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To cite this article: Austin Shaffer, Skylar Zilliox & Jessica Smith (2017) Memoranda of understanding and the social licence to operate in Colorado’s unconventional energy industry: a study of citizen complaints, Journal of Energy & Natural Resources Law, 35:1, 69-85, DOI: [10.1080/02646811.2016.1216696](https://doi.org/10.1080/02646811.2016.1216696)

To link to this article: <https://doi.org/10.1080/02646811.2016.1216696>



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Published online: 12 Sep 2016.



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## Memoranda of understanding and the social licence to operate in Colorado's unconventional energy industry: a study of citizen complaints

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*(Received 11 March 2016; final version received 29 June 2016)*

As growth in unconventional energy production has brought oil and gas development closer to Colorado's Front Range communities, a desire for more local control over that development has resulted in bans and moratoria in a few communities. Memoranda of understanding (MOUs), signed between local governments and industry operators, are emerging as a policy tool to allow development to proceed while addressing the concerns of local communities. This study analyses how MOUs shape public opinion of unconventional energy production by comparing two communities on the northern edge of the Denver metropolitan area: Erie, which instituted one of the state's first MOUs in 2012, and nearby Firestone, which does not have MOUs in place. Analysing complaints made to the Colorado Oil and Gas Conservation Commission suggests that the MOUs narrow the breadth of citizen complaints and increase citizen engagement with state governing bodies. Finally, we find that the most significant predictor of complaint volume is encroachment of drilling activities close to communities.

**Keywords:** unconventional energy; hydraulic fracturing; social licence to operate; memorandum of understanding; citizen complaints

### Introduction

Colorado is at the forefront of policy-making and public debate over the regulation of hydraulic fracturing. In 2011 the state was the first to pass comprehensive rules requiring public disclosure of the chemicals used in the hydraulic fracturing process, and in 2014 the state was the first to regulate methane emissions from oil and gas production.<sup>1</sup> This rule-making emerged as new technologies of directional drilling and hydraulic fracturing brought oil and gas activity closer to rapidly growing suburban communities along the Front Range.<sup>2</sup> While the state has a long history of oil and gas production that stretches back to the early 1900s, the fracking boom of the 2000s brought development closer to communities without previous industry experience. For the Niobrara shale play, production was 83,000 barrels in 2008, 4.1 million in 2012, and, before the slump in oil

1 Tanya Heikkila and others, 'Understanding a Period of Policy Change: The Case of Hydraulic Fracturing Disclosure Policy in Colorado' (2014) 31 Review of Policy Research 65; Sara Rinfret, Jeffrey J Cook and Michelle C Pautz, 'Understanding State Rulemaking Processes: Developing Fracking Rules in Colorado, New York, and Ohio' (2014) 31 Review of Policy Research 88.

2 Charles Davis, 'The Politics of "Fracking": Regulating Natural Gas Drilling Practices in Colorado and Texas' (2012) 29 Review of Policy Research 177.

prices, was estimated to reach as many as 16 million by 2020.<sup>3</sup> The Colorado Oil and Gas Conservation Commission (COGCC) permits thousands of new wells each year, ranging from a low of 1,529 before the unconventional energy boom and a high of 8,027 in 2008, before the financial crisis. From 2012 to 2014 annual permits hovered around 4,000 and dropped to 3,000 in 2015, following a drop in oil prices.<sup>4</sup>

Concerns over the environmental and health effects of oil and gas development prompted some local governments to pass moratoria and bans, which were eventually deemed ‘invalid and unenforceable’ by the Colorado Supreme Court in May 2016.<sup>5</sup> For example, in Erie, a suburban community north of Denver, outcry was heard from the anti-development group Erie Rising as mothers raised concern for fear of polluted air and health hazards for their children attending an elementary school located 1,500 feet from a proposed drilling site. In response, the Erie local government enacted a moratorium in 2012 to suspend further oil and gas development until studies on air quality were conducted and the town could develop a method to work with oil and gas companies. The study found low probable impact on air quality,<sup>6</sup> and the well was eventually drilled and completed with almost non-existent public comment and criticism.<sup>7</sup> One of the lasting legacies of the moratorium was that it allowed for the development of the first memorandum of understanding (MOU) between the town of Erie and the two companies with a strong presence in the area. An MOU directs operators to attach best management practices, negotiated between the town of Erie and industry operators, to drilling permits submitted to the COGCC.<sup>8</sup> The Erie MOUs signed in 2012 and renegotiated in 2015 required best management practices that went above the required state regulations, signalling the importance of garnering the social licence to operate in addition to formal government approval.<sup>9</sup> Once the MOUs were signed, the moratorium was lifted and oil and gas activity resumed.

<sup>3</sup> Joshua Zaffos, ‘Front Range Drilldown’ (2013) 45(15) *High Country News* [www.hcn.org/issues/45.15/front-range-drilldown](http://www.hcn.org/issues/45.15/front-range-drilldown) accessed 30 May 2016.

<sup>4</sup> COGCC, *Oil and Gas Staff Report* (18 April 2016) <http://cogcc.state.co.us/>. The official mission of the COGCC is to foster the ‘responsible development of Colorado’s oil and gas natural resources in a manner consistent with the protection of public health, safety, and welfare, including the environment and wildlife resources’. Some of its key responsibilities include handling the drilling permit process; ensuring industry compliance with state-wide oil and gas statutes and regulations; and managing public complaints against specific wells <http://cogcc.state.co.us/#/home> accessed 27 August 2016.

<sup>5</sup> Joel Minor, ‘Local Government Fracking Regulations: A Colorado Case Study’ (2014) 33 *Stanford Environmental Law Journal* (SELJ) 61; Bruce Finley, ‘Colorado Supreme Court Rules State Law Trumps Local Bans on Fracking’ *Denver Post* (2 May 2016) [www.denverpost.com/2016/05/02/colorado-supreme-court-rules-state-law-trumps-local-bans-on-fracking](http://www.denverpost.com/2016/05/02/colorado-supreme-court-rules-state-law-trumps-local-bans-on-fracking) accessed 27 August 2016.

<sup>6</sup> Cynthia Ellwood, ‘Technical Memorandum: Town of Erie Air Quality Assessment’ (4 May 2012); Colorado Department of Public Health & Environment, ‘Air Emissions Case Study Related to Oil and Gas Development in Erie, Colorado’ (Air Pollution Control Division, Technical Services Program, 5 December 2012).

<sup>7</sup> Though fracking entails numerous impacts on air and water quality, the Erie case illustrates that ‘popular concerns about potential hazards to personal health and safety are often inconsistent with scientific evidence regarding the probability or risk that such hazards will actually happen.’ Ian Thomson, ‘Commentary: Understanding and Managing Public Reaction to “Fracking”’ (2015) *Journal of Energy & Natural Resources Law* 33, 266.

<sup>8</sup> Tayvis Dunnahoe, ‘Colorado Communities Collaborate with Operators’ *Oil & Gas Journal* (13 December 2013) [www.ogj.com/articles/uogr/print/volume-1/issue-4/colorado-communities-collaborate-with-operators.html](http://www.ogj.com/articles/uogr/print/volume-1/issue-4/colorado-communities-collaborate-with-operators.html) accessed 1 May 2016.

<sup>9</sup> Don Smith and Jessica M Richards, ‘Social License to Operate: Hydraulic Fracturing-Related Challenges Facing the Oil & Gas Industry’ (Rocky Mountain Mineral Law Foundation & International

MOUs are becoming an increasingly popular way for Colorado communities to strike a balance between local control over oil and gas activity, the industry's aspiration to work in the area and the state's desire to develop those resources.<sup>10</sup> These MOUs will also be of interest to a wider audience, especially states experiencing conflicts over unconventional energy and other forms of natural resource production, since they offer a third path between banning industry activities and allowing them to proceed with little local input.

Yet very little is known about how these policy tools affect the ways in which communities, companies and local governments understand and interact with each other. We hypothesised that MOUs could be effective in creating more positive working relationships between these stakeholders, since they provide an arena for local citizens to register their concerns and participate in the governance process. This is significant because other social science research in communities with unconventional energy production demonstrates a correlation between mistrust of governing bodies and officials' increased perception of risks and problems.<sup>11</sup> Given the challenge of representing local interests in policy processes on hydraulic fracturing that privilege state agencies and actors,<sup>12</sup> MOUs provide a potentially novel mechanism for integrating local concerns into the regulation and management of industry activity.

In this article, we analyse the effects of MOUs by comparing relationships among citizens, government bodies and companies in two communities: Erie, which has used MOUs since 2012, and nearby Firestone, which has a similar demographic profile and drilling activity but no MOU structure. To focus on the effects of MOUs, we analyse and compare complaints filed against wells in both Erie and Firestone to the COGCC, the state body charged with regulating those complaints. We begin by situating our study in relation to literature on the 'social licence to operate' in the extractive industries, with particular attention to the role of grievance mechanisms. We then offer an overview of the Erie and Firestone communities, outline our methodology and then share the results of our study. Our study suggests that MOUs both increase and narrow the content of citizen complaints.

Legal scholars and lawyers, especially those with some kind of involvement in the unconventional energy industry, will find this article useful on a few counts. First, the

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Bar Association Special Institute on International Mining and Oil & Gas Law, Development, and Investment, Cartagena, Colombia, 21 April 2015).

<sup>10</sup> MOUs were also developed with other Colorado counties and towns in order to formalise their relationships with companies. These counties include: Adams, Gunnison, Arapahoe and Elbert. Other towns include Greeley and Timnath.

<sup>11</sup> Kathryn Brasier and others, 'Risk Perceptions of Natural Gas Development in the Marcellus Shale' (2013) 15 *Environmental Practice* 108; Kyle J Ferrar and others, 'Assessment and Longitudinal Analysis of Health Impacts and Stressors Perceived to Result from Unconventional Shale Gas Development in the Marcellus Shale Region' (2013) 19 *International Journal of Occupational and Environmental Health* 104; Bernard Goldstein, Elizabeth Ferrell Bjerke and Jill Kriesky, 'Challenges of Unconventional Shale Gas Development: So What's the Rush' (2013) 27 *Notre Dame Journal of Law, Ethics & Public Policy* 149; Jeffrey B Jacquet, 'Review of Risks to Communities from Shale Energy Development' (2014) 48 *Environmental Science & Technology* 8321; William R Freudenburg and Robert Emmett Jones, 'Criminal Behavior and Rapid Community Growth: Examining the Evidence 1' (1991) 56 *Rural Sociology* 619.

<sup>12</sup> Minor (n 5) at 61; Barry G Rabe and Christopher Borick, 'Conventional Politics for Unconventional Drilling? Lessons from Pennsylvania's Early Move into Fracking Policy Development' (2013) 30 *Review of Policy Research* 321; Barbara Warner and Jennifer Shapiro, 'Fractured, Fragmented Federalism: A Study in Fracking Regulatory Policy' (2013) 43 *Publius: The Journal of Federalism* 474.

article shines a light on MOUs as an increasingly prevalent part of the policy terrain surrounding disputes between local and state government bodies over the regulation and management of a controversial industry. MOUs serve a policy purpose in setting expectations for industry activity, even if the question of the legal enforcement of MOUs is an open one.<sup>13</sup> On the heels of the May 2016 Colorado Supreme Court ruling against local bans and moratoria, their presence may continue to grow as a method of providing some degree of local control over oil and gas development. Second, the article demonstrates a few of the unanticipated effects of legal instruments such as MOUs. While the MOUs were ostensibly designed to set best practices for unconventional energy development, they also had the effect of shaping public opinion and perception of the key issues surrounding that development.

### Fracking, MOUs and community acceptance

The unconventional energy boom has been driven by technological advances in the twinned processes of horizontal drilling and hydraulic fracturing. Hydraulic fracturing technically refers to the stimulation process used by oil and gas companies to obtain increased amounts of hydrocarbons from conventional sand reservoirs and to allow development in unconventional shale reservoirs. This process injects large quantities of water and sand with trace amount of chemicals into the reservoir rock below the ground in order to create thin productive fractures that release the hydrocarbons contained within the target rocks.<sup>14</sup> This process has become very controversial due to the scarcity of water in the region and the potential for chemicals to pollute groundwater sources.<sup>15</sup> Whereas engineers and company representatives restrict the use of the term ‘hydraulic fracturing’ to refer to the stimulation process just described, critics use the term ‘fracking’ to criticise this form of oil and gas development as a whole.<sup>16</sup>

<sup>13</sup> The extent to which the COGCC enforces the best management practices dictated by the MOU is unclear, and interviews with COGCC officials revealed that they treat the ‘attached’ MOU document as recommendations for industry practice rather than as inflexible requirements. For a critique of the COGCC’s power in relation to industry see Jeffrey J Cook, ‘Who’s Pulling the Fracking Strings? Power, Collaboration and Colorado Fracking Policy’ (2015) 25 *Environmental Policy and Governance* 373.

<sup>14</sup> Blaine Edwards and others, ‘Hydraulic Fracturing: Protecting against Legal and Regulatory Risk’ *Oil & Gas Journal* (1 August 2011) [www.ogj.com/articles/print/volume-109/issue-31/general-interest/hydraulic-fracturing-protecting-against.html](http://www.ogj.com/articles/print/volume-109/issue-31/general-interest/hydraulic-fracturing-protecting-against.html) accessed 1 May 2016; J Quinn Norris and others, ‘Fracking in Tight Shales: What Is It, What Does It Accomplish, and What Are Its Consequences?’ (2016) 44 *Annual Review of Earth and Planetary Sciences* 321.

<sup>15</sup> Paula Ditrack, ‘Drought Raising Water Costs, Scarcity Concerns for Shale Play’ *Oil & Gas Journal* (30 July 2012) [www.ogj.com/articles/print/vol-110/issue-7d/general-interest/drought-raising-water-costs.html](http://www.ogj.com/articles/print/vol-110/issue-7d/general-interest/drought-raising-water-costs.html) accessed 1 May 2016. See also Paul C Stern, Thomas Webler and Mitchell J Small, ‘Special Issue: Understanding the Risks of Unconventional Shale Gas Development’ (2014) 48 *Environmental Science & Technology* 8287.

<sup>16</sup> The harsh ‘k’ sound in fracking provides anti-development activists with clever puns on the English expletive – such as ‘no fracking way’, ‘frack off’ and ‘keep the frack out of my water’ – and comparisons between oil and gas development and gendered violence and rape. Indeed, the environmentalist Bill McKibben designated ‘fracking’ as the ‘ugliest word in the English language’. See Stefanie Brook Trout, Taylor Brorby and Pam Houston, *Fracture: Essay Poems, and Stories on Fracking in America* (1st edn, Ice Cube Press 2016); Bill McKibben, ‘The Ugliest Word in the English Language’ (*Sojourners Online*, 20 June 2011) <http://sojo.net/blogs/2011/06/20/ugliest-word-english-language-fracking> accessed 29 April 2016. See also Darrick Evensen and others, ‘What’s the “Fracking” Problem? One Word Can’t Say It All’ (2014) 1 *The Extractive Industries and Society* 130; Ion Bogdan Vasi and

The desire to better understand perceptions of this new form of oil and gas activity has inspired social science research in the affected communities, which is informed by, but distinct from, the analysis of more general national-level opinion polls. One key finding across them is that while a sizeable portion are undecided, among those who do hold an opinion, opposition to fracking is strongest among urban residents, women, and people with higher education who are politically liberal, with support for current or increased levels of regulation being correlated with pro-environmental policy attitudes and Democratic Party affiliation.<sup>17</sup> This research, however, does not provide nuanced data on the perception of people in communities that are directly affected by unconventional energy production, and whether specific experiences or relationships with companies and development shape opinions.

The majority of the on-the-ground social science research is based in communities in the Marcellus play, with a focus on Ohio and Pennsylvania, and the Barnett play in Texas. Results from this research are mixed. The primary perceived benefits of oil and gas activity are economic, especially in the form of increased local tax revenues.<sup>18</sup> Yet residents also worry about increasing gaps between landowners who stand to become wealthy from this development and the rest of the community, who would also bear many of the negative social and environmental impacts. Indeed, local opposition to fracking in northern Pennsylvania is strongly associated with those who do not directly benefit economically from it.<sup>19</sup>

These same studies reveal that the key concerns of community members focus on the potential social and environmental risks of increased oil and gas activity. These include degradation of or stress on water resources; road damage and increased truck traffic; threats to health; and changes in quality of life, including the influx of large numbers of new residents and workers associated with boomtowns. Environmental psychologists and rural sociologists in particular argue that disruption – and *perceived* disruption – to place-based identities spur oppositional behaviour.<sup>20</sup> This holds the most true for smaller rural communities that do not have experiences with extractive industries.<sup>21</sup> Ethnographic research bears out this finding. Anna Willow finds that people who live close to drilling sites in Ohio, for example, suffer a decrease in what she calls ‘socio-natural wellbeing’, or the ‘subjective well-being constituted in relationship to local

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others, “‘No Fracking Way!’” Documentary Film, Discursive Opportunity, and Local Opposition against Hydraulic Fracturing in the United States, 2010 to 2013’ (2015) 80 *American Sociological Review* 934.

<sup>17</sup> Hilary Boudet and others, “‘Fracking’ Controversy and Communication: Using National Survey Data to Understand Public Perceptions of Hydraulic Fracturing’ (2014) 65 *Energy Policy* 57; C Clarke, H Boudet and D Bugden, *‘Fracking’ in the American Mind: American’s Views on Hydraulic Fracturing in September 2012* (George Mason University, Center for Climate Change Communication 2013); Charles Davis and Jonathan M Fisk, ‘Energy Abundance or Environmental Worries? Analyzing Public Support for Fracking in the United States’ (2014) 31 *Review of Policy Research* 1.

<sup>18</sup> Brooklynn Anderson and Gene L Theodori, ‘Local Leaders’ Perceptions of Energy Development in the Barnett Shale’ (2009) 24 *Southern Rural Sociology* 113; Brasier and others (n 11). For Louisiana see Anthony E Ladd, ‘Stakeholder Perceptions of Socioenvironmental Impacts from Unconventional Natural Gas Development and Hydraulic Fracturing in the Haynesville Shale’ (2013) 28 *Journal of Rural Social Sciences* 56.

<sup>19</sup> Jeffrey B Jacquet, ‘Landowner Attitudes toward Natural Gas and Wind Farm Development in Northern Pennsylvania’ (2012) 50 *Energy Policy* 677.

<sup>20</sup> Jeffrey B Jacquet and Richard C Stedman, ‘The Risk of Social-Psychological Disruption as an Impact of Energy Development and Environmental Change’ (2014) 57 *Journal of Environmental Planning and Management* 1285.

<sup>21</sup> Brasier and others (n 11).



environments'.<sup>22</sup> Locals find themselves living in landscapes that are suddenly unpredictable, filled with disruptive industrial noise, infrastructure and activity, and subject to contamination from undisclosed chemicals used in the fracking process. She argues that these citizens experience a lack of control over their lives and the environment in which they live as they encounter political systems and processes, such as the restricted role for public input in the permitting process, that privilege industry.<sup>23</sup>

Surprisingly, no clear relationship has been found between proximity of residences to gas wells and opinion about industry.<sup>24</sup> Instead, community experience was more significant in both the Marcellus and Barnett plays. In the Marcellus, communities with historical experience of the extractive industry report fewer types of impact than did those without that experience.<sup>25</sup> Yet the region's history of coal extraction also prompted widespread concerns that 'the gas industry would not develop the Marcellus responsibly, but would instead extract the resource for profit and leave behind serious environmental problems for future generations to address'.<sup>26</sup> In a Texas county that had already experienced large-scale development, residents argued that the costs outweighed the benefits, whereas residents of a nearby county in which development was just beginning believed that benefits would outweigh the costs. Yet even those in the more sceptical Texas county took a pragmatic attitude, arguing that local resources are finite and that imperfect decisions had to be made about their use, as expressed by one resident who said, 'We need energy, but we need water, too. If you had to choose, would you rather be cold or thirsty?'.<sup>27</sup>

The social science literature on perceptions of unconventional energy production has very little to say about how specific policy initiatives influence public opinion. As mentioned above, it does show that distrust of governing bodies and officials is likely to increase perception of risks and problems.<sup>28</sup> Our research therefore advances the social science literature on perceptions of unconventional energy production by determining the extent to which those perceptions are influenced by specific governance tools. Given that MOUs ostensibly increase public participation in the governance process, as well as the transparency of its officials and governing bodies, there is a possibility that they also foster more positive views of industry.

This hypothesis is also supported by experiences in international mining, though the material differences between the industries and their interface with local communities should caution against simplistic comparisons. Research finds, for example, that effective grievance mechanisms are one way to advance interactional and procedural justice, creating positive change for relationships between mines and communities.<sup>29</sup> While the

22 Anna J Willow, 'Wells and Well-Being: Neoliberalism and Holistic Sustainability in the Shale Energy Debate' *Local Environment* (2 March 2015) 4.

23 Anna J Willow and others, 'The Contested Landscape of Unconventional Energy Development: A Report from Ohio's Shale Gas Country' (2014) 4 *Journal of Environmental Studies and Sciences* 56; Anna J Willow, 'The New Politics of Environmental Degradation: Un/expected Landscapes of Disempowerment and Vulnerability' (2014) 21 *Journal of Political Ecology* 237.

24 Boudet and others (n 17).

25 Brasier and others (n 11).

26 *Ibid*, 54.

27 Anderson and Theodori (n 18) 124.

28 Brasier and others (n 11); Ferrar and others (n 11); Goldstein and others (n 11), 149; Jacquet (n 11).

29 Rachel Davis and Daniel M Franks, *Costs of Company-Community Conflict in the Extractive Sector* (Corporate Social Responsibility Initiative Report, John F. Kennedy School of Government, Harvard

COGCC complaint system is akin to a grievance mechanism, it is distinct in that it is administered by a state agency, rather than the company in charge of development. Another comparison with mining is that the MOU shares many features of the increasingly prominent environmental agreements, which are signed between companies and the communities closest to production sites as an attempt to bring environmental performance within community expectations.<sup>30</sup> Again, these are different from the Erie MOU in that they are usually signed between companies and indigenous communities rather than suburban municipalities. Our research will also therefore shed light on how community engagement tools normally associated with mining function in both a distinct industry (unconventional energy production) and a distinct local context (US suburbs rather than indigenous communities).

### **Location: profile of two towns**

Studying the effect of MOUs in Erie presented multiple challenges. We could not simply compare citizen concerns and complaint activity before and after the MOUs were instituted because drilling activity was not constant before and after the MOUs were in place. Instead, we compared Erie with Firestone, a nearby community that shares similar industry activity and demographic characteristics but does not have an MOU in place. This method allows for a somewhat natural experiment, controlling for regional effects in understanding the impact of MOUs (Figure 1).

As explained in greater detail below, Erie and Firestone are both characterised by similar levels of drilling and production activity. Both are suburban communities located 35 miles north of Denver along the population-dense Interstate 25 corridor. Approximately ten miles separate these towns. Erie has a population of 18,145 and a population density of 1055.6 people per square mile, whereas Firestone has a population of 10,147 and a population density of 978.5 people per square mile.

The majority of people in both communities work in Denver but live in the suburbs, which offer more ‘family-friendly’ affordable large homes, a perception of small town safety, and strong public services such as schools. They are both relatively privileged communities. The median annual income of Erie and Firestone is \$107,000 and \$87,000, respectively. Education rates are also high, with over 90 per cent of adults in both communities holding high school diplomas, though around half hold bachelor’s degrees in Erie and only a third do in Firestone. Both communities, in line with the rest of Colorado, are racially homogeneous, with about 90 per cent of people identifying as white. The two towns also share similar age distributions and are dominated by young families, who have led the substantial population growth there. Residential

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University, Cambridge, MA 2014) [www.hks.harvard.edu/m-rcbg/CSRI/research/Costs%20of%20Conflict\\_Davis%20%20Franks.pdf](http://www.hks.harvard.edu/m-rcbg/CSRI/research/Costs%20of%20Conflict_Davis%20%20Franks.pdf); Deanna Kemp and others, ‘Mining, Water and Human Rights: Making the Connection’ (2010) 18 *Journal of Cleaner Production* 1553; John R Owen and Deanna Kemp, ‘Social Licence and Mining: A Critical Perspective’ (2013) 38 *Resources Policy* 29.

<sup>30</sup> Bram Noble and Jasmine Birk, ‘Comfort Monitoring? Environmental Assessment Follow-up under Community–Industry Negotiated Environmental Agreements’ (2011) 31 *Environmental Impact Assessment Review* 17; Ciaran O’Faircheallaigh, ‘Community Development Agreements in the Mining Industry: An Emerging Global Phenomenon’ (2013) 44 *Community Development* 222; Jessica Smith Rolston, ‘Turning Protesters into Monitors: Appraising Critical Collaboration in the Mining Industry’ (2015) 28 *Society and Natural Resources* 165.



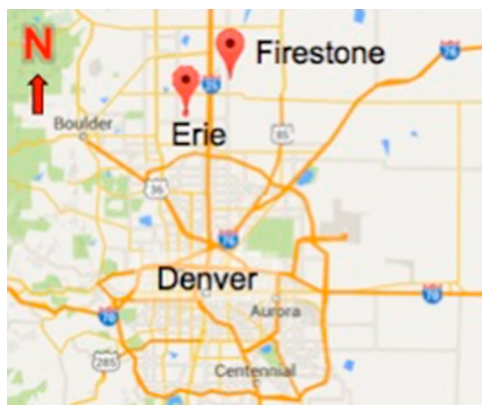


Figure 1. Colorado map of target areas.

developments in Erie, for example, were specifically designed to attract young families, with neighbourhoods characterised by wide streets with broad shoulders where kids can play and ride bikes. Firestone has a more noticeable agricultural presence.

The residential developments that attracted the young families leading the population boom are located adjacent to and sometimes directly over previously drilled oil and gas fields. Historically, both communities have been deeply involved with oil and gas for more than 40 years with the Spindle and Wattenberg oil and gas fields.<sup>31</sup> This was unknown, especially to new residents, until 2009, when directional drilling and hydraulic fracturing made the reserves attractive for development once again, but this time with multi-well pads.<sup>32</sup>

This increase in drilling activity generated community concerns in both Firestone and Erie, but only in Erie did citizens establish formal organisations.<sup>33</sup> The outcry in Erie centred around two wells: the Canyon Creek well, permitted and drilled from 2011 to 2012, and the Pratt well, permitted and drilled in 2014. Both wells pads were sited in sensitive areas, with the Canyon Creek well approximately 1,500 feet from two elementary schools, and the Pratt well approximately 800 feet from houses in the Vista Ridge neighbourhood. During the Canyon Creek well development, opponents expressed many environmental worries and fears that the well would create unsafe conditions for children. Community members banded together to form Erie Rising, a ‘grassroots, mom-powered organization’ dedicated to expressing concerns about the impacts of hydraulic fracturing on children’s health.<sup>34</sup> During the

<sup>31</sup> Debra K Higley and Dave O Cox, ‘Oil and Gas Exploration and Development along the Front Range in the Denver Basin of Colorado, Nebraska, and Wyoming’ in *Petroleum Systems and Assessment of Undiscovered Oil and Gas in the Denver Basin Province, Colorado, Kansas, Nebraska, South Dakota, and Wyoming – USGS Province 39* (US Geologic Survey Digital Data Series DDS-69-P, 2007) <https://pubs.usgs.gov/dds/dds-069/dds-069-p/chapters.html>.

<sup>32</sup> Multiple horizontal wells pads were made a visible distinction on the COGCC interactive map from 2009 to current. COGCC, Oil and Gas Interactive Map (2016) [cogcc.state.co.us/maps.html#/gisonline](http://cogcc.state.co.us/maps.html#/gisonline).

<sup>33</sup> A more complete history of oil and gas development in Erie, including the two wells analysed here, can be found in Skylar Zilliox, ‘Regulating Relationships: Memorandums of Understanding and Unconventional Energy Development in Suburban Colorado’ (MS thesis, Colorado School of Mines 2016).

<sup>34</sup> Erie Rising, ‘About [Erie Rising]’ <https://erierising.wordpress.com/about-2> accessed 1 May 2016.

construction of the Canyon Creek well, Erie residents filed a higher number of complaints with the COGCC than in the previous three years combined.

After the Canyon Creek well, public controversy was dormant until the Pratt well began construction and drilling in late 2014. Drilling at the Pratt site began shortly before Thanksgiving, and ended two days after Christmas, making the residents in Vista Ridge even more sensitive to impacts from drilling activity. Unfortunately, the Pratt well experienced several significant problems. Issues with the site began early in October 2014, with the unearthing of a landfill that contained hazardous waste during construction of the well pad. The operator failed to properly cover the excavation site, which led to garbage blowing around the nearby neighbourhoods. Next, unexpected flaring – with no adequate communication with neighbours living adjacent to the well – created fears in the surrounding community. Lastly, during drilling, sound and vibration levels that significantly exceeded state noise regulations disrupted daily life and prevented nearby residents from sleeping and working. These noise issues, which the operator attempted to address with multiple noise mitigation strategies, went unresolved and ultimately led to the COGCC requiring the operator to cease well construction. Nearby residents filed a very large volume of complaints with the COGCC during the 2014 holiday season, most of which focused on the persistent noise issues. In addition to filing complaints to the COGCC, the Pratt site became a critical topic of debate during official public meetings of the Erie Board of Trustees.<sup>35</sup>

### **Methods: well comparison**

Our study involved multiple methods, including well mapping, analysis of complaints to the COGCC, and interviews with people directly affected by oil and gas development such as the local homeowners, local governmental officials and company personnel.

The COGCC database is a state-run database containing information on complaints, spills and locational information on oil and gas wells. This database is publicly available and serves as a gateway for citizens to file complaints and research well information within the state. Using the COGCC complaints and spills database requires inputs such as the location or the name of a specific well. The database's most significant information includes locations, well name, American Petroleum Institute (API) number, production history, company owner and date of well completions, all in a downloadable Excel document format. The COGCC database also contains an interactive map indicating the locations of wells in Colorado. In our study, these well location files were downloaded into ArcGIS to display well locations, which allowed for greater flexibility in visualising the wells in Colorado.<sup>36</sup> ArcGIS also allowed us to filter out the well location data by vertical, slant and horizontal wells. The angle of the well is very important since virtually all wells drilled in this area have been drilled horizontally since 2009. It was also important to distinguish between these types of wells and the timeframe in which they were drilled because horizontal wells are those that are

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<sup>35</sup> The first MOU was scheduled to expire in August 2015. Erie's Board of Trustees had begun renegotiations in Fall 2014 to create a new agreement, and the Pratt well became a major talking point in Town Hall meetings.

<sup>36</sup> ArcGIS is geographic mapping software commonly used to show locations of geologic relevance, surface boundaries, and wellbore trajectories.

hydraulically fractured, the focus of our work and the primary source of debate in Colorado and elsewhere. Using horizontal wells as a key indicator therefore helped visualise and sort which areas are currently being affected by oil and gas activity, and filter out old wells.

To determine the dates of oil and gas activity, proximity of oil and gas activity to Erie and Firestone and complaint volumes for wells within these towns, we used the COGCC database. To see the location of wells to nearby communities, we used ArcGIS. First, we found wells within the 36-square-mile sections of Firestone and Erie. Erie was in the centre of one section and Firestone was sprawled over the edge of two sections.<sup>37</sup> Therefore, we analysed two sections for Firestone and one section for Erie. We then took the API numbers from the vertical, slant and horizontal wells in these sections. Checking these API numbers in the COGCC well database confirmed that vertical wells have not been drilled since the early 2000s, slant wells have been less prominent since 2006, and horizontal wells have been the main method of drilling since 2009. The compilation of this data provided an overall timeline of relevant drilling activity from 2010 to 2014.

With the timeframe determined, we quantified the volume of outcry from the public by analysing the number and content of the complaints filed in relation to wells within the 36-square-mile sections of Erie and Firestone on the COGCC database. This form of communication empowers the general community to raise issues with oil and gas activity, as the complaint becomes a part of the public record and the COGCC must respond to each one, describing how the issues were addressed.<sup>38</sup> The general community, including the person registering the complaint, can then track these complaints and responses. While this method reveals a great deal about the residents who use this system, it does not account for the complete number of grievances in the area due to: members of the community not wishing to speak up about the issues publicly, members not trusting the COGCC to act on their behalf, or members' lack of knowledge that this method exists. Crucially, people who directly contact the companies involved, thus bypassing the COGCC altogether, are missed by this method completely.

Complaints are filed separately, meaning that the same person can file multiple complaints on the same case with another complaint tag appearing in the database, as opposed to continuing the old complaint file. This leads to some reappearing (instead of reoccurring) complaints that could be misleading in determining the accurate volume of distinct complaint entries. Therefore, reappearing complaints were filtered out of our analysis. Complaints were then sorted by categories such as noise, water, air, property, etc, as described below.

## Results

### *Complaint volume*

The total number of complaints over the 2010–14 timeframe in Firestone and Erie were 33 and 59, respectively. Erie clearly has more complaints, yet it is important to analyse the content of those complaints and their clustering. Forty-seven of those 59 were filed

<sup>37</sup> These sections can be found in the database under 68W, 1N and 67-68W, 2N, respectively.

<sup>38</sup> COGCC, 'COGCC Public Complaint Process' (2016) <http://cogcc.state.co.us/documents/complaints/Complaint%20Fact%20Sheet.pdf>.

Table 1. Complaints by year.

Township	Firestone	Erie
2010	5	0
2011	4	1
2012	12	8
2013	5	2
2014	7	48
Total	33	59

in December 2014 during the Pratt incident and eight of those remaining 12 were filed during the Canyon Creek development. The remaining ‘complaints’ all questioned issues unrelated to oil and gas problems, such as whether a well was still producing on their respective land. This indicates that, if community members in Erie had grievances about oil and gas activity, they did not regularly use the COGCC database to express these concerns until there was widespread public outcry over the specific controversial wells. In Firestone, in contrast, complaints were registered throughout the entire timeframe, and those that were registered directly addressed problems corresponding to well sites and oil and gas activity (Table 1).

Organising the complaints by year allows for an analysis of changes that might have occurred in Erie in relation to the signing of the MOU in 2012. It also shows regional changes not specific to either town. For example, complaints increased in 2012 in both Erie and Firestone, along with increase in drilling activity (see Figure 5 below).

### *Complaint content*

We then separated these complaints into different categories to gain insight into what issues they covered, which suggests which issues were important for the public to register in this way, and to investigate whether those issues varied from the MOU town to the MOU-less town. The complaint categories were generated as each different issue appeared. If that same issue reoccurred in a later complaint, it was placed in that category. For example, one individual reported, ‘noise issues being intolerable’, so the noise category was made. No complaint was filed under multiple categories due to each complaint being very specific about a single issue. The following figure shows a typical complaint (with identifying information removed) (Figures 2).

We also analysed the complaints based on the level of familiarity with oil and gas regulations that were evident in how community members described the issue. In Erie, complaints vary from the relatively dispassionate and knowledgeable comment that, ‘C levels are out of compliance’, to more general and incendiary ones such as a noise sounds like ‘a jet engine roaring’ or ‘makes your teeth vibrate’. Both of these complaints were categorised under noise. The other complaint types included the following: air quality, water quality, soil sampling, land and property damages, land reclamation, well pad grading, aesthetics and unrelated to oil and gas.<sup>39</sup>

<sup>39</sup> Examples of filed complaints that are unrelated to oil and gas include one in which the COGCC was called for potential flaring that turned out to be a burning tyre and weeds growing on a drilling pad; and one in which an abandoned well that was complained about actually turned out to be a pig pen.

**COGIS - Complaint Reports**

Form  [Related](#) [Doc](#)

Date Rec'd: 6/13/2014 Complaint taken by:

DocNum:  API number: 05-123-38451

Complaint Type:

**Complainant Information**

Name:

Address:

Date Received: 6/13/2014

Connection to Incident: Resident

**Description of Complaint:**

Operator:

Oper. No.

Date of Incident: 6/13/2014

Type of Facility: WELL

Well Name/No.

County Name: WELD **COGCC office received a noise complaint**

Operator contact:

qtrqr: SWNW section: 5 township: 2N range: 68W meridian: 1

**Complaint Issue**

Issue: NOISE Assigned To: Jason Gomez Status: In Process

Description: On 6-13-2014, the **COGCC office received a noise complaint** from Jenn Medoff at 11690 Montgomery Circle Longmont CO. The complainant indicated she could here noise coming from a well location with a flare which is located to the west of her home. The complainant was also worried about the flame burning on location which she believed to be causing the noise.

Figure 2. Example complaint from COGCC database.

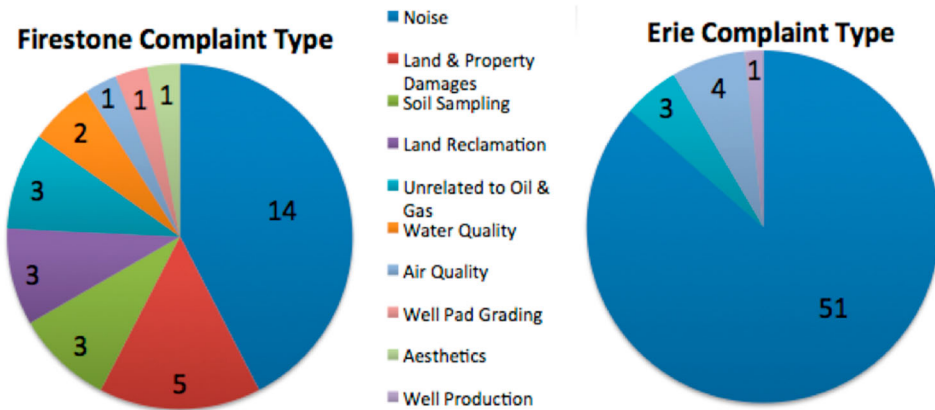


Figure 3. Types of complaints in Erie and Firestone.

By replicating this analysis with Firestone, we were able to compare how knowledgeable this community was about oil and gas (Figure 3). Echoing the examples from Erie given above, Firestone was similar with some complaints being general, such as in the case of a ‘squealing noise’ from a ‘frac’ whereas others say the noises were above ‘C Scale noise’ when fracturing is occurring. Other variations in Firestone include a landowner claiming compensation for property damage from the ‘operator [working] outside their agreed upon window identified in surface use agreement’. In

contrast with Erie, the complaints are the most specific when referring to land issues, such as a county park representative, ‘present[ing] evidence showing impact to cropland’. Otherwise the complaints remain very general.

The majority of all who registered complaints, however, seem to have little knowledge of oil and gas practices and just want to be left alone, as evidenced in the following examples:

- ‘Low frequency noise just throbbed in my ears and I was unable to sleep for several hours. The interruption of sleep is miserable and extremely uncomfortable for me and my family.’
- ‘Extremely loud at 5:45 a.m.(12/9) – was awakened by noise. Noise ebbs and flows but when it is loud it is very loud. 12/10 – noticed it was loud when woke up at 6:15 – didn’t awaken, still loud – 6:25 there was big booming – kind of a noise a dump truck in the distance dumping its load would make The drone, the low frequency sometimes wakes her up – can just feel it in your body.’
- ‘WOKE UP AT 0237 TO CONSTANT VIBRATION OF MY CLOCK AND SEVERAL ITEMS ON MY NIGHTSTAND. ONCE I WAS AWAKE I REMOVED THE ITEMS TO THE FLOOR IN HOPES THE RATTLING OF THE ITEMS WOULD ALLOW ME TO RETURN TO SLEEP. AT THIS POINT THE LOW FREQUENCY NOISE JUST THROBBED IN MY EARS AND I WAS UNABLE TO SLEEP FOR SEVERAL HOURS. THE INTERRUPTION OF SLEEP IS MISERABLE AND EXTREMELY UNCOMFORTABLE FOR ME AND MY FAMILY.’ (All caps in the original)

### *Complaints and drilling activity*

By examining these complaints over the five-year time span it is noticeable that Erie types of complaints change from being concerned about air pollution and noise, before the 2012 MOU, to just being concerned with noise after the MOU. These complaints in Erie can be seen over time in [Figure 4](#). This could likely be why the 2012 MOU features language that directly addresses additional air pollution and health issues. Interestingly, Firestone shows variety in what types of complaints occur over the five-year time span but no clear indication of complaints pointing towards one issue. This lack of noticeable change could be caused by the variety of complaints in Firestone when compared to Erie. In Erie, the MOU specifically addressed air pollution and other environmental concerns. This would indicate having an MOU in place directs citizens to complain only about issues not covered by the MOU (in this case, noise), or that the issues of pollution were resolved by the practices required by the MOU.

Next, we wanted to compare this separation of complaints to the drilling activity. Organising the number of complaints by time with drilling activity allowed us to identify any time periods involving any major incidents, periods of stagnation in which company activity caused no distress in the eyes of the public, and general averages in the number of filed complaints per year. [Figures 5](#) and [6](#) show drilling activity, filed complaints and well encroachment by drilling activity.

When factoring in the six-month moratorium on drilling in Erie during 2012, the rate of drilling in the two communities would be very similar. Looking at the Erie dataset by time, there are few complaints except for the Canyon Creek event and an abnormally high peak during the Pratt incident during 2012 and the end of 2014 respectively. This analysis by year shows how especially high complaints can correlate



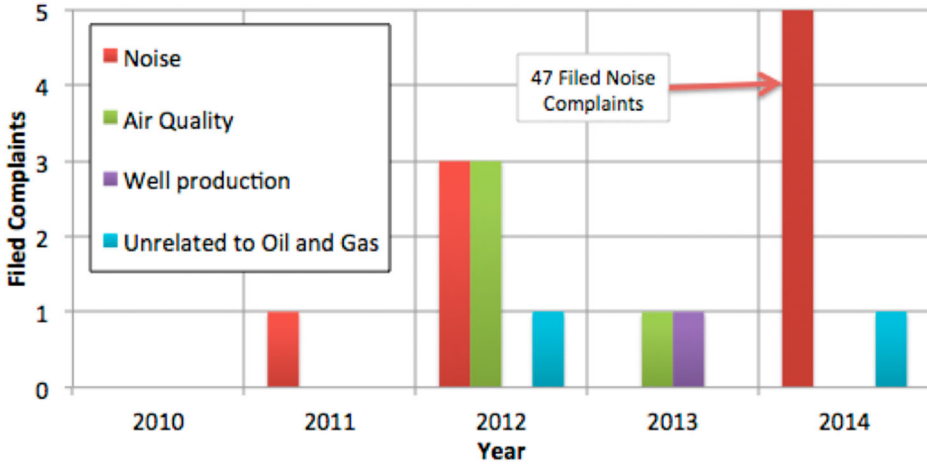


Figure 4. Erie types of complaints 2010–14.

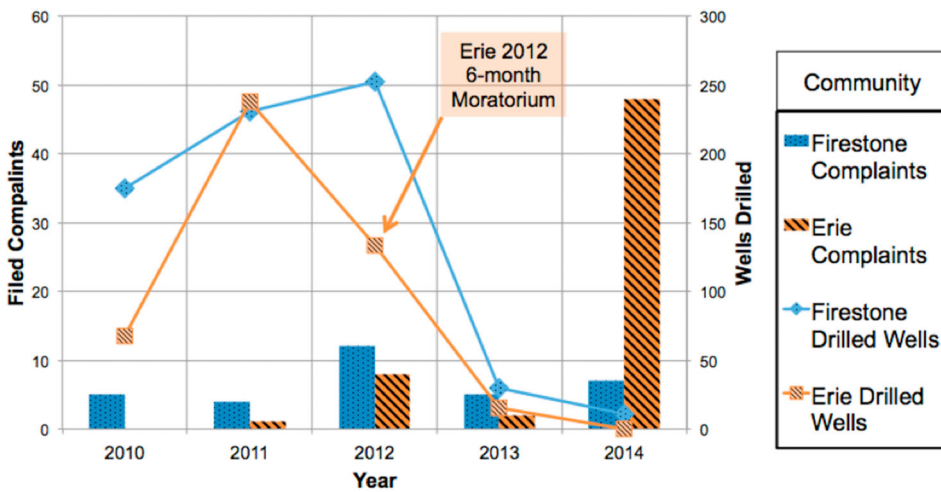


Figure 5. Complaints and drilling activity in communities by year.

with a specific event that reaches the status of being a public controversy reported in local media and discussed in government meetings. It also shows that in comparison with Firestone, Erie had very few complaints with the exceptions of Canyon Creek and the Pratt incident during the five-year time span. Looking at Firestone, the complaint volume peaked in 2012 by double from the general trend. This is likely due to the peak in drilling activity in the same timeframe but also the encroachment of drilling activity into the residential areas of Firestone. Both of these occurrences can be seen in the figures above. During the same year, Erie’s drilling activity decreases while the complaints have a small peak. This drilling activity most likely decreased due to the moratorium set in place by Erie during March to August of 2012, but the peak in complaints is caused by the Canyon Creek well.

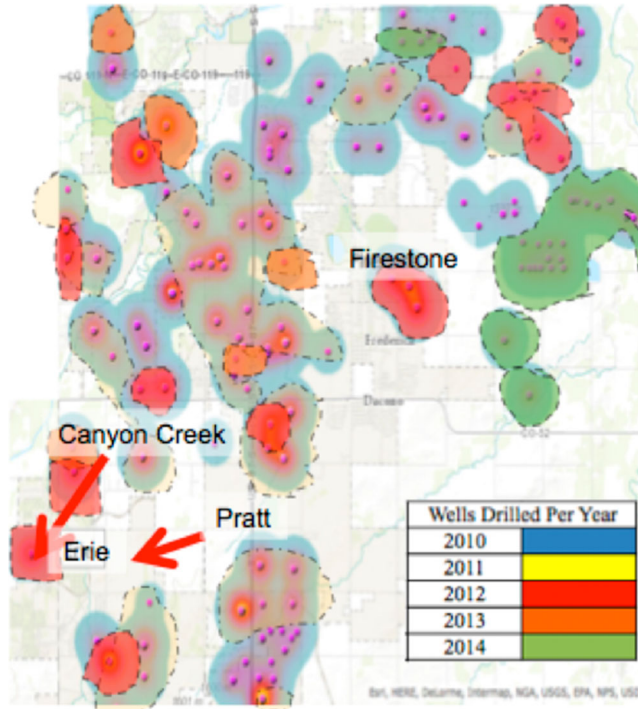


Figure 6. Map of drilling activity 2010–14, courtesy Laura Read.

To determine whether Firestone simply had more complaints on average because there was more drilling activity, we catalogued the number of wells drilled during 2010–14, which would show the total volume of drilling activity the local communities would have had the possibility to witness. The number of wells for each area is shown in Figure 5 with Erie having 684 wells and Firestone having a total of 1,074 wells drilled. Firestone shows more wells than Erie by 10:7 but has almost three times the complaints of Erie, when excluding the Pratt incident.<sup>40</sup>

**Conclusion**

As the combined techniques of horizontal drilling and hydraulic fracturing bring unconventional energy production closer to communities, MOUs present one strategy for managing relationships among companies, communities and local governing bodies. By codifying best practices for managing the social and environmental impacts of oil and gas activity, they offer residents and governing bodies increased assurance that these impacts will be mitigated according to their expectations. Moreover, they offer companies increased clarity on exactly what community expectations are, as well as increased certainty in the permitting process. MOUs can help address a problematic

<sup>40</sup> The Pratt site was not included in this analysis because it shows an exceptionally unusually high number of complaints for a single drilling site.

‘expectation gap’<sup>41</sup> between what communities desire from extractive industries and what companies are prepared to offer. This policy tool may become increasingly prevalent if local bans and moratoria are taken off the table as a strategy to achieve a measure of local control over oil and gas development.

MOUs also shape citizen participation in the governance of oil and gas activity. In our case, the presence of an MOU had multiple impacts on citizen use of the state-run COGCC database. First, the types of complaints are more focused in the town with the MOU. We observe that after the first MOU was put into place, Erie’s complaints change from being dominated by air pollution (the primary concern of citizens that was incorporated into the MOU) to being almost entirely focused on sound complaints. Firestone, in contrast, has a larger variety of complaints that range from noise, land or pollution issues. There are multiple possible causes of this narrowing. For example, the MOU may actually improve environmental performance, meaning that citizens have a smaller range of concerns or the MOU may create the perception that environmental performance meets their standards and therefore does not merit complaint, even if there are no actual differences in environmental performance.

Second, citizens in the town with the MOU relied heavily on the state system to file complaints when a drilling pad was out of state regulation. This is most visible during the Pratt incident, in which 47 complaints were filed over the course of a month in a very centralised location of the community. Again, there are multiple potential causes of this behaviour. The MOUs may encourage citizens to use the official state complaint system because they have increased knowledge of or trust in government mechanisms and processes. It is also highly likely that the demographic characteristics of Erie, as a relatively white and affluent suburb, make the MOU attractive and viable: the people who stand to bear the greatest burdens of oil and gas activity are also those whose interests are well represented in the local government. Rather than being alienated from formal government bodies and mechanisms, as is common in cases of environmental agreements between industry and indigenous and other poor communities, residents of Erie take an active role in and express appreciation for their local government. MOUs involving government bodies in communities characterised by significant internal divisions or disempowered residents would likely be less effective.

Third, drilling encroachment is the strongest factor leading to complaints being filed and helps explain the content of those complaints. Proximity of wells to residential locations is a greater predictor of complaint volume than is the rate of drilling activity. This correlation also sheds light on the content of complaints, which overwhelmingly focused on noise, a very localised rather than general complaint. These complaints were present even among citizens who demonstrated knowledge of the particular regulations and activities associated with drilling and completing wells, suggesting that education about the technical dimensions of this form of energy production is not enough to sway public perception. It also suggests that suburbanites have distinct concerns about oil and gas activity. Whereas more rural populations have strongly opposed unconventional energy on the grounds that it changes people’s relationship with the land, as Willow describes in Ohio, residents of Erie and Firestone simply wanted to be able to coexist with industrial activity without it interrupting the routines of their everyday

<sup>41</sup> Owen and Kemp (n 29).

life, such as sleeping and eating without disruptive noises.<sup>42</sup> Lastly, we note that the complaints are highly localised and clustered around particular wells and neighbourhoods, meaning that the formal complaint mechanism is not utilised as a referendum to critique the environmental and social implications of oil and gas development in general.

In their ideal form, MOUs give an opportunity for companies, local governments and communities to communicate and attempt to reconcile their expectations of oil and gas development. They generate a learning process in which people can come to understand major features of the oil and gas industry, while the oil and gas industry has a mechanism to listen to the communities closest to their operations. This link of communication between these actors and the local government allows for oil and gas operations to run more smoothly, with complaints being pointed toward issues that are not already being addressed by oil and gas companies.

### **Acknowledgements**

The authors acknowledge colleagues from WE<sup>2</sup>ST for their support and guidance throughout this study. Findings, opinions and conclusions in this work are those of the authors and are not a statement or representation of the views, policies or opinions of ConocoPhillips or its employees or representatives.

### **Funding**

This work was supported by ConocoPhillips through the ConocoPhillips Center for a Sustainable WE<sup>2</sup>ST at the Colorado School of Mines. The ConocoPhillips Center was established to promote the joint sustainability of unconventional energy development and water resources in arid regions.

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<sup>42</sup> Willow (nn 22, 23).