October 11, 2019

Eric Garcetti, Mayor of Los Angeles
Los Angeles City Council
200 N. Spring Street
Los Angeles, CA 90012

RE: Oil and Gas Extraction in Los Angeles and Public Health Evidence

As scientists and health professionals with expertise in the impacts of oil and gas extraction on human populations or the environment, we are writing to ensure that the City of Los Angeles possesses analyses grounded in the most available, current and relevant epidemiological research as it considers policies to protect Los Angeles residents from environmental health risks with respect to oil and gas operations. **We have reviewed the analysis and recommendations of the City's recently-released report on oil and draw attention here to the existing evidence that demonstrates health impacts associated with upstream petroleum extraction among residents living ½ to 3 miles from drill sites. Current evidence suggests environmental and health risks further than the 600-ft recommendation proposed to be considered by the city. Many communities near oil extraction in Los Angeles are home to vulnerable populations, who may face cumulative environmental burdens.**

Recent reviews of scientific literature show growing evidence of adverse exposure and health impacts associated with petroleum extraction (Johnston, Lim, & Roh, 2018; Shonkoff, Hays, & Finkel, 2014). Los Angeles sits atop one of the largest urban oil fields in the country with over nearly 2500 active wells. A single drill site typically operates for decades and the extraction process produces emissions of multiple health-hazardous air pollutants, including benzene, toluene, ethylbenzene, xylene, formaldehyde, hydrogen sulfide, and methylene chloride. Many of these compounds are known to be toxic to human health, carcinogenic, cause respiratory harm, or are endocrine disrupting chemicals and can cause long-term developmental or reproductive harm—a consideration for health across generations (Zielinska, Campbell, & Samburova, 2014; Moore, Zielinska, Pétron, & Jackson, 2014; Field, Soltis, & Murphy, 2014; Colborn, Schultz, Herrick, & Kwiatkowski, 2013). These chemicals can migrate off-site due to fugitive emissions, spills, leaks, or accidents.

Despite relatively few studies having been conducted in Los Angeles, the current body of knowledge drawing from scientific studies on upstream oil and gas extraction from across diverse areas of the US and globally, indicate a substantive base of evidence to inform public health efforts by the City of Los Angeles. For example, despite diversity in extraction techniques, geology and local populations, scientific studies have consistently identified drilling activities significantly associated with adverse birth outcomes in Pennsylvania (Casey et al., 2015; Hill, 2012; Stacy et al., 2015), Colorado (McKenzie et al., 2014; McKenzie, Allshouse, & Daniels, 2019), Texas (Whitworth, Marshall, & Symanski, 2017; Walker Whitworth, Kaye Marshall, & Symanski, 2018) and Oklahoma (Janitz, Dao, Campbell, Stoner, & Peck, 2019). *While the exposure measurements in these studies vary based on the community, such*

adverse perinatal effects are associated with maternal proximity of ½ mile to 3 miles from drill activity.

Recent health surveys near petroleum extraction sites have reported symptoms of throat and nasal irritation, eye burning, sinus problems, headaches, skin problems, severe fatigue, loss of smell, cough, nosebleeds and psychological stress (Steinzor, Subra, & Sumi, 2013; Rabinowitz et al., 2015) (Elliott et al., 2018) (Jemielita et al., 2015) (Casey, Wilcox, Hirsch, Pollak, & Schwartz, 2018). Among adults, risk factors for cardiovascular disease increases with the intensity of oil and gas activity nearby (L. M. McKenzie et al., 2019). These symptoms were more common in individuals living near oil and gas facilities compared to those farther away. Others identify neurological symptoms, kidney damage and thyroid problems among residents living in oil extraction regions when compared to those living farther away. Stress, including social and economic stress, can make these health conditions worse (Morello-Frosch, Zuk, Jerrett, Shamasunder, & Kyle, 2011)

Additional studies demonstrate a higher burden of cancer mortality in communities exposed to oil extraction (San Sebastián M, Armstrong B, A, & C., 2001) (Moolgavkar, Chang, Watson, & Lau, 2014) (L. M. McKenzie et al., 2017) (Finkel, 2016). For example, in Colorado, scientists found that children diagnosed with leukemia had a 4.6 increased odds of living in an area with dense petroleum extraction (L. M. McKenzie et al., 2017).

Air surrounding oil and gas production areas is particularly vulnerable to toxic emissions. With relevance to drilling operations in California, a recent review concluded that the production phase, with the lengthy operation timeframes, episodic peak emission events, and largest number of hazardous air pollutants sourced to the various equipment and operations, has the potential to emit the highest concentrations of hazardous air pollutants over the longest time period (Garcia-Gonzales, Shonkoff, Hays, & Jerrett, 2019). Air quality is further compromised by truck traffic to and from the drilling site or operation of diesel equipment (Goodman et al., 2016) (Allshouse, McKenzie, Barton, Brindley, & Adgate, 2019) (Blair, Brindley, Dinkeloo, McKenzie, & Adgate, 2018). Exposure to these air pollutants have been shown to be higher in areas near drilling sites (Lisa M. McKenzie, Witter, Newman, & Adgate, 2012) (Colborn et al., 2013) (Pétron et al., 2012) (Macey et al., 2014) – including in Los Angeles (Collier-Oxandale et al., 2018; Shamasunder et al., 2018). The scientific literature demonstrates adverse human health impacts from exposure to these chemicals (Lisa M. McKenzie et al., 2012) (Atsdr, 1999). Recent literature identifies noise as an important co-exposure near operations (Richburg & Slagley, 2019) (Radtke, Autenrieth, Lipsey, & Brazile, 2017). Acute inhalation exposures to petroleum hydrocarbons have found increased risks of eye irritation and migraine headaches (Kim et al., 2009) (Tunsaringkarn, Ketkaew, Siriwong, & Rungsiyothin, 2013) (Tustin et al., 2017), as well as asthma symptoms (Rasmussen et al., 2016) (White et al., 2009) (Wichmann et al., 2009).

Studies of animals living in oil producing regions have shown an increased accumulation of toxins in various organs, in particular toxic metals as well as damage to the kidney (Miedico et al., 2016) (Al-Hashem, 2011). Toxic metals and petroleum hydrocarbons have also been measured in soil and water near oil extraction sites (Johnston et al., 2018), including diverse locations such as Texas (Bojes & Pope, 2007,) China (Zhang et al., 2013) (Fu, Cui, & Zang, 2014) (Wang, Cao, Liao, Huang, & Tang, 2015), Nigeria (Asia, Jegede, Jegede, Ize-Iyamu, & Akpasubi, 2007) and Iraq (Alawi & Azeez, 2016).

Hydrogen sulfide (H_2S) is an odorant gas associated with oil drilling. Most human organ systems are susceptible to the toxic effects of H_2S, particularly mucus membranes, including the central nervous system, the respiratory system, the cardiovascular system and the gastrointestinal system (Reiffenstein, Hulbert, & Roth, 1992). At ambient levels, odorant chemicals may produce irritation of the eyes, nose, and throat. Such compounds can induce symptoms such as nausea, vomiting, headaches, stress, negative mood, and a stinging sensation (Schiffman, Miller, Suggs, & Graham, 1995) (Wing et al., 2008). Odors that are viewed as unpleasant, embarrassing, or sickening may interfere with mood, beneficial uses of property, and social activities. There is evidence that chronic exposure to elevated ambient concentrations contribute to harm to the respiratory system in both adults and children in addition to elevated cough, headaches and wheezing (Jaakkola, Paunio, Virtanen, & Heinonen, 1991) (Marttila, Jaakkola, Vilkka, Jappinen, & Haahtela, 1994).

Buffers or setbacks have been shown to be a meaningful public health policy approach to limit human health exposures to harmful contaminants (Fry, 2013) (Haley, McCawley, Epstein, Arrington, & Bjerke, 2016) (Lisa M McKenzie, Allshouse, Burke, Blair, & Adgate, 2016) (Banan & Gernand, 2018). From a public health perspective, given the existing evidence on adverse health risks from oil and gas development, it is important to reduce exposures to harmful pollutants at home, in schools and at work places.

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