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Crude justice: Community-based research amid oil development in South Los Angeles

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The public health consequences and environmental injustices stemming from oil development in densely populated urban environments are of increasing concern to residents surrounding oil and gas development facilities. The Los Angeles Basin contains one of the highest concentrations of crude oil in the world, with over 5,000 active oil wells in Los Angeles County. Oil was struck in the Los Angeles Basin in the 1890s and reached its production peak in the 1930s, making up nearly half of California's oil production at the time and nearly one quarter of the world's oil output. Oil development shaped, and oftentimes dominated, Los Angeles's development as a global city (Pratt et al. 2014). Today, although oil wells are scattered across the city and county, it is poor communities and communities of color that live closer to wells, have outdated emissions equipment, and have the oil fields near to homes uncovered rather than enclosed (Reyes 2016). The legacy of decision making over oil drilling in Los Angeles is that thousands of active wells in the greater Los Angeles area are located among a dense population of more than 10 million people. Seventy percent of active oil wells in the city are located within 1,500 feet (457 meters) of a home or sensitive land use such as a school, playground, or hospital – places where people live, work, and play (Sadd and Shamasunder 2015).

Oil development in Los Angeles grew side by side with urbanization. In some communities, such as the South Los Angeles neighborhood of West Adams, residences were destroyed to make room for oil development operations, and

houses now sit adjacent to the 36-well field site. The city and counties of Los Angeles require no setback distances, allowing houses to sit adjacent to an oil field wall and as close as 60 feet (18 meters) from operating wells.

Oil industry operations in Los Angeles benefited from a history of more than a century of coordination among state and local governments to smooth the way for ongoing oil production, even as the city's population grew and despite periods of public scrutiny or protest (Sabin 2004; Quam-Wickham 2015; Shamasunder 2018). This coordination took place in the years before the passage of major US environmental legislation in the 1970s and continued into the present, as oil field permits were grandfathered[1] in and so avoided new regulatory mandates. As communities have increasingly raised concerns about nearby wells, regulatory agencies and industry have argued there is insufficient data to affirm the merits of their concern and compel regulatory agencies, the state, and corporations to respond. As connected to the larger post-truth stories presented in this volume, strong scientific evidence on an issue (such as climate change) (Oreskes and Conway 2011) may be weighed alongside efforts to cast doubt on existing knowledge or call for ever more data collection as a way to delay or deter action.

In Los Angeles, today's environmental justice struggles to address health hazards from oil contamination in neighborhoods are inherited from decades of environmental justice activism in the region (Shamasunder 2018). Community-led efforts by a coalition of frontline organizations have brought attention to the consequences of active oil development near a dense urban population. Communities facing long-standing enforcement disparities and a fragmented regulatory landscape have an uphill battle to shed light on the contradiction of California's portrayal as a climate change leader while neighborhood oil development continues unabated (Koseff 2018). STAND-LA (Stand Together Against Neighborhood Drilling) has been working to address impacts from oil development on neighborhood health and quality of life in environmental justice neighborhoods, and to achieve a distance setback from oil field operations and sensitive land uses such as childcare centers, schools, playgrounds, and houses. This chapter details a community-based study conducted by neighborhood organizations within the coalition in partnership with researchers to systematically collect neighborhood-level health data near to two wells that could be compared with city- and county-wide health data as well as to gain a stronger understanding of how residents experienced living near to oil development. The project is detailed below.

Community-based science amid urban oil development

The environmental justice (EJ) movement in the United States has, since the 1980s, moved forward an agenda of environmental protection through a racial justice and civil rights framework. Struggles by environmental justice communities argued that residents are entitled to clean and healthy environments in places where they live, work, play, and pray regardless of race, ethnicity, or socioeconomic status. Frontline communities often live in neighborhoods with multiple environmental hazards. The health consequences of exposure to these hazards can be compounded by social and economic vulnerabilities of race, poverty, age, and linguistic isolation, among other factors, thereby constituting a cumulative impact (Office of Environmental Health Hazard Assessment 2014).

Environmental justice activists have taken a multi-pronged approach to confronting environmental inequalities that leverage tactics inside and outside of government, with one strategy of collaborating with academics to generate relevant data that can contribute to improved state response (Morello-Frosch et al. 2005). However, some scholars have argued for the movement activists to deploy more diverse and multi-scalar methodological approaches with attention to strategies outside of regulatory relief, to recognize the role of the state in perpetuating injustice and find new avenues to confront entrenched inequality and systems of oppression (Pulido 2016; Pellow 2017). Yet, community-based participatory research (CBPR) and citizen science efforts have remained vital, though not singular, components of on-the-ground environmental justice efforts, with research designed around the "3Rs" – rigor, reach, and relevance – being critical to scientific findings (Balazs and Morello-Frosch 2013). While many of these struggles are rooted in political contest, the local state still relies on scientific data in decision-making processes, making the knowledge-making and fact-establishing process maintain continued relevance, despite these limitations (Jasanoff 1987).

EJ community organizations have historically documented health and environmental consequences from polluting industries and other incompatible land uses located near their homes, schools, and playgrounds. Poor communities of color that are impacted by multiple sources of pollution often actively seek information and gather data to demonstrate the hazards and risks they face, and to inform policy and decision making (Brown 1992; Cole and Foster 2001). In Los Angeles, residents near oil development sites have routinely reported health symptoms such as nosebleeds and headaches. These symptoms have also been described in other oil and gas production areas around the country (Witter et al. 2013). Oil production and drilling is associated with exposure to hazardous air pollutants (HAPs) and toxicants, such as BTEX chemicals (benzene, toluene,

ethylbenzene, and xylene) (Macey et al. 2014). In addition, secondary drilling and production enhancement practices inject fluids into oil and gas reservoir rocks to enhance recovery of hydrocarbon products. In Los Angeles, acidizing is routinely used, where large volumes and high concentrations of hydrochloric acid, hydrofluoric acid, or other chemicals are injected underground, mixing and reacting with other well fluids, most of which lack adequate hazard evaluations. Oil development facilities within the South Coast Basin submit chemical use reports for certain well activities, and these reports show chemical ingredients with known air toxics such as hydrogen chloride, xylene, hydrofluoric acid, and ethylbenzene used as part of standard well development and maintenance acidizing practices (Abdullah et al. 2017; Stringfellow et al. 2017).

In the South Los Angeles neighborhood of West Adams, the Jefferson oil field wall is 3 feet (1 meter) away from the nearest home, and the field itself constitutes a complex of more than 60 active oil wells. For members of this primarily black and Latino neighborhood, where over 60% of residents live below the poverty line, information about the oil field, ongoing operations, and on-site hazards are hard to obtain. Chemical combinations trucked into closed compounds are shrouded in trade secret protections, and community residents must remain vigilant to learn about plans and activities at the field (Redeemer Community Partnership 2016). In June 2016, West Adams residents filed a petition for nuisance abatement to enclose the field and afford them some of the same protections found in wealthier neighborhoods (Petition for Abatement of Public Nuisance 2016). Such disparities in the enforcement and regulation of oil industry operations have prompted communities to raise questions about systemic environmental injustice by city and county agencies.

Neighborhood oil drilling health survey

In 2012 and 2013, residents of the University Park neighborhood in South Los Angeles complained of foul emissions and reported nosebleeds, headaches, and respiratory problems. These complaints coincided with increased oil production in the nearby field, where production rose 400% in one year following the purchase of the facility by AllenCo Energy Inc (from 4,178 barrels in 2009 to 21,239 barrels in 2010) (Sahagun 2013). Subsequently, the EPA (Environmental Protection Agency) fined and closed AllenCo. The facility is temporarily closed with plans to reopen once it installs emissions control equipment and receives state approval. Other extraction facilities in this and many other densely populated Los Angeles neighborhoods continue to operate.

Following resident complaints and prior to AllenCo's closure, the community embarked on a health survey that grew into a broader academic–community

collaboration, on which the research for this chapter is based. Our partnership includes a coalition of residents living nearby the AllenCo and Jefferson oil fields, *promotoras de salud* (community health workers), students, and academic researchers, who came together to examine health consequences from oil development through a self-reported community health survey. We also gathered qualitative information about community knowledge of the oil field and experiences of living nearby. Our findings demonstrate adverse health impacts for asthma and respiratory harm in excess of that seen further from the well site and as compared to residents in the broader city of Los Angeles. We also found that residents often lacked knowledge of the well itself and many did not know how to report symptoms or odors, a challenge that reveals the extent of oil company obfuscation of their presence in the community and lack of regulatory attention to making community reporting to regulatory authorities transparent and accessible.

Ongoing research on health impacts from living nearby oil and gas development suggests an important spatial dimension, with residents who live closer to active wells experiencing greater adverse impacts. Residents living within half a mile (0.8 kilometers) of a gas well, compared with residents living further away from such active gas development, have worsened health consequences from exposure to emissions (Meng and Ashby 2014). Greater density and proximity of natural gas wells to maternal residences (within a 10 mile/16 kilometer radius) were associated with adverse birth outcomes (McKenzie et al. 2014). Residential proximity has also been associated with skin and respiratory conditions in residents near natural gas extraction activities with distances typically measured at less than 0.6 to 0.12 miles (1–2 kilometers) from well to residence (Rabinowitz et al. 2014).

Proximity of residents to active oil development

Since studies of oil and gas development suggest proximity to emissions as central to considerations of public health impacts, policy relief routinely suggest setbacks or buffers as one possible public health protection (Haley et al. 2016). Los Angeles requires no buffers or setbacks, which permits very close distances between residents and extraction sites. Responding to community complaints, in April 2017 Los Angeles City Council introduced a motion for the city to study the possibility of a safety buffer (Southern California Public Radio 2017). Seventy percent of active wells in Los Angeles are located within a 1,500 foot (457 meter) distance from "sensitive land uses," such as a home, school, childcare facility, urban park or playground, or senior residential facility, as defined by Cal EPA (California Air Resources Board 2005) (Table 3.1). Setbacks have

Table 3.1 Sensitive land uses in selected areas hosting oil production facilities.

Location	Number of schools	Childcare facilities	Schools per 10,000 people	Childcare per 10,000 people	Childcare per sq. mile
LA County	3,036	3,903	3.09	3.98	1.6
LA City	1,087	1,385	2.88	3.67	2.9
Within 1,500 ft. of an active LA City well	40	29	3.25	2.35	1.5
University Park: AllenCo oil field	5	2	7.83	3.13	8.0
Historic West Adams: Jefferson oil field	1	2	1.29	2.59	8.0
Historic West Adams: Murphy oil field	3	1	5.44	1.81	4.0
Wilmington: Warren E&P oil field	0	1	0.00	2.35	2.4
Baldwin Hills: Inglewood oil field	2	7	3.64	2.35	4.4

been enacted in municipalities in Colorado, Pennsylvania, and Texas to separate oil and gas development from residences for health and safety protections. We conducted a random sample household survey of residents living within a 1,500 foot radius of oil development sites. We compared resident self-reported health within that radius to resident health in Service Planning Area 6 (SPA6), the Los Angeles County Department of Public Health designated area in which South Los Angeles is located, and to Los Angeles County residents overall.

In partnership with residents, we also piloted the use of an open-source low-cost air quality monitoring system during the survey period in West Adams (Jefferson oil field) as a pilot site. While these sensors present challenges in terms of lower accuracy/precision compared with conventional monitoring equipment (Piedrahita et al. 2014), they have led to more affordable and accessible tools that can complement existing monitoring by state agencies and serve as a screening method for concerned communities, which may be in neighborhoods that lack regulatory agency monitors. In recent years, much work has gone into understanding the capabilities of low-cost sensors (Mead et al. 2013) and they have been utilized in a variety of applications from personal exposure monitoring to high-density networks designed for monitoring in complex urban environments (Eugster and Kling 2012). In addition to providing community residents with new options for data collection, low-cost sensors allow researchers and residents to examine high time-resolution data alongside community-member knowledge, which offers another way to engage community expertise

to better understand the potential impact of local emission sources, such as oil and gas operations.

The West Adams and University Park neighborhoods

The West Adams and University Park neighborhoods in South Los Angeles host well-established fields with sustained and active oil development. Community partners included Esperanza Community Housing and Redeemer Community Partnership, both member organizations of STAND-LA. Esperanza is a long-standing community organization in the University Park area, where the AllenCo oil site is located. The neighborhood is predominantly Latino (76%) with 72% of residents living 200% below the poverty line and 81% renters. Redeemer Community Partnership has been a community development corporation in the West Adams neighborhood for over 25 years and has been organizing the community around the Jefferson drill site. The neighborhood is 87% residents of color, with 58% Latino and 20% African American. Twenty percent of the population is under the age of five (as compared to 7% for Los Angeles County), 68% of residents live 200% below the poverty line, and 69% of residents are renters (Table 3.2).

Table 3.2 Demographics of West Adams and University Park within the 1,500 foot buffer.

Population	West Adams buffer area, 1,500 ft. around Jefferson oil field	University Park buffer area, 1,500 ft. around AllenCo oil field	City of Los Angeles
Total population	6,641	5,401	2,546,606
% Age 5 or under	20.90%	5.31%	7.63%
% Age 65 or older	9.92%	6.94%	6.95%
% People of color	87.82%	84.17%	72.85%
% Non-Hispanic black	20.86%	8.17%	9.99%
% Non-Hispanic white	12.18%	15.83%	27.15%
% Hispanic	58.20%	76.00%	50.85%
% Linguistically isolated	23.42%	39.21%	12.37%
% Less than high school	42.49%	46.72%	18.91%
Per capita income	$11,194	$11,203	$18,839
Median household income	$23,912	$20,115	$37,723
Poverty (< 150%)	51.51%	59.39%	20.57%
Poverty (< 200%)	64.88%	72.30%	27.57%
% Renters	68.77%	81.13%	34.70%
Median household size	2.7	3.4	1.7

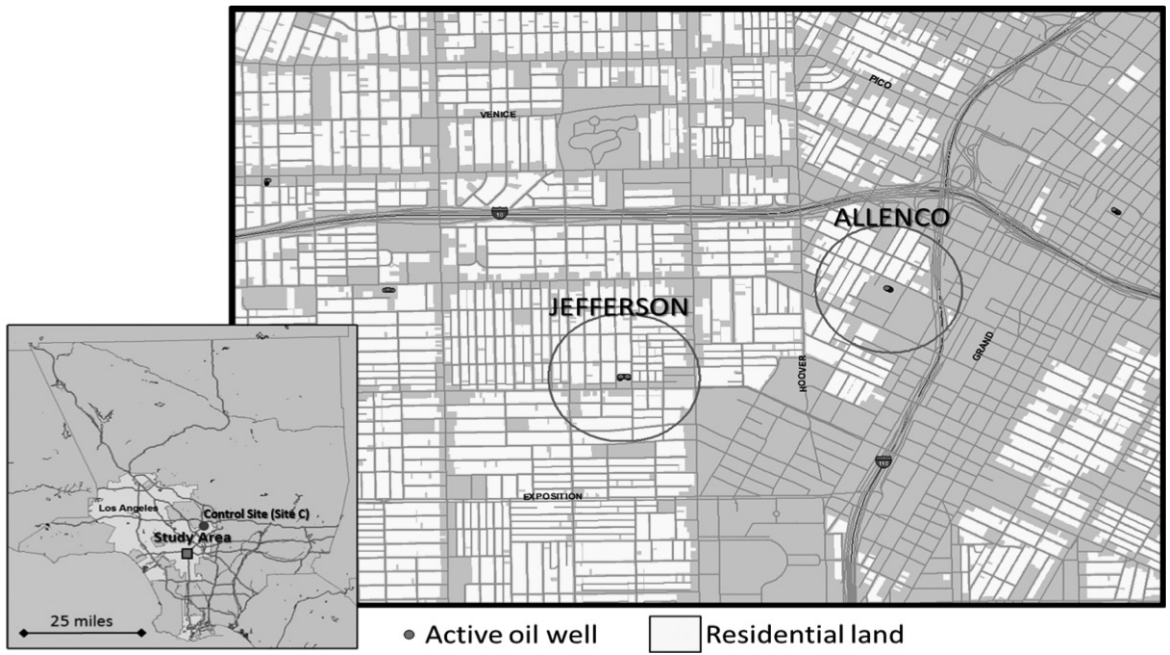
Adapted from the US Census Bureau American Community Survey 5-year data set 2009–2013 2014.

Study area and sample selection

The study areas were defined to represent the neighborhoods surrounding the wells and production facilities at two locations that produce oil from the Las Cienegas oil field (Figure 3.1). Study areas were defined by constructing a circular buffer using ArcGIS (Esri, Redlands, CA, USA), with a 1,500 foot radius, surrounding the outer perimeter of the two oil production sites (Figure 3.1). The Jefferson drill site (Jefferson) is located in the West Adams neighborhood, and the AllenCo drill site (AllenCo) is located in the University Park neighborhood of Los Angeles. We chose a 1,500 foot (457 meter) buffer based on distances considered by other urban cities, such as Dallas (Austin and Zeeble 2013). Based on analysis of the population within the buffer, we selected a target minimum sample size of 76 households around AllenCo and 84 households around Jefferson, conducting the surveys at the addresses identified using a random sampling algorithm to ensure systematic sample coverage.

Community-centered research methods as a community organizing strategy

Health surveys are a recognized method of community organizing in an environmental justice context (Cohen et al. 2012). The survey provided a vehicle for community education about issues of concern in the neighborhood. Residents were able to provide their contact information if they wanted to participate in report-back from survey results or other community events. In partnership with Esperanza's trained network of community health workers, Promotoras de Salud in Action, we conducted the door-to-door surveys of residents in Spanish and English. *Promotoras de salud* live and work in the community, engage in long-term community building, and have a baseline of trust in the neighborhood. *Promotora de salud* networks are have long been recognized as community health experts within environmental justice research (Minkler et al. 2010). *Promotoras* were agile at accessing residents, many of whom work in service sector jobs, the night shift, or have other non-traditional working hours. We also trained four bilingual Occidental College students to conduct surveys alongside *promotoras*. Using the addresses generated from the random household sample, we visited each household on our list, starting in March 2016 and continuing through May 2016. If we could not find anyone at home, we returned on different days and at different times until we could complete the survey. Residents would also become interested as they saw surveyors in conversation with other residents. These residents' surveys supplemented the random sample surveys if the address



3.1 Location map. Study area is located in the mid-city area of Los Angeles, just west of downtown. Circles are 1,500-foot (457 meter) radius buffers surrounding active wells. Note active oil wells in other nearby residential neighborhoods.

fell within the 1,500 foot buffer. Through these methods, we were able to achieve a high survey response rate.

In addition to asthma and respiratory health, we asked questions about infertility and birth outcomes: community organizers were interested in these variables as many women had reported miscarriages and other adverse birth outcomes. We provided this self-reported information back to the community but we do not include an analysis of this data in published materials as we did not have specific enough data to do a birth outcomes analysis, and had informed residents in advance. Thus, that information served to inform community data collection efforts moving forward.

Esperanza Community Housing, Redeemer Community Partnership, and researchers collaboratively designed the survey to ask questions of community importance, such as ratings of the environmental quality of their neighborhood, feelings of safety living in the neighborhood, resident knowledge and experience of the site, health insurance and uninsured numbers, asthma rates, and asthma hospitalization. For detailed methods and results, see Shamasunder et al. (2018). We surveyed 84 households comprising 315 residents in University Park and 119 households comprising 498 residents in West Adams. In both sites, more than 50% of surveyed households had incomes of $20,000 or less (University Park: 57.1%, West Adams: 53.7%). Median household income according to census data (2010–2015 ACS 5-year rollup) for West Adams is $25,980, and for University Park is $20,115. This data demonstrates higher poverty levels and lower incomes as compared to the city. There is also an absence of regulatory agency monitoring nearby the operating wells. The use of low-cost sensors was piloted in this study to help provide community-level monitoring data.

A pilot of low-cost sensor use for community-based research

Low-cost sensor systems are typically small and low power, which makes them fairly easy to deploy at potential sites within the community (e.g., homes, schools, or businesses). This flexibility allows researchers and community members to work together in choosing sites that will best inform the research question. In this pilot study, the monitors were set up and maintained by community-based research partners at three field sites. These sites include three residences – one near an active drill site, one across the street from an inactive drill site, and one in an area with no drilling (our control site). Sites A and B were located in the Study Area (Figure 3.1), whereas Site C was located roughly seven miles away in Northeast Los Angeles. Site C was intended to serve as a comparison for the low-cost sensor data portion of the study, and no other measures were taken at this location. All sites were relatively similar in terms of

land use and proximity to other major pollution sources (e.g., highways). The sites were selected to provide a preliminary example of what sensors can tell us regarding the differences in methane levels/trends in areas with drilling versus those without drilling. These results were preliminary and intended to explore the potential for this technology in the context of community-based participatory research (CBPR), an area where low-cost sensors are increasingly of interest in communities with little access to air monitoring, and in this instance in a cumulatively burdened, environmental justice context.

Community-based survey and low-cost sensor findings

Our random household sample and exposure monitoring within 1,500 feet of oil development sites is the first study in partnership with residents living in very close proximity to oil development in Los Angeles. It is also the first study, to our knowledge, to compare the self-reported health of residents within 1,500 feet of oil development to residents in the broader area of South Los Angeles (SPA6) and Los Angeles County. In over one hundred years of oil development in Los Angeles, with residences placed side by side with oil fields, there has been little research on the public health consequences of these land use choices. We see this study as a first step to considering community concerns.

In our results, many residents (University Park: 45.8%, West Adams: 38.9%) living within 1,500 feet of active oil development did not know that a field was located in the neighborhood. This is likely due to tall walls and landscaping surrounding both sites, and visible signage of private property and no trespassing. Indeed, the oil industry in Los Angeles made significant investment in order to limit their visibility as the region's population grew. Around the region, oil companies have built tall hedges around walls and planted landscaped gardens. For example, in 1965 a consortium of companies hired famed Disney theme park architect Joseph H. Linesch to design $10 million THUMS Island (named for the consortium of companies Texaco, Humble (now Exxon), Union, Mobil, and Shell) (Gougis 2015). The complex is a set of four artificial islands built to camouflage drill rigs with landscaping, waterfalls, and tall structures to hide from view 42 acres of oil fields and 1,100 wells in a vast underground oil field (Schoch 2006). These same strategies have been employed, to a lesser extent, around the Jefferson and AllenCo fields.

From our survey, one of the main burdens appeared to be odors, which some respondents reported as preventing daily activities (University Park: 15.7%, West Adams: 27.5%). However, only a few respondents said they had reported odors or any health symptoms to the gas company, the Los Angeles Department of Public Health, the South Coast Air Quality Management District, or any

other entity, as most responded that they lacked information about how to report. Further, since most residents are unaware of these activities, they may attribute symptoms to allergies or general poor air quality.

Oil and gas development is associated in the scientific literature with degraded air quality and exposure to air pollution as well as exacerbated respiratory conditions and asthma (Rasmussen et al. 2016; Webb et al. 2016). For both University Park and West Adams, compared with SPA6, resident-reported asthma prevalence was significantly higher. Respondents in West Adams (15.5%) and University Park (12.1%) reported experiencing asthma symptoms of coughing and wheezing on a weekly or daily basis. Decreases in ambient pollution levels in southern California have been associated with statistically significant decreases in asthma-related symptoms in children (Rabinowitz et al. 2014). Children under the age of five living within the West Adams buffer area represent 20% of the population as compared to 7% of residents in the city of Los Angeles, and this group is more biologically sensitive to air pollution health impacts.

Through sensor monitors, we found that spatial differences occurred at a fine temporal scale. These differences occurred with periods of elevated methane lasting from approximately 10 minutes to up to 3 hours. These events included differences in methane between the two sites greater than 1.0 ppm (parts per million), well above the calibration site. Given that these events occurred at one site and not the other, they were likely the result of an emission source nearer to Site A. This was even more evident for the events that occurred during daytime hours when more atmospheric mixing is typically taking place (Bamberger et al. 2014). Additional measurements would aid in further narrowing down the source of these events. For example, wind speed and direction information combined with data from multiple sensors might point to the origin of emissions.

A benefit of utilizing low-cost sensors in a CBPR context is that local experience, such as observations about local activities or odors, can improve interpretations of the data. On one day, nearby residents reported seeing heavy equipment in use at the active drill site. If similar methane spikes were observed every time this activity occurred, it would indicate a correlation worthy of further investigation. Examining this qualitative data alongside quantitative data provided by low-cost sensors may result in a more robust and comprehensive understanding of the community's experiences, be responsive to community concerns, and in turn carry through and inform community-based action or policy recommendations.

Conclusion

Oil development has proceeded in Los Angeles for more than one hundred years with little attention to public health consequences of these long-lived facilities. Environmental justice communities living near active oil development are burdened by multiple polluting sources. It is difficult to examine oil-development-related impacts in cumulatively burdened neighborhoods, near freeways, diesel pollution, and other industrial sources, but it is critical to do so given the consistent reports from residents living nearby. The academic–community study detailed here is just one step in a longer, community-determined agenda. This research centers resident health concerns and the rights of residents to have knowledge about their communities and supports hypothesis generation for future air monitoring or health studies. It points to the need for regulatory agencies to provide clear, transparent, and actionable reporting structures with sustained community education on how residents can report problems such as odors, nosebleeds, or headaches. Our study leads to additional questions that require more complex scientific design and raises the imperative that centers community knowledge as new research proceeds.

Studies on oil and gas development have associated distance with worsened air pollution, an issue of significant concern in Los Angeles. Buffers or setbacks are well recognized as protective by regulatory authorities such as local air districts and should be incorporated into neighborhood oil development sites to protect community health (Penning et al. 2014). This early research helped support an infrastructure for further efforts related to oil and gas development in Los Angeles.

Los Angeles hosts the entirety of the oil supply chain, from extraction through refining, and continues to be a top oil producing hub. Community concerns over the public health consequences of oil development are deep seated, with considerable attention in environmental justice neighborhoods. Los Angeles also has a long history of environmental justice organizing and community-engaged environmental justice research. Data collection is a single prong of a larger strategy toward policies that will improve community health, making community–academic collaborations of continued relevance in on-the-ground struggles for justice.

On May 15, 2019, the city of Los Angeles announced that it is officially requiring the Jefferson oil field, owned by Sentinel Peak Resources, to close and clean up the neighborhood drill site. The field is one of the closest in the city to residences, just feet away, as well as 130 feet (40 meters) from a church and 730 feet (222 meters) from an elementary school. The city found ongoing nuisances

from the drilling operation and ordered them to clean up the site in addition to closing it down. Community efforts to address the hazards from this field have been years long, and they hope the closed site can be transformed into a library or a park that will benefit the community.

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Note

1 "Grandfather clauses either exempt or create more lenient standards for existing facilities. The stricter standards imposed by the legislation apply only to new facilities, while grandfathered facilities may be permitted to continue polluting at prior levels. The new environmental standards may therefore do little to improve environmental quality for those living near grandfathered facilities" (Kaswan 1997, 270).

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