program Interviewer, Colorado Department of Public Health and Environment.** Dr. Hall organized, managed, and administered in-person interviews for the American Congress of Obstetricians and Gynecologists Maternal Influenza Review Program. She performed data collection and management, compiled case review summaries, reported to a case review team of medical professionals, and completed a descriptive summary of the findings and recommendations.
- CDC Emerging Infections Program, Graduate Internship, Colorado Department of Public Health and Environment, University of Colorado Health Sciences Center.** Dr. Hall worked as a Surveillance Officer with the Centers for Disease Control and Prevention's Emerging Infections Program. She performed medical record abstraction for influenza-associated hospitalization, invasive MRSA, and pertussis surveillance projects. She collected and entered data for influenza antiviral and PCV13 vaccine effectiveness surveillance.
- Lead Epidemiologist and Biostatistician, Comunidades Unidas, Peru.** Dr. Hall worked as an epidemiologist and biostatistician in a global health project in remote villages on the Napo River, Loreto Region, Peru. The project aimed to train local leaders in remote communities to be Community Health Workers who could act as first responders for traumas, seasonal and regional illnesses, and malaria. Leaders were also trained in sanitation and hygiene. Dr. Hall developed a curriculum for these trainings and helped to implement WHO Integrated Management of Childhood Illness-based patient history loggers for Community Health Workers to track patient care and for CU Peru to collect and evaluate. She also worked with the

Ministerio de Salud, Dirección Regional de Salud Loreto (DIRESA Loreto), and the local Mayors to distribute malaria test kits, teach Health Workers how to test community members, and developed logistical strategies for sending the tests to labs for diagnostics and surveillance. Dr. Hall designed a pre/post survey tool to assess the knowledge, attitudes, and practices of the community health workers who attended CU Peru's training. Dr. Hall completed IRBs and IRB exemptions for all projects. She managed the data collection, database creation, and analysis of data. Dr. Hall prepared a manuscript for publication and posters for presentations at global health conferences.

## EXPERT TESTIMONY

In the Superior Court, County of Kern, State of California Aera Energy, LLC and Chevron U.S.A. Inc. v. Gavin Newsom et al. Case Nos. BCV-22-100748 and BCV-22-100636. Deposition Monday, January, 12, 2026 Trial Testimony Thursday, January 29, 2026.

## ADDITIONAL OUTBREAK EXPERIENCE

E. coli O157:H7 Outbreak, 2013, Colorado Department of Public Health and Environment.

Stevens Johnson's Syndrome Cluster at Children's Hospital Colorado, 2013, Centers for Disease Control and Prevention.

Synthetic Marijuana Outbreak, 2013, Colorado Department of Public Health and Environment.

Gunnison Raw Milk Campylobacter Outbreak, 2013 Colorado Department of Public Health and Environment.

## PROFESSIONAL AFFILIATIONS

Nominated Council Member, International Society of Regulatory Toxicology and Pharmacology (IS RTP), 2025–Present

American Public Health Association, 2021–Present

Council for State and Territorial Epidemiologist, 2014–Present

Cannabis Subcommittee Co-chair, 2018–2019

ICD-10-CM Drug Poisoning Indicators Working Group Case Definition Subcommittee Co-chair, 2017–2019

ICD-10-CM Drug Poisoning Indicators Working Group

International Society for Infectious Diseases, 2013–Current

Member, Health eMoms Advisory Board, 2017–2019

Marijuana Data Working Group Chair, 2017–2019

Colorado State Epidemiology Outcomes Working Group, 2015–2019

Colorado Environmental Health Association, 2013–2014

## PUBLICATIONS

Bonner E, Costa A, Miller M, Celente M, Hall K, Farstad E, McMullin T. Understanding ethylene oxide background concentrations in the US. The Toxicologist Supplement to Toxicological Sciences.

At the 65<sup>th</sup> Annual SOT Meeting and ToxEpxo. March 22-25, 2026 San Diego, CA.

<https://www.toxicology.org/pubs/docs/Tox/2026Tox.pdf>

Hall K and McMullin T. Air Toxics, Health Risk, and Regulatory Reality - Using Data to Navigate Public Health Concerns and Policy in Oil & Gas. Air Quality Regulation of the Oil and Gas Industry 4-1 (Found. For Nat. Resources & Energy L. 2026).

Hall KE, Miller M, Costa A, and Mahoney L. Tontitown, Arkansas Air Sampling Study: May 2, 2025 to May 12, 2025. 2025 September. Arkansas Energy & Environment, Environmental Quality <https://www.adeg.state.ar.us/tontitown/>.

Crawford KA, Gardner JA, Meyer EA, Hall KE, Gary DS, Esser MB. Current marijuana use and alcohol consumption among adults following the legalization of nonmedical retail marijuana sales — Colorado, 2015-2019. CDC Weekly. 2021 October; 70(43);1505-1508. [https://www.cdc.gov/mmwr/volumes/70/wr/mm7043a3.htm?s\\_cid=mm7043a3\\_w](https://www.cdc.gov/mmwr/volumes/70/wr/mm7043a3.htm?s_cid=mm7043a3_w).

Hall KE. Evaluation of Cannabis ICD-10-CM Codes' Performance to Predict Emergency Department Visits Partially Attributable to Cannabis. 2020 August. University of Colorado, Anschutz Medical Campus. <https://dl.acm.org/doi/10.5555/AAI28086241>.

Shelton SK, Mills E, Saben JL, Devivo M, Williamson K, Abbott D, Hall KE, Monte AA. Why do patients come to the emergency department after using cannabis? Clin Toxicol (Phila). 2020 Jun;58(6):453-459. doi: 10.1080/15563650.2019.1657582. Epub 2019 Sep 16. PMID: 31526057; PMCID: PMC7073292.

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## PRESENTATIONS

- Assessing the Adequacy of Environmental Risk Management Framework for Oil and Gas Operations through a Public Health Risk Lens; Katelyn E Hall, Tami McMullin; Public Health in the Rockies, Keystone, CO. September 2022.
- Emergency Response during a Pandemic: COVID-19 Case Study; Katelyn E Hall, Scott Malm, Lourdes Mahoney, Ashley Reardon; Coastal Bend Hurricane Conference, Robstown, TX. May 2022.
- Worker Safety during a Pandemic: Case Study COVID-19; Katelyn E Hall; The National Forum for Environmental & Toxic Tort Issues, Chicago, IL. September 2021.
- Marijuana Use among Adults Who Report Binge Drinking in Colorado from 2014-2017; Kacy Crawford, Elisabeth Meyer, Katelyn E Hall, Dahsan S Gary; 2019 Council of State and Territorial Epidemiologists, Raleigh, NC. June 2019.
- Cannabis-Related Surveillance: Changes in Patterns of Cannabis Use since State Legalization; Julia Dilley, Katelyn E Hall; 2019 Council of State and Territorial Epidemiologists, Raleigh, NC. June 2019.

Cannabis-Related Surveillance: Changes in Public Health Outcomes since State Legalization; Katelyn E Hall, Julia Dilley 2019 Council of State and Territorial Epidemiologists, Raleigh, NC. June 2019.

Cannabis Discharge Coding in the ICD-10-CM Transition; 2018 Council of State and Territorial Epidemiologists, West Palm Beach, FL. June 2018.

Increased Prevalence of Mental Illness Primary Diagnoses Among Hospitalizations and Emergency Department Visits with Marijuana Associated Administrative Codes; 2016 Council of State and Territorial Epidemiologists, Anchorage, AK. June 2016.

Increases in Rates of Hospitalizations and Emergency Department Visits with Marijuana Associated Administrative Codes in Colorado from 2000 to 2014; 2015 Public Health in the Rockies, Vail, CO. September 2015; 2015 CSTE Annual Conference, Boston, MA. June 2015.

Assessment of community health worker training program in the Peruvian Amazon demonstrates effective learning retention: implications for health care education in a resource-limited setting; 2014 CSTE Annual Conference, Nashville, TN/ Jun 2014; Consortium of University for Global Health, Washington D.C.: 5th Annual CUGH Conference: Universities 2.0: Advancing Global Health in the Post-MDG Era/ May 2014; University of Colorado Denver, Anschutz Medical Campus: 28th Annual Student Research Forum. December 2013.

Cannabis-Related Surveillance: Changes in Public Health Outcomes since State Legalization; Katelyn E Hall, Julia Dilley 2019 Council of State and Territorial Epidemiologists, Raleigh, NC. June 2019.

Cannabis Discharge Coding in the ICD-10-CM Transition; 2018 Council of State and Territorial Epidemiologists, West Palm Beach, FL. June 2018.

Increased Prevalence of Mental Illness Primary Diagnoses Among Hospitalizations and Emergency Department Visits with Marijuana Associated Administrative Codes; 2016 Council of State and Territorial Epidemiologists, Anchorage, AK. June 2016.

Increases in Rates of Hospitalizations and Emergency Department Visits with Marijuana Associated Administrative Codes in Colorado from 2000 to 2014; 2015 Public Health in the Rockies, Vail, CO. September 2015; 2015 CSTE Annual Conference, Boston, MA. June 2015.

Assessment of community health worker training program in the Peruvian Amazon demonstrates effective learning retention: implications for health care education in a resource-limited

setting; 2014 CSTE Annual Conference, Nashville, TN. June 2014; Consortium of University for Global Health, Washington D.C.: 5th Annual CUGH Conference: Universities 2.0: Advancing Global Health in the Post-MDG Era. May 2014; University of Colorado Denver, Anschutz Medical Campus: 28th Annual Student Research Forum. December 2013.

## SPEAKING ENGAGEMENTS

ICD-10-CM Drug Overdose Indicators; CSTE Conference 2019. June 2019; Provided an instructional presentation on the new CSTE and CDC national guidance on counting drug overdoses in ICD-10-CM.

What Has Happened to State Public Health after Retail Cannabis Legalization, So Far? Denver Marijuana Management Symposium. November 2018; Described state prevalence of marijuana use and potential marijuana related adverse health outcomes across multiple states that have legalized recreational marijuana.

Colorado Marijuana and Public Health; Society of Women Environmental Professionals. January 2018; Described the impacts of recreational marijuana legalization on marijuana use prevalence and adverse health outcomes in Colorado.

Data Limitations, Historical Perspective, and Colorado Hospital Association Discharge Data; Denver Marijuana Management Symposium. October 2017; Described the limitations surrounding marijuana surveillance data and examined health outcomes data surrounding alcohol prohibition and the release of e-Cigs to the market for guidance on what to expect with recreational marijuana legalization and the diversity of the marijuana market. Examined trends in hospital and emergency department visits with marijuana ICD-9-CM coding over legalization time points.

Cannabis Discharge Coding in the ICD-10- CM Transition; CSTE Marijuana Subcommittee. August 2017; We aimed to examine trends in the rates of emergency department and hospital discharges with cannabis coding before and after the transition to ICD-10-CM. Time series analysis confirmed no differences in the quarterly counts of discharges with cannabis codes before and after transition to ICD-10-CM in both hospital and emergency department discharges.

What is happening in states that have legalized non-medical marijuana? CSTE Conference 2017. June 2017; Examined marijuana use trends among youth and adults in Colorado, Oregon, and Washington. Analyzed marijuana related adverse health effects in Oregon and Colorado

**ATTACHMENT B**

Materials Relied On

## Attachment B: Materials Relied On

1. Bhavna Shamasunder, Ashley Collier-Oxandale, Jessica Blickley, James Sadd, Marissa Chan, Sandy Navarro, Michael Hannigan, and Nicole J. Wong, "Community-Based Health and Exposure Study around Urban Oil Developments in South Los Angeles," *International Journal of Environmental Research and Public Health* 15, no. 1 (2018): 138, <https://doi.org/10.3390/ijerph15010138>.
2. Bland JM, Altman DG. Multiple significance tests: the Bonferroni method. *BMJ*. 1995;310.
3. California Council on Science & Technology. (2015, July). An independent scientific assessment of well stimulation in California, Volume II: Potential environmental impacts of hydraulic fracturing and acid stimulations. <https://ccst.us/reports/an-independent-scientific-assessment-of-well-stimulation-in-california-volume-2/>
4. California Health and Safety Code, § 59000-59017 (2019)
5. City of Los Angeles Notice of Fee for CASE NO. ZA-2026-3203-RV. June 25, 2026.
6. City of Los Angeles Office of Zoning Administration. Communication Letters to E&B Natural Resources Management Corporation. June 7, 2024.
7. Compiled CalGEM and SCAQMD Violations and Complaints for the Murphy Drill Site. April 22, 2024.
8. Department of Toxic Substances Control. (2025). Human Health Risk Assessments quick reference guide. <https://dtsc.ca.gov/brownfields/human-health-risk-assessments-quick-reference-guide/>
9. Department of Toxic Substances Control. (2025). Human Health Risk Assessments quick reference guide. <https://dtsc.ca.gov/brownfields/human-health-risk-assessments-quick-reference-guide/>
10. Email from EarthJustice: Request to Present at OZA Public Hearing. Nikki Bordokas. June 29, 2026.
11. Formal Responses from E&B Natural Resources to OZA Letters of Communication. July 22, 2024.
12. Hopper, Leigh. L.A.'s legacy of oil drilling impacts lung function in residents living near active and inactive wells. April 15, 2021.
13. Jill E. Johnston, Arbor J. L. Quist, Sandy Navarro, Shohreh F. Farzan, and Bhavna Shamasunder, "Cardiovascular Health and Proximity to Urban Oil Drilling in Los Angeles, California," *Journal of Exposure Science & Environmental Epidemiology* 34, no. 3 (2024): 505–511, <https://doi.org/10.1038/s41370-023-00589-z>.
14. Jill E. Johnston, Temuulen Enebish, Sandrah P. Eckel, Sandy Navarro, and Bhavna Shamasunder, "Respiratory Health, Pulmonary Function and Local Engagement in Urban Communities Near Oil Development," *Environmental Research* 197 (2021): 111088, <https://doi.org/10.1016/j.envres.2021.111088>.
15. Johnston, J. E., Enebish, T., Eckel, S. P., Navarro, S., & Shamasunder, B. (2021). Respiratory health, pulmonary function and local engagement in urban communities near oil development [Supplemental material]. *Environmental Research*, 197, Article 111088. <https://doi.org/10.1016/j.envres.2021.111088>
16. Letter from Colorado University on Recommendations Regarding E&B Air Monitoring Practices. May 29, 2025.
17. Letter from EarthJustice to City Planner Re: E&B's Annual Safety Inspection Report for the Murphy Drill Site. January 30, 2026.
18. Letter from EarthJustice to Office of Zoning Administration. June 1, 2026.
19. Letter from EarthJustice to OZA Requesting Nuisance Abatement Proceeding for Murphy Drill Site. May 28, 2025.
20. Letter from University of California Irvine Re: Review of E&B's Murphy Drill Site Fenceline Monitoring System. February 9, 2026.
21. Letter of Determination for Case No. ZA-1959-15227-O-PA6-1A. South Los Angeles Area Planning Commission. January 31, 2024.
22. Lindenfeld, J. (2023, March 3). In a largely Black and Latino community, neighbors worry about the oil wells in their midst. *Capital & Main*. <https://capitalandmain.com/in-a-largely-black-and-latino-community-neighbors-worry-about-the-oil-wells-in-their-midst>
23. Los Angeles Department of Building and Safety Permit Application. June 9, 2026.

## Attachment B: Materials Relied On

24. Murphy Drill Site Annual Inspection Reports 2024, 2025, 2026. March 11, 2026.
25. Murphy Drill Site Map. February 2, 2026.
26. Notice of Public Hearing for Murphy Drill Site. Los Angeles Department of City Planning. <https://planning.lacity.gov/dcpapi2/meetings/document/81033>.
27. Proof of Mailing Statement for CASE NO. ZA-2026-3203-RV Notice of Public Hearing. June 25, 2026.
28. Quanjer, P. H., Stanojevic, S., Cole, T. J., Baur, X., Hall, G. L., Culver, B. H., Enright, P. L., Hankinson, J. L., Ip, M. S. M., Zheng, J., & Stocks, J. (2012). Multi-ethnic reference values for spirometry for the 3–95-yr age range: The Global Lung Function 2012 equations. *European Respiratory Journal*, 40(6), 1324–1343. <https://doi.org/10.1183/09031936.00080312>.
29. Shaffer JP. Multiple Hypothesis Testing. *Annu Rev Psychol*. 1995;46:561-584.
30. South Coast Air Quality Management District. (n.d.). *Community investigations*. Retrieved July 16, 2026, from <https://www.aqmd.gov/home/news-events/community-investigations>
31. Stanojevic, S., Kaminsky, D. A., Miller, M. R., Thompson, B., Aliverti, A., Barjaktarevic, I., Cooper, B. G., Culver, B., Derom, E., Hall, G. L., Hallstrand, T. S., Leuppi, J. D., MacIntyre, N., McCormack, M., Rosenfeld, M., & Swenson, E. R. (2022). ERS/ATS technical standard on interpretive strategies for routine lung function tests. *European Respiratory Journal*, 60(1), Article 2101499. <https://doi.org/10.1183/13993003.01499-2021>.
32. USEPA, 2004. Air Toxics Risk Assessment Reference Library. Volume 1 – Technical Resource Manual. April.
33. USEPA, 2004. Air Toxics Risk Assessment Reference Library. Volume 2 – Facility Specific Assessment. April.
34. USEPA, 2004. Air Toxics Risk Assessment Reference Library. Volume 3 – Community Scale Assessment. April.
35. USEPA, 2024. Interim Framework for Advancing Consideration of Cumulative Impacts. November.
36. USEPA, 2026. Human Exposure and Health. July 6. <https://www.epa.gov/report-environment/human-exposure-and-health#note1>

**ATTACHMENT C**

Figure S1 from Johston 2021 Study

**Attachment C. Figure S1 from the Johnston 2021 study.**

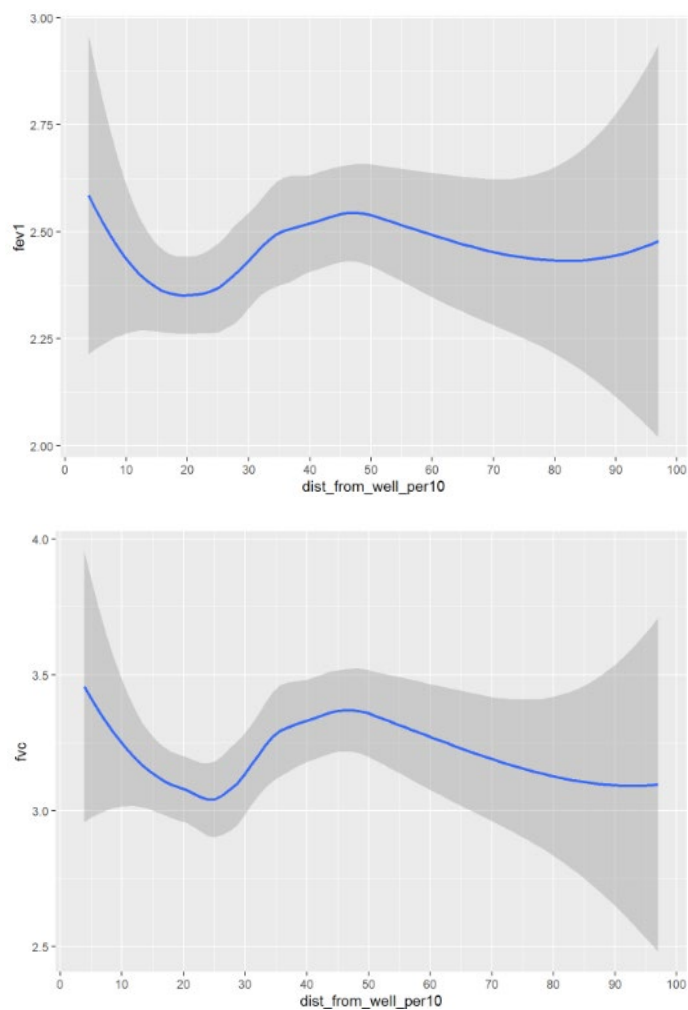


Figure S1: This plot shows a smooth function between distance from oil wells (in 10 m) and a) FEV1 and b) FVC measurements among study participants. We observe a change in the relationship about 200m from the well site.