

IN THE COURT OF APPEALS IN THE STATE OF NEW MEXICO

MARIO ATENCIO, *et al.*

Plaintiffs-Appellees,

v.

THE NEW MEXICO LEGISLATURE,

Defendant-Appellant,

&

THE STATE OF NEW MEXICO, *et al.*,

Defendants-Appellants,

&

NEW MEXICO CHAMBER OF COMMERCE, and
INDEPENDENT PETROLEUM ASSOCIATION OF
NEW MEXICO

Intervenor-Defendants-Appellants.

No. A-1-CA-42006
consolidated
with: A-1-CA-42001,
A-1-CA-42003, and
A-1-CA-42006
Santa Fe County
D-101-CV-2023-01038

**BRIEF OF *AMICI CURIAE* PUBLIC HEALTH PROFESSIONALS IN
SUPPORT OF PLAINTIFFS-APPELLEES**

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RULES

N.M.R. App. P. 12-320(C)	1
Rule 12-318(F)(3) N.M.R.A	xviii

OTHER AUTHORITIES

A. Bushong, et al., <i>Publicly Available Data Reveals Association Between Asthma Hospitalizations and Unconventional Natural Gas Development in Pennsylvania</i> , 17(3) PLOS ONE e0265513 (2022)	11
A. Hecobian et al., <i>Air Toxics and Other Volatile Organic Compound Emissions from Unconventional Oil and Gas Development</i> , 6(12) ENVT'L SCI. & TECH. LETTERS, 720–726 (2019);	15
A.L. Bolden et al., <i>Exploring the Endocrine Activity of Air Pollutants Associated with Unconventional Oil and Gas Extraction</i> , 17 ENVT'L HEALTH (2018), available at https://doi.org/10.1186/s12940-018-0368-z	17
A.M. Bamber et al., <i>A Systematic Review of the Epidemiologic Literature Assessing Health Outcomes in Populations Living near Oil and Natural Gas Operations: Study Quality and Future Recommendations</i> , 16(12) INT'L J. ENVT'L RES. & PUB. HEALTH 2123 (2019)	9
B. J. Hays et al., <i>Public Health Implications of Environmental Noise Associated with Unconventional Oil and Gas Development</i> , 580 SCI. OF THE TOTAL ENV'T 448–456 (2017)	24
B.E. Fontenot, et al., <i>An Evaluation of Water Quality in Private Drinking Water Wells Near Natural Gas Extraction Sites in the Barnett Shale Formation</i> , 47 ENVT'L SCI. TECH. 10032-10040 (2013)	17
Bill Donahue, National Public Radio, <i>What Will It Take to Tackle Water Scarcity on the Navajo Nation?</i> (Sept. 26, 2024)	29
C. Gaughan et al., <i>Residential Proximity to Unconventional Oil and Gas Development and Birth Defects in Ohio</i> , 229 ENVT'L RES. 115937 (2023)	30
C.D. Kassotis et al., <i>Endocrine-Disrupting Activities and Organic Contaminants Associated with Oil and Gas Operations in Wyoming Groundwater</i> , ARCHIVES OF ENVT'L CONTAMINATION & TOXICOLOGY 1–12 (2018)	17
C.D. Kassotis, et al., <i>Endocrine Disrupting Activities of Surface Water Associated with a West Virginia Oil and Gas Industry Wastewater Disposal Site</i> , 557-558 SCI. TOTAL ENV'T 901-910 (2016)	17

- C.J. Clark, *Unconventional Oil and Gas Development Exposure and Risk of Childhood Acute Lymphoblastic Leukemia: A Case-Control Study in Pennsylvania, 2009–2017*, 130(8) ENVT'L HEALTH PERSPECTIVES 087001 (2022) 30
- C.L. Waldner et al., *Associations Between Oil- and Gas-well Sites, Processing Facilities, Flaring, and Beef Cattle Reproduction and Calf Mortality in Western Canada*, 50 PREVENTATIVE VET. MED. 1-17 (2001) 27
- C.M. Richburg et al., *Noise Concerns of Residents Living in Close Proximity to Hydraulic Fracturing Sites in Southwest Pennsylvania*, 36(1) PUB. HEALTH NURSING 3-10 (2019) 24
- C.N. Westman & T.L. Joly, *Oil Sands Extraction in Alberta, Canada: A Review of Impacts and Processes Concerning Indigenous Peoples*, 2 HUMAN ECOLOGICAL INTERDISCIPLINARY J. 233–43 (2019) 22
- Cheryl L. Waldner, *Western Canada Study of Animal Health Effects Associated with Exposure to Emissions from Oil and Natural Gas Field Facilities. Study Design and Data Collection I. Herd Performance Records and Management*, 63 ARCHIVES OF ENVT'L & OCCUPATIONAL HEALTH 167-184 (2008) 27
- Cheryl Waldner, *Risk of Abortion and Stillbirth in Cow-Calf Herds Exposed to the Oil and Gas Industry in Western Canada*, 64 ARCHIVES OF ENVT'L & OCCUPATIONAL HEALTH 29-45 (2009) 27
- D. Blair et al., *Residential Noise from Nearby Oil and Gas Well Construction and Drilling*, 28(6) J. EXPO SCI ENVIRON EPIDEMIOL. 538–47 (2018) 24
- D.J. Gonzalez, et al., *Upstream Oil and Gas Production and Ambient Air Pollution in California*, 806 SCI. OF THE TOTAL ENV'T 150298 (2022) 15
- David J.X. Gonzalez et al., *Upstream Oil and Gas Production and Ambient Air Pollution in California*, 806 SCIENCE OF THE TOTAL ENV'T 1, 2 (Feb. 2022) 13
- David T. Allen, *Emissions from Oil & Gas Operations in the United States & Their Air Quality Implications*, 66 J. AIR & WASTE MGM'T ASS'N 549-75 (2016) 11
- Diane A. Garcia-Gonzales et al., *Hazardous Air Pollutants Associated with Upstream Oil and Natural Gas Development: A Critical Synthesis of Current Peer-Reviewed Literature*, 40 ANN. REV. PUB. HEALTH 283–304 (2019) 15
- E Caron-Beaudoin et al., *Gestational Exposure to Volatile Organic Compounds (VOCs) in Northeastern British Columbia, Canada: A Pilot Study*, 110 ENVT INT'L 131-8 (2018) 16
- E.D. Czolowski, et al., *Toward Consistent Methodology to Quantify Populations in Proximity to Oil and Gas Development: A National Spatial Analysis and Review*, 125 ENVT'L HEALTH PERSPECTIVES (2017) 17
- Ella Myette & Mylene Riva, *Surveying the Complex Social-Ecological Pathways Between Resource Extraction and Indigenous Peoples' Health in Canada: A*

- Scoping Review with a Realist Perspective, 8(2) EXTRACTIVE INDUSTRIES & SOC'Y 100901 (2021) 22
- Ellen Webb et al., *Neurodevelopmental & Neurological Effects of Chemicals Assoc. with Unconventional Oil & Natural Gas Operations & Their Potential Effects on Infants and Children*, 33 REV. ENVT'L HEALTH 3-29 (2018) 30-31
- Ellen Webb et al., *Potential Hazards of Air Pollutant Emissions from Unconventional Oil and Natural Gas Operations on the Respiratory Health of Children and Infants*, 31 REV. ENVT'L HEALTH 225-243 (2016) 30-31
- Florencia Pascual, *Fracking & Childhood Leukemia: New Evidence Supports Greater Res. Setbacks*, 130 ENVT'L HEALTH PERSPECTIVES 94002-1 (2022) 21
- H.L. Brantley et al., *Assessment of Volatile Organic Compound and Hazardous Air Pollutant Emissions from Oil and Natural Gas Well Pads Using Mobile Remote and Onsite Direct Measurements*, 65(9) J. AIR & WASTE MGMT. ASSOC 1072-1082 (2015) 15
- Helen G. Siegel et al., *Investigation of Sources of Fluorinated Compounds in Private Water Supplies in an Oil and Gas-Producing Region of Northern West Virginia*, 57 ENVT'L SCI. & TECH. 17452-17464 (2023) 17
- Hiroko Tabuchi, E.P.A. *Approved Toxic Chemicals for Fracking a Decade Ago, New Files Show*, NEW YORK TIMES (July 12, 2021) 18
- Holly Elser, et al., *Petro-Risksapes and Environmental Distress in West Texas: Community Perceptions of Environmental Degradation, Threats, and Loss*, 80 ENERGY RES. & SOC. SCI. 101798 (2020); 18 P.O. Lai et al, *Understanding the Psychological Impact of Unconventional Gas Developments in Affected Communities*, 101 ENERGY POL'Y 492-501 (2017) 23
- Hubertus Brunn et al., *PFAS: Forever Chemicals—Persistent, Bioaccumulative and Mobile: Reviewing the Status and the Need for Their Phase Out and Remediation of Contaminated Sites*, 35(1):20 ENVT'L SCI. EU. at 2 (2023) 18
- I. Mikati I, et al., *Disparities in Distribution of Particulate Matter Emission Sources by Race & Poverty*, 108(4) AM. J. PUB. HEALTH 480–485 (2010) 25
- I.W. Tang et al., *Birth Defects and Unconventional Natural Gas Developments in Texas, 1999–2011*, 194 ENVT'L RES. 110511 (2021) 30
- INSTITUTE OF MEDICINE, ENVIRONMENTAL DECISIONS IN THE FACE OF UNCERTAINTY, at 53 (2013) 8
- Ioana O. Agache et al., *Chapter 5: Respiratory Disorders*, in CLIMATE CHANGE AND PUBLIC HEALTH 86-108 (Barry S. Levy & Jonathan Patz 2024) 11
- J. Johnston & L. Cushing, *Chemical Exposures, Health, and Environmental Justice in Communities Living on the Fenceline of Industry*, 7 CURR. ENVIR. HEALTH RPT. 7, 48–57 (2020) 14

- J.E. Johnston et al., *Respiratory Health, Pulmonary Function and Local Engagement in Urban Communities near oil development*, 197 ENVIRON. RES. 197, 1–10 (2021) 13
- J.L. Calderon et al., *Managing Upstream Oil and Gas Emissions: A Public Health Oriented Approach*, 310 J. ENVTL. MGMT 114766, 6 (2022) 13
- Jared E. Munster, *Oil, Indifference, and Displacement: An Indigenous Community Submerged and Tribal Relocation in the 21st Century*, 11 AM. INDIAN L.J. 1 (2023) 29
- Jill E. Johnston et al., *Impact of Upstream Oil Extraction and Environ. Public Health: A Review of the Evidence*, 657 SCI. TOTAL ENV'T 187-199 (2018) 20
- Jonathan J. Buonocore et al., *Air Pollution and Health Impacts of Oil and Gas Production in the United States*, 1 ENVT'L RES. 021006 (2023) 11, 14
- Joseph P. Gone, *Redressing First Nations Historical Trauma: Theorizing Mechanisms for Indigenous Culture as Mental Health Treatment*, 50 TRANSCULTURAL PSYCHIATRY (2013) 29
- Joseph V. Rodricks, *Reference Guide on Exposure Science*, in *Federal Judicial Center, REFERENCE MANUAL ON SCIENTIFIC EVIDENCE* 503-539 (3d. ed. 2011) 7
- K. Cozzetto et al., *Chapter: Climate Change Impacts on the Water Resources of American Indians and Alaska Natives in the U.S.*, in *CLIMATE CHANGE AND INDIGENOUS PEOPLES IN THE UNITED STATES: IMPACTS, EXPERIENCES AND ACTIONS* 569-584, 571 (Julie Koppel Maldonado et al., eds., 2014) 28
- K.V. Tran et al., *Residential Proximity to Hydraulically Fractured Oil and Gas Wells and Adverse Birth Outcomes in Urban and Rural Communities in California (2006-2015)*, 5(6) ENVT'L EPIDEMIOLOGY e172 (2021) 30
- K.V. Tran et al., *Residential Proximity to Oil and Gas Development and Birth Outcomes in California: A Retrospective Cohort Study of 2006–2015 Births*, 128(6) ENVT'L HEALTH PERSPECTIVES 067001 (2020) 30
- Karen Maguidre & John V. Winters, *Energy Boom and Gloom? Local Effects of Oil and Natural Gas Drilling on Subjective Well-Being*, 48 GROWTH & CHANGE 590-610 (2017) 23
- Kartikey Singh et al., *Air and Noise Pollution in Oil and Gas Industry*, 7 INT'L RES. J. OF ENGINEERING & TECH. 1090-1098 (2020) 24
- Kathy V. Tran et al., *Residential Proximity to Oil and Gas Development and Birth Outcomes in California: A Retrospective Cohort Study of 2006–2015 Births*, 128 ENVT'L HEALTH PERSPECTIVES 067001-1, 067001-8 (2020) 20
- Ken Eng & David Feeney, *Comparing the Health of Low Income and Less Well Educated Groups in the United States and Canada*, 5(10) POP. HEALTH METRICS 1-9 (2007) 25

- L. Cushing et al., *Flaring from Unconventional Oil and Gas Development and Birth Outcomes in the Eagle Ford Shale in South Texas*, 128(7) ENV'T'L HEALTH PERSPECTIVES 077003 (2020) 30
- L.B. Paulik LB, *Environmental and Individual PAH Exposures Near Rural Natural Gas Extraction*, 241 ENV'T'L POLLUT. 397–405 (2018) 16
- L.M. McKenzie et al., *Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural Colorado*, 4 ENV'T'L HEALTH PERSPECTIVES 412–7 (2014) 16
- L.M. McKenzie et al., *Congenital Heart Defects and Intensity of Oil and Gas Well Site Activities in Early Pregnancy*, 132 ENV'T INT'L 104949 (2019a) 30
- L.M. McKenzie, et al., *Childhood Hematologic Cancer and Residential Proximity to Oil and Gas Development*, 12(2) PLOS ONE e0170423 (2017) 32
- L.S. Horowitz et al., *Indigenous Peoples' Relationships to Large-Scale Mining in Post/Colonial Contexts: Toward Multidisciplinary Comparative Perspectives*, 5 EXTRACTIVE INDUSTRIES SOC'Y 404–14 (2018) 22
- Lihui Zhao, et al., *Insight into Binding Model of Per- and Polyfluoroalkyl Substan. to Proteins and Membranes*, 175 ENV'T INT'L 107951, at 5 (2023) 18
- Lisa M. McKenzie et al., *Ambient Nonmethane Hydrocarbon Levels Along Colorado's Northern Front Range: Acute and Chronic Health Risks*, 52 ENV'T'L SCI. TECHNOL. 4514-4525 (2018) 20
- M. Bamberger & R.E. Oswald, *Unconventional Oil and Gas Extraction and Animal Health*, 16 ENV'T'L SCI.: PROCESSES IMPACTS 1860-1865 (2014) 27
- M. Basner, et al., *Auditory and Non-Auditory Effects of Noise on Health*, 383 THE LANCET 1325-1332 (2014) 24
- M. Hendryx & J. Luo, *Nat. Gas Pipeline Compressor Stations: VOC Emissions and Mortality Rates*, 7 THE EXTRACTIVE INDUSTRIES AND SOCIETY 864-69 (2020) 11
- M.A. Yonas, *Psychosocial Stress and Asthma Morbidity*, 12 CURR. OPIN. ALLERGY CLIN. IMMUNOL. 202–210 (2012) 25
- M.D. Willis et al., *Associations between Residential Proximity to Oil and Gas Drilling and Term Birth Weight and Small for-Gestational-Age Infants in Texas: A Difference-in-Differences Analysis*, 129(7) ENV'T'L HEALTH PERSPECTIVES 77002 (2021) 30
- M.D. Willis et al., *Congenital Anomalies Associated with Oil and Gas Development and Resource Extraction: A Population-Based Retrospective Cohort Study in Texas*, 33(1) J. EXPOSURE SCI. & ENV'T'L EPIDEMIOLOGY 84–93 (2023) 30
- M.D. Willis et al., *Unconventional Natural Gas Development and Pediatric Asthma Hospitalizations in Pennsylvania*, 166 ENV'T'L RES. 402–408 (2018) 11

- Malerie Lazar & Lisa Davenport, *Barriers to Health Care for Low Income Families: A Rev. of Literature*, 35 J. COMM'Y HEALTH NURSING 28-37 (2018) 25
- Mary D. Willis et al., *Associations Between Residential Proximity to Oil and Gas Extraction and Hypertensive Conditions During Pregnancy: A Difference-in-Differences Analysis in Texas, 1996–2009*, 51(2) INT'L J. EPIDEMIOLOGY 525-536 (2021) 19, 23
- Mary D. Willis et al., *Residential Proximity to Oil and Gas Development and Mental Health in a North American Preconception Cohort Study: 2013-2023*, 114(9) AM. J. PUB. HEALTH 923-934 (2024) 23
- Melodie Meyer, *Fracking in Pueblo and Dine' Communities*, 29 UCLA J. ENVT'L L & POL'Y 89, 109 (2021) 22
- Melody E. Morton Ninomiya et al., *Indigenous Communities and the Mental Health Impacts of Land Dispossession Related to Industrial Resource Development: A Systematic Review*, 7 THE LANCET PLANETARY HEALTH, e501-e517, e507 (2023) 22
- Michael Borenstein et al., Preface, in *Introduction to Meta-Analysis* xxvii (2021) 7
- Michael Hendryx, *Chapter 3: How Energy Production and Public Health Are Connected*, in SUSTAINABLE DEVELOPMENT AND RURAL PUBLIC HEALTH: FROM FOSSIL FUELS TO GREENER FUTURES 23-34 (Michael Hendryx, ed., 2024) 9
- N.C. Deziel et al., *Unconventional Oil and Gas Development and Health Outcomes: A Scoping Review of the Epidemiological Research*, 182 ENVT'L RES. 109124 (2020) 9
- National Institute of Health, National Cancer Institute, *Endocrine System*, available <https://www.cancer.gov/publications/dictionaries/cancer-terms/def/endocrine-system> 19
- Omar Hahad et al., *Noise and Mental Health: Evidence, Mechanisms, and Consequences*, J. EXPO. SCI. ENVT'L EPIDEMIOLOGY (2024) 25
- Paul F. Hudak & David J. Wachal, *Oil Production, Agriculture, and Groundwater Quality in the Southeastern Gulf Coast Aquifer, Texas*, 73 ENVT'L MONITORING & ASSESSMENT 249-264 (2001) 16, 17
- Priyanka Saha et al., *Chapter 18: Noise Pollution from Oil, Gas, and Petrochemical Industries*, in CRISES IN OIL, GAS, AND PETROCHEMICAL INDUSTRIES 419-434 (2023) 24
- R.B. Jackson et al., *Increased Stray Gas Abundance in a Subset of Drinking Water Wells Near Marcellus Shale Gas Extraction*, 110 PROC. NAT'L ACAD. SCI. USA, 11250-11255 (2013) 17
- Robert Mechior Figueroa, *Chapter 16: Indigenous Peoples and Cultural Losses*, in THE OXFORD HANDBOOK OF CLIMATE CHANGE AND SOCIETY (John S. Dryzek et al., eds., 2011) 29

- S.K. Griswold, et al., *Asthma Exacerbations in North American Adults: Who Are the 'Frequent Fliers' in the Emergency Department?*, 127 CHEST 1579–1586 (2005) 25
- Sara E. Breitmeyer et al, *Per- and Polyfluorinated Alkyl Substances (PFAS) in Pennsylvania Surface Waters: A Statewide Assessment, Associated Sources, and Land-Use Relations*, 888 SCI. OF THE TOTAL ENV'T 164161(1-10) (2023) 18
- See U.S. Environmental Protection Agency, *What are Hazardous Air Pollutants?*, available at <https://www.epa.gov/haps/what-are-hazardous-air-pollutants> 15
- Sonya Ahamed, et al., *The Food-Energy-Water Nexus, Regional Sustainability, and Hydraulic Fracturing: An Integrated Assessment of the Denver Region*, CASE STUDIES IN THE ENV'T 1-21 (2019) 27
- Stephanie Malin, *Depressed Democracy, Environmental Injustice: Exploring the Negative Mental Health Implications of Unconventional Oil and Gas Production in the United States*, 70 ENERGY RES. & SOC. SCI. 101720 (2020) 23
- STEVE LERNER, *SACRIFICE ZONES: THE FRONTLINE OF TOXIC CHEMICAL EXPOSURE IN THE UNITED STATES* 73-118 (2010) 10
- Sun Young Kyung & Sung Hwan Jeong, *Particulate-Matter Related Respiratory Diseases*, 83 TUBERC. RESPIR. DIS. 116-121 (2020) 13
- Thanh T. Hoang et al., *Residential Proximity to Oil and Gas Developments and Childhood Cancer Survival*, 130 CANCER 3613-3774, 3728 (2024) 21
- Thomas J. Doherty & Amy D. Lykins, *Chapter 9: Mental Health Impacts*, in CLIMATE CHANGE AND PUBLIC HEALTH 180-204 (Barry S. Levy & Jonathan Patz 2024) 21
- U.S. Environmental Protection Agency, *Integrated Science Assessment (ISA) for Ozone and Related Photochemical Oxidants, Final Report* (Apr. 2020) 12
- U.S. Environmental Protection Agency, *Providing Safe Drinking Water in Areas with Abandoned Uranium Mines* 2
- U.S. Geological Survey, *Groundwater Flow Model Investigation of the Vulnerability of Water Resources at Chaco Culture National Historical Park Related to Unconventional Oil and Gas Development* (2023), available at <https://pubs.usgs.gov/sir/2023/5097/sir20235097.pdf> 16
- UCLA Institute of the Environment and Sustainability, *Impacts of Oil and Gas Drilling on Indigenous Communities in New Mexico's Greater Chaco Landscape* (2020) 22
- Victoria D. Balise et al., *Systematic Review of the Association Between Oil and Natural Gas Extraction Processes and Human Reproduction*, 106 FERTILITY & STERILITY, 795-819 (2016) 30, 32

- W.B. Allshouse et al., *Community Noise and Air Pollution Exposure During the Development of a Multi-Well Oil and Gas Pad*, 53 ENV'T'L SCI. & TECH. 7126-7135 (2019) 24
- Wenbin Jiang et al., *Characterization of Produced Water and Surrounding Surface Water in the Permian Basin, the United States*, 430 J. HAZARDOUS MATERIALS 128409 (2022) 17
- Young J. Juhn, *Influence of Asthma Epidemiology on the Risk for Other Diseases*, 4(3) ALLERGY ASTHMA IMMUNOL. Res. 122-131 (2012) 26, 27
- Z. Banan, Z. & J.M. Gernand, *Evaluation of Gas Well Setback Policy in the Marcellus Shale Region of Pennsylvania in Relation to Emissions of Fine Particulate Matter*, 68(9) J. AIR & WASTE MGMT. ASSOC. 988–1000 (2018) 13
- Z.F. Cairncross, et al., *Association Between Residential Proximity to Hydraulic Fracturing Sites and Adverse Birth Outcomes*, JAMA PEDIATRICS (2022) 30
- Zana Cranmer et al., *Energy Distributive Injustices: Assessing the Demographics of Communities Surrounding Renewable and Fossil Fuel Power Plants in the United States*, 100 ENERGY RES. & SOC. SCI. 103050 (2023) 25

RULE 12-318(G) NMRA STATEMENT OF COMPLIANCE

The body of this *Amicus Curiae* Brief uses a proportionally-spaced typeface (Times New Roman), contains 4564 words, as counted by Microsoft Word, and thus complies with the limitations of Rule 12-318(F)(3) N.M.R.A.

/s/ Mark Fine

INTEREST OF AMICI CURIAE

Amici Curiae are public health scientists and public health organizations whose work addresses the impacts of oil and gas production, as well as climate change in general, on the health of neighboring communities, also known as frontline communities.¹ As public health scientists and public health organizations, we bring scientific research and organizational experience to explain our current understanding of the public health effects of oil and gas production on frontline communities.

Amicus **Alliance of Nurses for Healthy Environments (ANHE)** is the only national nursing organization whose primary focus is on the intersection of health and the environment. Due to the significant health effects experienced by individuals and communities, and the climate impacts, throughout much of our history ANHE has worked with nurses in New Mexico and across the country to support health protective policies related to the fossil fuel industry.

Amicus **American Lung Association** was founded 120 years ago and is the leading organization working to save lives by improving lung health and preventing

¹ As required by N.M.R. App. P. 12-320(C), Amici Curiae represent that no counsel for a party authored this brief in whole or in part and no counsel or party made a monetary contribution intended to fund the preparation or submission of this brief. Given Amici's specific expertise and this Court's interest in focused briefing that aids its decision making process, Amici address only the general effects of oil and gas production on neighboring—also known as frontline—communities.

lung disease through education, advocacy and research. One of the organization's strategic imperatives is to champion clean air for all, working to protect public health from air pollution to ensure that all people have air that is safe and healthy to breathe.

Amicus **William F. Athas**, Ph.D., is a long-time resident of New Mexico, an epidemiologist and retired professor of public health, and a teacher of environmental health at the undergraduate and graduate level for over 20 years. He has particular expertise in human health risk assessment and public health mapping and is actively contributing personal time and effort to various community initiatives regarding adverse health impacts from oil and gas production in New Mexico, including the likely expansion of drilling operations on Federal lease lands, the current lack of health-protective proximity set-backs for oil and gas operations near vulnerable populations, and industry-driven efforts to implement widespread environmental release of treated oil and gas production wastewater.

Amicus **Dr. Jonathan Buonocore** is an Assistant Professor at Boston University School of Public Health in the Department of Environmental Health. His research focuses on health benefits of climate policies, and exposures, environmental justice, and health impacts of energy systems, energy policies, and the energy transition.

Amicus **Lori Byron** was the Medical Expert for *Held v Montana*, the constitutional climate change lawsuit brought by 16 Montana youth in the state of Montana. She is the Organizer for the American Academy of Pediatrics Climate Advocates Program and Chair her state group and has a M.S. in Energy Policy.

Amicus **Joan A. Casey** is an Associate Professor of Environmental and Occupational Health Sciences and Epidemiology at the University of Washington School of Public Health. She is an environmental epidemiologist who conducts large-scale spatial epidemiologic studies to understand links between the environment and population health. She has co-authored over 100 journal articles, many of which focus on the health impacts of oil and gas development and health equity.

Amicus **Lara J. Cushing** is Associate Professor of Environmental Health Sciences and Fielding Presidential Chair in Health Equity at the University of California, Los Angeles. She is the author or co-author of over 50 journal articles, book chapters, and technical reports including research on the impacts of oil and gas production on pregnancy and preterm birth. She was a contributing author to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) and a fellowship awardee of the Robert & Patricia Switzer Foundation and JPB Environmental Health Fellowship.

Amicus **Dr. Howard Frumkin** is Professor Emeritus of Environmental and Occupational Health Sciences at the University of Washington School of Public Health, where he served as Dean from 2010 to 2016. He was previously Director of the National Center for Environmental Health and the Agency for Toxic Substances and Disease Registry at the U.S. Centers for Disease Control and Prevention. He is a physician board-certified in internal medicine and in occupational and environmental medicine, a doctoral-trained epidemiologist, editor of the leading environmental health textbook, and author of over 300 peer-reviewed journal articles and chapters.

Amicus **Dr. David J.X. González** is an Assistant Professor of Environmental Health Sciences at the University of California, Berkeley. He has expertise in environmental epidemiology, ambient air pollution, and health equity, and he has published numerous studies examining the health impacts of oil and gas development in the United States.

Amicus **Jonathan Patz, MD, MPH** is a Vilas Distinguished Achievement Professor and John P. Holton Chair of Health and the Environment at the University of Wisconsin-Madison. Professor Patz is an elected member of the U.S. National Academy of Medicine for his pioneering research on climate change and human health, and he currently serves as Director and PI of the NIH-sponsored “Community-driven, Health-First Climate Action Research Center” at

UW-Madison. Dr. Patz served as Health Co-Chair for the first *U.S. National Climate Assessment* and for 15 years, served as a Lead Author for the United Nations Intergovernmental Panel on Climate Change (IPCC). Professor Patz has taught and conducted research on the public health effects of climate change, energy development and global environmental change for nearly 30 years. His faculty appointment is jointly with the Department of Population Health Science and the Nelson Institute for Environmental Studies. He has published over 200 scientific publications and several textbooks on these subjects.

Amicus **Physicians for Social Responsibility (PSR)** is a national non-profit organization founded in 1961 that mobilizes health professionals and public health advocates to protect human life from the gravest threats to health and survival. With 24,000 individual members and activists, and over 20 chapters nationwide, PSR contributes a health perspective to climate, energy, and environmental policy at the local, federal and international levels.

Amicus **Physicians for Social Responsibility-New Mexico Chapter** is an organization of health care professionals guided by the values and expertise of medicine and public health; we work to protect human life from the gravest threats to health and survival.

Amicus **Science and Environmental Health Network (SEHN)** was established as a non-profit organization in 1999. With legal, medical, public health

and other scientific expertise SEHN forges law, ethics, and science into tools for action. *The Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking and Associated Gas and Oil Infrastructure*, Ninth Edition, October 19, 2023 was produced by members of a program of SEHN.

Amicus **Bhavna Shamasunder** is an Associate Professor and Chair of Urban and Environmental Policy and Public Health at Occidental College in Los Angeles. Her expertise is at the intersection of environmental justice, environmental health sciences, and community-engaged research. She has published extensively on community health consequences of oil production in Los Angeles. Her research has been funded by the National Science Foundation, the National Institute of Environmental Health Sciences, and the California Breast Cancer Research Program.

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Our scientific work uses a variety of methodologies in order to better characterize the effects of oil and gas production on neighboring communities. Some involve observational studies to evaluate direct health outcomes as correlated to existing exposures, randomized control trials on animals to test the health effects of particular exposures, longitudinal studies to examine populations over time when the effects of exposure is not immediate, and biomonitoring to quantify the amount of pollutants integrated into human bodies.² Some are meta-analyses, that is, “the synthetic results from a series of studies,”³ while others are systemic reviews of existing studies to examine the totality of the evidence. The point is that we apply all of these methodologies in conjunction in order to better characterize the effects of oil and gas production on frontline communities.⁴

One of the reasons we rely upon a variety of methodologies is because research into the effects of oil and gas production on frontline communities is

² See Joseph V. Rodricks, *Reference Guide on Exposure Science*, in Federal Judicial Center, REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 503-539 (3d. ed. 2011).

³ See Michael Borenstein et al., Preface, in *Introduction to Meta-Analysis* xxvii (2021).

⁴ Cf. Rodricks, *supra* note 2, at 539-40 (describing how “exposure science” draws from a number of different scientific disciplines and noting that “[m]any exposure assessments involving collaborative efforts among members of [] various disciplines.”

complicated by ethical and practical considerations.⁵ As the Institute of Medicine observed in its environmental decision making in the face of uncertainty, “It is not ethical to intentionally expose people to chemicals at exposure concentrations that are likely to cause adverse effects, even following a short duration of exposure. Moreover, clinical trials are costly and typically are designed to capture the short-term effects of an intervention, whereas many adverse effects of chemicals can take decades to develop.”⁶ Similarly, it is unethical to conduct randomized control trials to examine the health harms from oil and gas development, so we must rely on observational studies and natural experiments—that is, comparing the results of different levels of exposure already occurring in different communities.

So instead, to understand risk, researchers must rely upon the combination of epidemiological, observational studies of associations, and direct medical studies described earlier, along with toxicological knowledge on how various chemicals injure the body. We provide this context so that the Court understands why we provide our public health research in the manner we do, with a combination of research evidence. Direct observations on exposed populations, when available, are often the lynchpin for decision making.

⁵ See INSTITUTE OF MEDICINE, ENVIRONMENTAL DECISIONS IN THE FACE OF UNCERTAINTY, at 53 (2013), *available at* https://www.ncbi.nlm.nih.gov/books/NBK200848/pdf/Bookshelf_NBK200848.pdf. (One of the authors of this brief was a co-author of this report.)

⁶ *Id.*

SUMMARY OF ARGUMENT

Scientific research has demonstrated both significant direct links between the pollutants associated with oil and gas production and negative impacts on public health, as well as associations between negative health outcomes and proximity to oil and gas production facilities. We believe that the evidence shows impacts so extreme that this Court should consider our research in evaluating whether New Mexico has met its duties to “provide for control of pollution and despoilment” to protect the public health of frontline communities. *See* NM Const., Art. XX, §21.

ARGUMENT

I. Oil and Gas Production Can Harm the Health of Frontline Communities

Oil and gas production can harm the health of those in frontline communities in many ways, from increasing risk of respiratory disorders, increasing risk of hazardous chemical exposure, and also various negative cultural and mental health impacts in terms of cultural practice loss and increased depression and anxiety,⁷

⁷ *See* Michael Hendryx, *Chapter 3: How Energy Production and Public Health Are Connected*, in *SUSTAINABLE DEVELOPMENT AND RURAL PUBLIC HEALTH: FROM FOSSIL FUELS TO GREENER FUTURES* 23-34 (Michael Hendryx, ed., 2024); *see also* N.C. Deziel et al., *Unconventional Oil and Gas Development and Health Outcomes: A Scoping Review of the Epidemiological Research*, 182 ENV'T'L RES. 109124 (2020); A.M. Bamber et al., *A Systematic Review of the Epidemiologic Literature Assessing Health Outcomes in Populations Living near Oil and Natural Gas Operations: Study Quality and Future Recommendations*, 16(12) INT'L J. ENV'T'L RES. & PUB. HEALTH 2123 (2019).

such that these communities are referred to as “sacrifice zones.”⁸ This Part of our Proposed *Amicus Curiae* brief will describe how oil and gas production is closely associated with the increased exposure of frontline communities to releases of chemicals that have been found to cause respiratory disorders and other harmful physical health impacts, and how oil and gas production is associated with increased mental health problems in such communities.

We urge this Court to consider these health impacts as it evaluates this case in light of Article XX, §21 of the New Mexico State Constitution, which establishes the “fundamental importance” of protecting the state’s “beautiful and healthful environment” for the “public interest, health, safety, and the general welfare.” Although we are not lawyers, with our public health expertise, we believe that these impacts pose such an unacceptable risk burden that this Court should consider the substantial body of research related to human health in evaluating whether New Mexico has met its duties to “provide for control of pollution and despoilment” to protect the public health of frontline communities. *See* NM Const., Art. XX, §21.

A. Emissions Associated with Oil and Gas Production Have Been Demonstrated to Increase the Rate of Respiratory Disorders

⁸ *See* STEVE LERNER, SACRIFICE ZONES: THE FRONTLINE OF TOXIC CHEMICAL EXPOSURE IN THE UNITED STATES 73-118 (2010).

The contribution of oil and gas production to respiratory disorders in frontline communities is well documented.⁹ This is because oil and gas production as a general matter leads to increased levels of ground level ozone—due to increases in emissions of volatile organic compounds (VOCs) and nitrogen oxides (NO_x)—and fine particulate matter (PM_{2.5}) in the vicinity, as well as other pollutants.¹⁰ These emissions, in turn, can contribute to respiratory disorders through a number of biological pathways: by decreasing lung function, increasing the risk of chronic bronchitis and chronic obstructive pulmonary disease (COPD), increasing susceptibility to tuberculosis, and creating numerous other respiratory issues.¹¹

⁹ See, e.g., Ioana O. Agache et al., *Chapter 5: Respiratory Disorders*, in CLIMATE CHANGE AND PUBLIC HEALTH 86-108 (Barry S. Levy & Jonathan Patz 2024); see also Jonathan J. Buonocore et al., *Air Pollution and Health Impacts of Oil and Gas Production in the United States*, 1 ENV'T'L RES. 021006 (2023); M. Hendryx & J. Luo, *Natural Gas Pipeline Compressor Stations: VOC Emissions and Mortality Rates*, 7 THE EXTRACTIVE INDUSTRIES AND SOCIETY 864–69 (2020); M.D. Willis et al., *Unconventional Natural Gas Development and Pediatric Asthma Hospitalizations in Pennsylvania*, 166 ENV'T'L RES. 402–408 (2018); A. Bushong, et al., *Publicly Available Data Reveals Association Between Asthma Hospitalizations and Unconventional Natural Gas Development in Pennsylvania*, 17(3) PLOS ONE e0265513 (2022).

¹⁰ See David T. Allen, *Emissions from Oil and Gas Operations in the United States and Their Air Quality Implications*, 66 J. AIR & WASTE MGMT ASS'N 549-75 (2016). Note, though, because ground level ozone is not directly emitted by oil and gas production facilities, but is instead is formed through precursors such as VOCs and NO_x, the actual amount of ground level ozone formation can vary greatly depending on the climate and geography of the area.

¹¹ See Agache et al., *supra* note 9.

For example, ground level ozone, which is generated by sunlight causing chemical reactions of VOCs and NO_x directly produced by nearby oil and gas production “can cause respiratory tract irritation (with symptoms of shortness of breath, wheezing, and cough), acute decreases in lung function, systemic inflammation, and oxidative stress. It also increases epithelial barrier permeability, airway hyperresponsiveness (with exacerbations of asthma), and susceptibility to lower respiratory tract infections.”¹² Indeed, the EPA has already concluded that there is a “causal relationship” between short-term ozone exposure and adverse respiratory effects, as well as a “likely” “causal relationship” between long-term ozone exposure and negative respiratory effects.¹³

Living near oil and gas production facilities increases exposure to airborne particulate matter, including the small particles referred to as PM_{2.5}. “Sources of PM_{2.5} emissions associated with upstream oil and gas production may include combustion of diesel fuel from on-site equipment and heavy trucks, dust from construction sites and unpaved roads, and secondary formation in the

¹² *See id.* at 91.

¹³ *See* U.S. Environmental Protection Agency, Integrated Science Assessment (ISA) for Ozone and Related Photochemical Oxidants, Final Report (Apr. 2020).

atmosphere.”¹⁴ This increased exposure to airborne particles can also lead to respiratory issues, such as asthma and loss of pulmonary function.¹⁵ As authors of one systemic review conclude:

Several studies have shown that exposure to high concentrations of PM leads to an increase in hospitalization and mortality rates in patients suffering from COPD. Acute exacerbation of bronchial asthma and IPF is also linked to high concentrations of PM. Long-term exposure to PM is associated with lung cancer development; particularly, high concentrations of PM_{2.5} have been linked with acute exacerbation and increased prevalence of chronic respiratory disease in smokers aged 60 years and over.¹⁶

Finally, the NO_x and PM_{2.5} generated by neighboring oil and gas production, as well as the ozone created through the VOCs and NO_x generated by neighboring oil and gas production, can lead to other respiratory problems. For example, increases in these compounds “can damage the respiratory epithelial barrier, which can in turn make people more vulnerable to allergens, toxins, and infections agents. They can

¹⁴ David J.X. Gonzalez et al., *Upstream Oil and Gas Production and Ambient Air Pollution in California*, 806 SCIENCE OF THE TOTAL ENV'T 1, 2 (Feb. 2022); see also Z. Banan, Z. & J.M. Gernand, *Evaluation of Gas Well Setback Policy in the Marcellus Shale Region of Pennsylvania in Relation to Emissions of Fine Particulate Matter*, 68(9) J. AIR & WASTE MGMT. ASSOC. 988–1000 (2018).

¹⁵ See J.L. Calderon et al., *Managing Upstream Oil and Gas Emissions: A Public Health Oriented Approach*, 310 J. ENVTL. MGMT 114766, 6 (2022); J.E. Johnston et al., *Respiratory Health, Pulmonary Function and Local Engagement in Urban Communities near oil development*, 197 ENVIRON. RES. 197, 1–10 (2021); see generally Sun Young Kyung & Sung Hwan Jeong, *Particulate-Matter Related Respiratory Diseases*, 83 TUBERC. RESPIR. DIS. 116-121 (2020).

¹⁶ See Kyung & Jeong, *supra* note 15, at 119.

also cause the body to modulate innate and adaptive immune responses with excessive inflammation and tissue damage.”¹⁷

These respiratory health impacts are costly. In one recent study, researchers found that “air pollution in 2016 from the oil and gas sector in the US resulted in 410,000 asthma exacerbations, 2200 new cases of childhood asthma, and 7500 excess deaths with \$77 billion in total health impacts,” with NO_x, PM_{2.5}, and ozone being roughly equal contributors.¹⁸

B. Hazardous Chemicals Associated with Oil and Gas Production Have Been Demonstrated to Increase the Risk of Cancer, as Well as Neurological, Reproductive, and Developmental Disorders

Neighboring oil and gas production can also greatly increase the risk that those in frontline communities are exposed to other toxic chemicals.¹⁹ This is because oil and gas production is strongly associated with neighboring exposure to

¹⁷ See Agache et al., *supra* note 9, at 86-87.

¹⁸ See Buonocore et al., *supra* note 9, at 1.

¹⁹ See, e.g., J. Johnston & L. Cushing, *Chemical Exposures, Health, and Environmental Justice in Communities Living on the Fenceline of Industry*, 7 CURR. ENVIR. HEALTH RPT. 7, 48–57 (2020).

airborne hazardous pollutants,²⁰ and toxic pollutants released into neighboring water supplies.²¹ With respect to hazardous air pollutants, one systemic review identified 61 hazardous air pollutants (defined as air pollutants “that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects”²²) examined in peer-reviewed published scientific research examining hazardous air pollutants from 2012 to 2019.²³

According to the systemic review, “The current body of scientific literature suggests that upstream [oil and gas] development processes emit numerous air pollutants, including methane . . . aliphatic and aromatic hydrocarbons, aldehydes, and nitrogen oxides, some of which are also precursors to tropospheric ozone and secondary organic aerosol . . . production.”²⁴ While the systemic review was

²⁰ See, e.g., D.J. Gonzalez, et al., *Upstream Oil and Gas Production and Ambient Air Pollution in California*, 806 SCI. OF THE TOTAL ENV'T 150298 (2022); Diane A. Garcia-Gonzales et al., *Hazardous Air Pollutants Associated with Upstream Oil and Natural Gas Development: A Critical Synthesis of Current Peer-Reviewed Literature*, 40 ANN. REV. PUB. HEALTH 283–304 (2019); A. Hecobian et al., *Air Toxics and Other Volatile Organic Compound Emissions from Unconventional Oil and Gas Development*, 6(12) ENV'T SCI. & TECH. LETTERS, 720–726 (2019); H.L. Brantley et al., *Assessment of Volatile Organic Compound and Hazardous Air Pollutant Emissions from Oil and Natural Gas Well Pads Using Mobile Remote and Onsite Direct Measurements*, 65(9) J. AIR & WASTE MGMT. ASSOC 1072-1082 (2015).

²¹ See Johnston & Cushing, *supra* note 19, at 49.

²² See U.S. Environmental Protection Agency, *What are Hazardous Air Pollutants?*, available at <https://www.epa.gov/haps/what-are-hazardous-air-pollutants>.

²³ See Garcia-Gonzales, et al., *supra* note 20, at 283-304.

²⁴ *Id.* at 284.

structured to identify existing gaps to explore in future public health research, it also observes that a number of health-based spatial studies have identified significant connections between oil and gas production facilities and health responses related to hazardous air pollutants.²⁵

Hazardous water pollution can also increase with proximity to oil and gas production facilities.²⁶ One study in Southeast Texas, for example, found that “[c]hloride, bromide, and [total dissolved solids] concentrations, and bromide-chloride ratios were significantly higher in water wells near oil/gas wells.”²⁷ Another study has identified endocrine-disrupting chemicals in surface

²⁵ See, e.g., L.B. Paulik, *Environmental and Individual PAH Exposures Near Rural Natural Gas Extraction*, 241 ENV'T'L POLLUT. 397-405 (2018); E Caron-Beaudoin et al., *Gestational Exposure to Volatile Organic Compounds (VOCs) in Northeastern British Columbia, Canada: A Pilot Study*, 110 ENV'T INT'L 131-8 (2018); L.M. McKenzie et al., *Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural Colorado*, 4 ENV'T'L HEALTH PERSPECTIVES 412-7 (2014).

²⁶ See, e.g., Paul F. Hudak & David J. Wachal, *Oil Production, Agriculture, and Groundwater Quality in the Southeastern Gulf Coast Aquifer, Texas*, 73 ENV'T'L MONITORING & ASSESSMENT 249-264 (2001); see generally U.S. Geological Survey, *Groundwater Flow Model Investigation of the Vulnerability of Water Resources at Chaco Culture National Historical Park Related to Unconventional Oil and Gas Development* (2023), available at <https://pubs.usgs.gov/sir/2023/5097/sir20235097.pdf>.

²⁷ See Hudak & Wachal, *supra* note 26. at 262.

water near oil and gas wastewater disposal sites in West Virginia.²⁸ Other studies also find that proximity to oil and gas production is correlated to increased water pollution of many types.²⁹

Contamination of water supplies by Per- and Polyfluorinated Alkyl Substances (PFAS) can also result from oil and gas production.³⁰ For traditional oil and gas drilling, PFAS have been used “as corrosion inhibitors on pipes and drilling equipment, to enhance oil recovery, and as additives to prevent evaporation of

²⁸ See C.D. Kassotis, et al., *Endocrine Disrupting Activities of Surface Water Associated with a West Virginia Oil and Gas Industry Wastewater Disposal Site*, 557-558 SCI. TOTAL ENV'T 901-910 (2016); see also C.D. Kassotis et al., *Endocrine-Disrupting Activities and Organic Contaminants Associated with Oil and Gas Operations in Wyoming Groundwater*, ARCHIVES OF ENVT'L CONTAMINATION & TOXICOLOGY 1–12 (2018); A.L. Bolden et al., *Exploring the Endocrine Activity of Air Pollutants Associated with Unconventional Oil and Gas Extraction*, 17 ENVT'L HEALTH (2018), available at <https://doi.org/10.1186/s12940-018-0368-z>.

²⁹ See, e.g., E.D. Czolowski, et al., *Toward Consistent Methodology to Quantify Populations in Proximity to Oil and Gas Development: A National Spatial Analysis and Review*, 125 ENVT'L HEALTH PERSPECTIVES (2017); B.E. Fontenot, et al., *An Evaluation of Water Quality in Private Drinking Water Wells Near Natural Gas Extraction Sites in the Barnett Shale Formation*, 47 ENVT'L SCI. TECH. 10032-10040 (2013); R.B. Jackson et al., *Increased Stray Gas Abundance in a Subset of Drinking Water Wells Near Marcellus Shale Gas Extraction*, 110 PROC. NAT'L ACAD. SCI. USA, 11250-11255 (2013).

³⁰ See, e.g., Wenbin Jiang et al., *Characterization of Produced Water and Surrounding Surface Water in the Permian Basin, the United States*, 430 J. HAZARDOUS MATERIALS 128409 (2022); see also, e.g., Helen G. Siegel et al., *Investigation of Sources of Fluorinated Compounds in Private Water Supplies in an Oil and Gas-Producing Region of Northern West Virginia*, 57 ENVT'L SCI. & TECH. 17452-17464 (2023); Sara E. Breitmeyer et al., *Per- and Polyfluorinated Alkyl Substances (PFAS) in Pennsylvania Surface Waters: A Statewide Assessment, Associated Sources, and Land-Use Relations*, 888 SCI. OF THE TOTAL ENV'T 164161(1-10) (2023).

stored fuels.”³¹ Gas extraction methods such as hydraulic fracturing can also lead to PFAS contamination because the chemicals used to ease the flow of oil from the ground in hydraulic fracturing can also break down into PFAS.³² PFAS is often referred to as “forever chemicals,” due to how slowly they break down in nature.³³ While toxic responses to PFAS are not yet fully characterized, there are basically five different types of toxic responses: “response to stress, reproduction, lipid metabolism, xenobiotic metabolism [metabolism of a substance foreign to the body] and cell differentiation.”³⁴ The binding of the PFAS to various proteins causes these responses. For example, PFAS can interfere with the binding of thyroid hormones to their target thyroid hormone receptors, thereby disrupting the regular operation of the endocrine system.³⁵ The endocrine system, in turn, consists of “[t]he glands and organs that make hormones The hormones released by the endocrine system control many important functions in the body, including growth and development,

³¹ See Breitmeyer et al., *supra* note 30, at 16416.

³² See Hiroko Tabuchi, E.P.A. *Approved Toxic Chemicals for Fracking a Decade Ago, New Files Show*, NEW YORK TIMES (July 12, 2021).

³³ See Hubertus Brunn et al., *PFAS: Forever Chemicals—Persistent, Bioaccumulative and Mobile: Reviewing the Status and the Need for Their Phase Out and Remediation of Contaminated Sites*, 35(1):20 ENV'T'L SCI. EU. at 2 (2023) (“PFAS are characterized by their high thermal and chemical stability.”).

³⁴ Lihui Zhao, et al., *Insight into the Binding Model of Per- and Polyfluoroalkyl Substances to Proteins and Membranes*, 175 ENV'T INT'L 107951, at 5 (2023).

³⁵ See *id.* at 7.

metabolism, and reproduction.”³⁶ Similarly, PFAS can interfere with reproductive system receptors by binding to reproductive hormones in different ways, for example, by disrupting the regulation of estrogen in humans.³⁷ PFAS can also enter cell membranes, alter their fluidity, block the transport of substances through the membranes, and ultimately become toxic to the cells.³⁸

The air and water pollution associated with proximity to oil and gas production has been also associated with other negative health outcomes. For example, researchers have found that oil and gas extraction has been statistically associated with hypertensive conditions during pregnancy.³⁹ As another example, researchers studying oil and gas facilities in Colorado found that “[a]cute hazard indices for neurological . . . , hematological . . . , and developmental . . . health effects indicate that populations living within 152 m of an [oil and gas] facility could experience these health effects from inhalation exposures to benzene and

³⁶ National Institute of Health, National Cancer Institute, *Endocrine System*, available at <https://www.cancer.gov/publications/dictionaries/cancer-terms/def/endocrine-system>.

³⁷ See Zhao, *supra* note 34, at 7.

³⁸ See *id.* at 8.

³⁹ See Mary D. Willis et al., *Associations Between Residential Proximity to Oil and Gas Extraction and Hypertensive Conditions During Pregnancy: A Difference-in-Differences Analysis in Texas, 1996–2009*, 51(2) INT’L J. EPIDEMIOLOGY 525-536 (2021).

alkanes.⁴⁰ Another study conducted in California found that “[i]n rural areas, . . . exposure to high production volume was significantly associated with increased odds of LBW [low birth weight] and SGA [small for gestational age at birth] and decreased tBW [term birth weight] in comparison with the nonexposed group.”⁴¹ Additionally, in a large systemic review of 2,236 existing studies, researchers found that “current evidence suggests potential health impacts due to exposure to upstream oil extraction, such as cancer, liver damage, immunodeficiency, and neurological symptoms.”⁴²

Finally, in a study of those living next to oil and gas production facilities in Texas, researchers found “evidence that living within 1000 m of oil or gas wells was associated with higher mortality in children with AML [acute myeloid leukemia] and hepatoblastoma and lower mortality in children with Ewing sarcoma. In dose–response analyses, risk of death was greater among children with AML or hepatoblastoma who lived within 500 m of oil or gas wells or had higher number of

⁴⁰ See Lisa M. McKenzie et al., *Ambient Nonmethane Hydrocarbon Levels Along Colorado’s Northern Front Range: Acute and Chronic Health Risks*, 52 ENV’T L SCI. TECHNOL. 4514-4525 (2018).

⁴¹ See Kathy V. Tran et al., *Residential Proximity to Oil and Gas Development and Birth Outcomes in California: A Retrospective Cohort Study of 2006–2015 Births*, 128 ENV’T L HEALTH PERSPECTIVES 067001-1, 067001-8 (2020).

⁴² See Jill E. Johnston et al., *Impact of Upstream Oil Extraction and Environmental Public Health: A Review of the Evidence*, 657 SCI. TOTAL ENV’T 187-199 (2018).

wells across the three buffers.”⁴³ Similar studies have also found associations between unconventional oil and gas production with the increased risk of childhood leukemia.⁴⁴

C. Oil and Gas Production Facilities Are Associated with Negative Cultural and Mental Health Impacts

Finally, oil and gas production is associated with negative cultural and mental health impacts in frontline communities. These impacts include the degradation or destruction of Indigenous land and water, which can lead to increased psychiatric problems; loss of healthy traditional historic food sources; and generalized ecological grief.⁴⁵

The loss of Indigenous land and water due to oil and gas production cannot be understated. As one legal scholar has explained, “‘Water is life’” reflects indigenous views of people being a part of the landscape as opposed to separate from the land, creating a kinship-based responsibility to care for the land as a key part of the ecosystem, and working in harmony to sustain life for all beings. . . . If water is contaminated or depleted, humans cannot safely farm, cultivate livestock,

⁴³ See Thanh T. Hoang et al., *Residential Proximity to Oil and Gas Developments and Childhood Cancer Survival*, 130 *CANCER* 3613-3774, 3728 (2024).

⁴⁴ See Florencia Pascual, *Fracking and Childhood Leukemia: New Evidence Supports Greater Residential Setbacks*, 130 *ENV'TL HEALTH PERSPECTIVES* 094002-1 (2022).

⁴⁵ See Thomas J. Doherty & Amy D. Lykins, *Chapter 9: Mental Health Impacts*, in *CLIMATE CHANGE AND PUBLIC HEALTH* 180-204 (Barry S. Levy & Jonathan Patz 2024).

hunt and fish, or conduct ceremonies.”⁴⁶ This cultural loss, in turn, is associated with various mental health issues, including depression, stress, fear, and concern for future generations.⁴⁷ For example, one systemic review of previous studies conducted on land dispossession related to industrial resource development found that “[o]verall, studies showed that Indigenous Peoples experienced negative mental health impacts after land dispossession due to the development of industrial resource extraction projects on Indigenous lands, regardless of how geographically close they were to the industrial site.”⁴⁸

Such mental health impacts are not limited to Indigenous communities.

Numerous studies have examined how neighboring oil and gas production can be

⁴⁶ See Melodie Meyer, *Fracking in Pueblo and Dine' Communities*, 29 UCLA J. ENV'T'L L & POL'Y 89, 109 (2021).

⁴⁷ See Melody E. Morton Ninomiya et al., *Indigenous Communities and the Mental Health Impacts of Land Dispossession Related to Industrial Resource Development: A Systematic Review*, 7 THE LANCET PLANETARY HEALTH, e501-e517, e507 (2023); see also Ella Myette & Mylene Riva, *Surveying the Complex Social-Ecological Pathways Between Resource Extraction and Indigenous Peoples' Health in Canada: A Scoping Review with a Realist Perspective*, 8(2) EXTRACTIVE INDUSTRIES & SOC'Y 100901 (2021); C.N. Westman & T.L. Joly, *Oil Sands Extraction in Alberta, Canada: A Review of Impacts and Processes Concerning Indigenous Peoples*, 2 HUMAN ECOLOGICAL INTERDISCIPLINARY J. 233–43 (2019); L.S. Horowitz et al., *Indigenous Peoples' Relationships to Large-Scale Mining in Post/Colonial Contexts: Toward Multidisciplinary Comparative Perspectives*, 5 EXTRACTIVE INDUSTRIES SOC'Y 404–14 (2018); see generally UCLA Institute of the Environment and Sustainability, *Impacts of Oil and Gas Drilling on Indigenous Communities in New Mexico's Greater Chaco Landscape* (2020), available at <https://www.ioes.ucla.edu/wp-content/uploads/2020/09/ucla-ioes-practicum-impacts-of-oil-and-gas-on-indigenous-communities-in-new-mexico-final-report-9-2020.pdf>

⁴⁸ See Ninomiya et al., *supra* note 47, at e514.

drivers of chronic stress.⁴⁹ This can include the increased risk of depression and use of psychotropic medication by those planning pregnancies,⁵⁰ generalized feelings of depression and helplessness,⁵¹ and increased risk of anxiety-related disorders.⁵²

⁴⁹ See, e.g., Mary D. Willis et al., *Residential Proximity to Oil and Gas Development and Mental Health in a North American Preconception Cohort Study: 2013-2023*, 114(9) AM. J. PUB. HEALTH 923-934 (2024); Stephanie Malin, *Depressed Democracy, Environmental Injustice: Exploring the Negative Mental Health Implications of Unconventional Oil and Gas Production in the United States*, 70 ENERGY RES. & SOC. SCI. 101720 (2020); Holly Elser, et al., *Petro-Risksapes and Environmental Distress in West Texas: Community Perceptions of Environmental Degradation, Threats, and Loss*, 80 ENERGY RES. & SOC. SCI. 101798 (2020); 18 P.O. Lai et al., *Understanding the Psychological Impact of Unconventional Gas Developments in Affected Communities*, 101 ENERGY POL'Y 492-501 (2017); Karen Maguidre & John V. Winters, *Energy Boom and Gloom? Local Effects of Oil and Natural Gas Drilling on Subjective Well-Being*, 48 GROWTH & CHANGE 590-610 (2017).

⁵⁰ See Willis et al., *id.*

⁵¹ See Malin, *supra* note 49, at 7-8.

⁵² See Elser et al., *supra* note 49, at 10.

Oil and gas production is also associated with increased noise in the surrounding community.⁵³ One study, for example, found that “The maximum 1-min equivalent continuous sound levels over a 1-month period were 60.2 dBA [a particular type of weighted decibel] and 80.0 dBC [another particular type of weighted decibel].”⁵⁴ To put this into context, noise levels “exceeding 50 dBA or 60 dBC may cause annoyance and be detrimental to health; thus, these noise levels have the potential to impact health . . . and associated health effects warrant further investigation.”⁵⁵ Noise pollution, in turn, can lead to mental health conditions such

⁵³ See Priyanka Saha et al., *Chapter 18: Noise Pollution from Oil, Gas, and Petrochemical Industries*, in *CRISES IN OIL, GAS, AND PETROCHEMICAL INDUSTRIES* 419-434 (2023); Kartikey Singh et al., *Air and Noise Pollution in Oil and Gas Industry*, 7 INT’L RES. J. OF ENGINEERING & TECH. 1090-1098 (2020); C.M. Richburg et al., *Noise Concerns of Residents Living in Close Proximity to Hydraulic Fracturing Sites in Southwest Pennsylvania*, 36(1) PUB. HEALTH NURSING 3-10 (2019); W.B. Allshouse et al., *Community Noise and Air Pollution Exposure During the Development of a Multi-Well Oil and Gas Pad*, 53 ENVT’L SCI. & TECH. 7126-7135 (2019); B. J. Hays et al., *Public Health Implications of Environmental Noise Associated with Unconventional Oil and Gas Development*, 580 SCI. OF THE TOTAL ENV’T 448–456 (2017); D. Blair et al., *Residential Noise from Nearby Oil and Gas Well Construction and Drilling*, 28(6) J. EXPO SCI ENVIRON EPIDEMIOL. 538–47 (2018); M. Basner, et al., *Auditory and Non-Auditory Effects of Noise on Health*, 383 THE LANCET 1325-1332 (2014).
1332. [https://doi.org/10.1016/S0140-6736\(13\)61613-X](https://doi.org/10.1016/S0140-6736(13)61613-X)

⁵⁴ See Blair et al., *supra* note 53.

⁵⁵ See *id.*

as “depression, anxiety, suicide, and behavioral problems in children and adolescents.”⁵⁶

Moreover, the other physical health impacts created by oil and gas production on frontline communities can also lead to the loss of mental health. For example, those suffering from asthma and other respiratory disorders also suffer from psychosocial stress arising from exacerbations of their health conditions.⁵⁷

II. These Harms Can Exacerbate Pre-Existing Public Health Inequities in Already Existing in Frontline Communities

Much of oil and gas production is located near low-income and Indigenous communities.⁵⁸ Marginalized communities already face significant health challenges due to their lack of infrastructure and resources.⁵⁹ The harms described

⁵⁶ See Omar Hahad et al., *Noise and Mental Health: Evidence, Mechanisms, and Consequences*, J. EXPO. SCI. ENVT’L EPIDEMIOLOGY (2024), available at <https://doi.org/10.1038/s41370-024-00642-5>.

⁵⁷ See M.A. Yonas, *Psychosocial Stress and Asthma Morbidity*, 12 CURR. OPIN. ALLERGY CLIN. IMMUNOL. 202–210 (2012); S.K. Griswold, et al., *Asthma Exacerbations in North American Adults: Who Are the ‘Frequent Fliers’ in the Emergency Department?*, 127 CHEST 1579–1586 (2005).

⁵⁸ See generally Zana Cranmer et al., *Energy Distributive Injustices: Assessing the Demographics of Communities Surrounding Renewable and Fossil Fuel Power Plants in the United States*, 100 ENERGY RES. & SOC. SCI. 103050 (2023); see also Johnston & Cushing, *supra* note 19; I. Mikati I, et al., *Disparities in Distribution of Particulate Matter Emission Sources by Race and Poverty Status*, 108(4) AM. J. PUB. HEALTH 480–485 (2010).

⁵⁹ See generally Malerie Lazar & Lisa Davenport, *Barriers to Health Care for Low Income Families: A Review of Literature*, 35 J. COMM’Y HEALTH NURSING 28-37 (2018); Ken Eng & David Feeney, *Comparing the Health of Low Income and Less Well Educated Groups in the United States and Canada*, 5(10) POP. HEALTH METRICS 1-9 (2007).

in Part I of this brief serve to further exacerbate these pre-existing health challenges in many ways. This Part examines just four of the ways in which the harms described in Part I can exacerbate pre-existing conditions, ranging from increasing vulnerability to infectious diseases, harming the safety of livestock upon which these Indigenous and rural communities rely for subsistence, exacerbating the harms faced by Indigenous communities already vulnerable to resource and cultural loss, and exposing infants and children with already low health measures to additional stressors.

A. The Long-Term Respiratory Harms Created by Gas and Oil Production Will Make Populations More Vulnerable to Infectious Diseases

Respiratory ailments such as asthma are associated with greater severity of microbial infections.⁶⁰ For example, researchers “found that adults with asthma were at significantly increased risk for serious pneumococcal diseases [the name for any infection caused by the bacteria called *Streptococcus pneumoniae*] . . . compared with adults without asthma.”⁶¹ They also found “preliminary results showing an increased risk for pertussis [also known as whooping cough] among people with asthma.”⁶² Finally, the same group of researchers found that

⁶⁰ See Young J. Juhn, *Influence of Asthma Epidemiology on the Risk for Other Diseases*, 4(3) ALLERGY ASTHMA IMMUNOL. Res. 122-131 (2012).

⁶¹ See *id.* at 123.

⁶² See *id.*

“asthmatics may lose immunity against mumps or other viruses more rapidly than non-asthmatics and may become a population susceptible to outbreaks of serious infectious diseases.”⁶³

B. Toxic Chemical Exposure Can Contaminate Soil and Harm Livestock of Indigenous and Frontline Families, and Can Directly Lead to Food Insecurity and Malnutrition

Toxic chemicals associated with neighboring oil and gas production can harm the ability of frontline communities to produce food, which in turn can lead to food insecurity and malnutrition for families who may be more reliant on local food production. As described earlier, oil and gas production is associated with increased contamination of toxic chemicals in surface and drinking water. This water is also used by Indigenous and rural communities to water their crops and livestock, as well as to prepare their food.⁶⁴

While a comprehensive study of the direct impact of oil and gas production on neighboring agricultural production has not been conducted due to the complexities of exposure pathways, numerous studies have examined the impact of oil and gas production on livestock agriculture.⁶⁵ Such depression of livestock

⁶³ See *id.* at 124.

⁶⁴ See Sonya Ahamed, et al., *The Food-Energy-Water Nexus, Regional Sustainability, and Hydraulic Fracturing: An Integrated Assessment of the Denver Region*, CASE STUDIES IN THE ENV'T 1-21 (2019).

⁶⁵ See, e.g., M. Bamberger & R.E. Oswald, *Unconventional Oil and Gas Extraction and Animal Health*, 16 ENV'T'L SCI.: PROCESSES IMPACTS 1860-1865 (2014); Cheryl Waldner, *Risk of Abortion and Stillbirth in Cow-Calf Herds Exposed to the Oil and*

productivity can lead to increased food and economic insecurity for neighboring communities.

C. Indigenous Communities Are Especially Vulnerable to Cultural, Natural Resources, and Ecosystem Destruction, as Well As Forced Migration

Cultural destruction through the use of historically indigenous lands for oil and gas production can also compound the loss of cultural traditions, causing further psychiatric problems and substance abuse issues. As described earlier, Indigenous communities are more likely to rely on natural resources for economic purposes as well as day to day life.⁶⁶ This is especially true of water resources, where in 2003, “the Navajo Nation estimated that up to 30% of the population did not have piped water to their homes.”⁶⁷ And even today, the Navajo Nation reports

Gas Industry in Western Canada, 64 ARCHIVES OF ENV'T'L & OCCUPATIONAL HEALTH 29-45 (2009); Cheryl L. Waldner, *Western Canada Study of Animal Health Effects Associated with Exposure to Emissions from Oil and Natural Gas Field Facilities. Study Design and Data Collection I. Herd Performance Records and Management*, 63 ARCHIVES OF ENV'T'L & OCCUPATIONAL HEALTH 167-184 (2008); C.L. Waldner et al., *Associations Between Oil- and Gas-well Sites, Processing Facilities, Flaring, and Beef Cattle Reproduction and Calf Mortality in Western Canada*, 50 PREVENTATIVE VET. MED. 1-17 (2001).

⁶⁶ See, e.g., K. Cozzetto et al., *Chapter: Climate Change Impacts on the Water Resources of American Indians and Alaska Natives in the U.S.*, in CLIMATE CHANGE AND INDIGENOUS PEOPLES IN THE UNITED STATES: IMPACTS, EXPERIENCES AND ACTIONS 569-584, 571 (Julie Koppel Maldonado et al., eds., 2014) (“[American Indians and Alaska Natives] depend more on subsistence livelihoods and have deep spiritual and cultural connections with their waters and lands.”).

⁶⁷ See U.S. Environmental Protection Agency, *Providing Safe Drinking Water in Areas with Abandoned Uranium Mines*, available at <https://www.epa.gov/navajo-nation-uranium-cleanup/safe-drinking-water>.

that this 30% statistic remains true.⁶⁸ So these communities are especially sensitive to water pollution arising from neighboring oil and gas production. Indigenous communities have also been historically displaced by oil and gas production, leading to a loss in access to natural and cultural resources,⁶⁹ which in turn can create physical and mental health stressors for these communities.⁷⁰

D. Fetuses, Children, and the Young Are Also Especially Susceptible

Due to their early stages of development, fetuses, children, and the young can also be especially vulnerable to the harms associated with neighboring oil and gas

⁶⁸ See Bill Donahue, National Public Radio, *What Will It Take to Tackle Water Scarcity on the Navajo Nation?* (Sept. 26, 2024), available at <https://www.nrdc.org/stories/what-will-it-take-tackle-water-scarcity-navajo-nation#:~:text=The%20Navajo%20reservation%20has%20a,draw%20water%20from%20public%20spigots>.

⁶⁹ See, e.g., Jared E. Munster, *Oil, Indifference, and Displacement: An Indigenous Community Submerged and Tribal Relocation in the 21st Century*, 11 AM. INDIAN L.J. 1 (2023).

⁷⁰ See Joseph P. Gone, *Redressing First Nations Historical Trauma: Theorizing Mechanisms for Indigenous Culture as Mental Health Treatment*, 50 TRANSCULTURAL PSYCHIATRY (2013), available at <https://doi.org/10.1177/13634615134876>; Robert Mechior Figueroa, *Chapter 16: Indigenous Peoples and Cultural Losses*, in THE OXFORD HANDBOOK OF CLIMATE CHANGE AND SOCIETY (John S. Dryzek et al., eds., 2011).

production.⁷¹ For example, hydraulic fracturing for natural gas production is associated with the release of heavy metals (arsenic and manganese), particulate matter . . . , benzene, toluene, ethylbenzene, xylenes . . . , polycyclic aromatic

⁷¹ See, e.g., C. Gaughan et al., *Residential Proximity to Unconventional Oil and Gas Development and Birth Defects in Ohio*, 229 ENV'T'L RES. 115937 (2023); M.D. Willis et al., *Congenital Anomalies Associated with Oil and Gas Development and Resource Extraction: A Population-Based Retrospective Cohort Study in Texas*, 33(1) J. EXPOSURE SCI. & ENV'T'L EPIDEMIOLOGY 84–93 (2023); Z.F. Cairncross, et al., *Association Between Residential Proximity to Hydraulic Fracturing Sites and Adverse Birth Outcomes*, JAMA PEDIATRICS (2022), available at <https://doi.org/10.1001/jamapediatrics.2022.0306>; C.J. Clark, *Unconventional Oil and Gas Development Exposure and Risk of Childhood Acute Lymphoblastic Leukemia: A Case–Control Study in Pennsylvania, 2009–2017*, 130(8) ENV'T'L HEALTH PERSPECTIVES 087001 (2022); I.W. Tang et al., *Birth Defects and Unconventional Natural Gas Developments in Texas, 1999–2011*, 194 ENV'T'L RES. 110511 (2021); K.V. Tran et al., *Residential Proximity to Hydraulically Fractured Oil and Gas Wells and Adverse Birth Outcomes in Urban and Rural Communities in California (2006–2015)*, 5(6) ENV'T'L EPIDEMIOLOGY e172 (2021); M.D. Willis et al., *Associations between Residential Proximity to Oil and Gas Drilling and Term Birth Weight and Small for-Gestational-Age Infants in Texas: A Difference-in-Differences Analysis*, 129(7) ENV'T'L HEALTH PERSPECTIVES 77002 (2021); K.V. Tran et al., *Residential Proximity to Oil and Gas Development and Birth Outcomes in California: A Retrospective Cohort Study of 2006–2015 Births*, 128(6) ENV'T'L HEALTH PERSPECTIVES 067001 (2020); L. Cushing et al., *Flaring from Unconventional Oil and Gas Development and Birth Outcomes in the Eagle Ford Shale in South Texas*, 128(7) ENV'T'L HEALTH PERSPECTIVES 077003 (2020); L.M. McKenzie et al., *Congenital Heart Defects and Intensity of Oil and Gas Well Site Activities in Early Pregnancy*, 132 ENV'T INT'L 104949 (2019a); Ellen Webb et al., *Neurodevelopmental and Neurological Effects of Chemicals Associated with Unconventional Oil and Natural Gas Operations and Their Potential Effects on Infants and Children*, 33 REV. ENV'T'L HEALTH 3-29 (2018); Victoria D. Balise et al., *Systematic Review of the Association Between Oil and Natural Gas Extraction Processes and Human Reproduction*, 106 FERTILITY & STERILITY, 795-819 (2016); Ellen Webb et al., *Potential Hazards of Air Pollutant Emissions from Unconventional Oil and Natural Gas Operations on the Respiratory Health of Children and Infants*, 31 REV. ENV'T'L HEALTH 225-243 (2016).

hydrocarbons . . . and endocrine disrupting chemicals.⁷² These chemicals, in turn, have been linked to “significant neurodevelopmental health problems in infants, children and young adults.”⁷³ In a large systemic review of around 70 existing studies, researchers identified neurological and neurodevelopmental effects such as fetal growth problems and neural tube defects that arise from these chemicals.⁷⁴ They also point to how the endocrine disrupting chemicals to which frontline communities are exposed are linked to adverse neural and behavioral problems such as “impaired social interaction/activity, compromised learning and memory, increased anxiety and aggression, modified brain sex differences, altered hippocampal spine density and advanced puberty.”⁷⁵ All in all, the researchers suggest that these effects warrant establishing greater setback distances from unconventional oil and gas development.⁷⁶

Similarly, another systemic review of 45 existing studies found “moderate evidence for increased risk of miscarriage, prostate cancer, birth defects, and decreased semen quality,” as well as “ample evidence for disruption of the estrogen, androgen, and progesterone receptors with individual chemicals and complex

⁷² See Webb et al., *supra* note 70, at 3.

⁷³ See *id.*

⁷⁴ See *id.* at 11.

⁷⁵ See *id.* at 13.

⁷⁶ See *id.* at 20.

mixtures of chemicals and waste products related to oil and gas extraction.”⁷⁷

Finally, proximity to oil and gas development has been found to be associated with increased risk of childhood hematologic cancer.⁷⁸ These significant risks warrant consideration by this Court.

CONCLUSION

Because of the profound public health impacts we have observed that oil and gas production can inflict on frontline communities, amici urge this Court to affirm the decision below.

/s/ Mark Fine

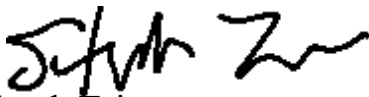
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⁷⁷ See Balise et al., *supra* note 70, at 817.

⁷⁸ L.M. McKenzie, et al., *Childhood Hematologic Cancer and Residential Proximity to Oil and Gas Development*, 12(2) PLOS ONE e0170423 (2017).

CERTIFICATE OF SERVICE

I hereby certify that on this 16th day of December, 2024, a true and correct copy of the foregoing document was e-filed and served through the Court's e-filing system upon counsel of record.

/s/ Mark Fine