Existing scientific literature on setback distances from oil and gas development sites

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Background: Need for an LA Relevant Setback

The current body of peer-reviewed scientific literature has a small but growing set of studies investigating the relationship between the proximity of modern oil and gas extraction nearby communities and health impacts. The published studies that have examined this relationship have considered health outcomes, exposure to toxic health risks, and discussed whether current setback requirements in various states are adequate to ensure the health and safety of people who live, work, play, and learn near these facilities. These studies were conducted primarily in lower population density communities and states. Yet, the majority of these studies find a positive correlation between distance of a home from an active oil or gas well and adverse health outcomes. The closer people live to oil and gas wells, the more likely they will be exposed to toxic air contaminants and the more elevated their risk of associated health effects.[1] Most of these distances are measured at a half-mile to a mile (See Table 2). Distances in Los Angeles are much closer. No peer-reviewed studies to date have investigated the relationship between the proximity of oil and gas development and health outcomes in California, nor have any studied this issue in the U.S. urban context. In Los Angeles alone, about 1.7 million people live within 1 mile of an active oil or gas well, and of that group, more than 32,000 people live within 100 m (about 328 feet) of an oil or gas well.[2]

Overview of Report Contents

A total of 14 studies and publications were considered for this report that investigated the health and quality of life impacts and exposures of unconventional natural gas development proximate to residences. Of the 14 studies and publications, 6 considered the distance of an active well to place of residence (Table 1), while the remaining 4 considered the concentration of wells proximate to residences (Table 2). Four of the publications are studies and non-peer reviewed reports that have setback recommendations or relevant considerations for a safe setback margin (included in Table 1). The distances considered in this report range in setback recommendations and findings from 1,500 to 6,600 feet. Among the peer-reviewed studies that specified where samples and data were collected, the average population density was about 150 people per square mile. To compare, the population density for the City of Los Angeles is about 50 times greater at 8,092.3 people per square mile. In neighborhoods like South Los Angeles that is home to several active oil drilling sites, the population densities are up to more than 20,000 people per square mile.[3] The population density in South Los Angeles is about **133 times greater** than those of the populations investigated in the existing literature. Table 1 lays out the peer-reviewed studies included in this report, ordered by the safe setback distance each study considered. Advocacy groups in Los Angeles have called for a 2,500-setback law to protect the health and safety of nearby residents. **Based on the current available research, a 2,500-foot setback recommendation is on the lower end of the range of distances where research has determined harmful health and quality of life impacts of toxic emissions and exposures.**

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Oil and Gas Extraction Methods

During much of the early and mid 1900's, conventional methods of extracting oil depleted most of the oil fields throughout the country. In Los Angeles, only 10% of oil field reservoirs can be recovered by conventional means.[2] Now, in order to access resources that are deeper or more difficult to recover than those that have been recovered historically, oil industry has pursued new technologies in "unconventional" or "enhanced oil recovery" methods.[2,5] These methods include steam, water, and/or chemical injection, hydraulic fracturing, acidization, and gravel packing.

Although the existing research has primarily focused on health impacts and toxic emissions from unconventional natural gas development, many of the same chemicals of concern used in so-called unconventional activities are used in routine activities such as well maintenance, well-completion, or rework on both conventional oil and natural gas wells.[6] There are many applications of hazardous chemicals in oil and gas development, and in fact the routine operational chemical use data is less available than that for unconventional chemical use activities.[6]

In Los Angeles, many of the extraction facilities utilize unconventional techniques, such as acidizing with hydrochloric and hydrofluoric acid, directional drilling, and gravel packing which involves use of tons of carcinogenic silica sand. Many of the oil fields in Los Angeles produce both oil and gas at a relatively equal ratio. Among the top ten producing oil fields in the City of Los Angeles, which include Beverly Hills, Wilmington, and Las Cienegas oil fields, the ratio of gas to oil production is about 0.91.[7] Therefore, the existing research in other parts of the country holds relevance for the nature of oil and gas extraction in Los Angeles.

Health and Quality of Life Impacts

The consequences to health from oil and gas activity investigated in the reviewed studies include birth outcomes, asthma, other respiratory and dermal impacts, pediatric sub-chronic non-cancer and chronic hazard indices, unhealthy noise levels, and various associated health symptoms. Among the existing research, the greatest distance to oil and gas activity investigated was 2 km (6,561 feet) where exposure to hydrogen sulfide combined with VOCs were detected.[7] The shortest distance measurement studied was 1,500 feet and this study found significantly more reports of health symptoms in households within 1,500 feet of an active well. The health symptoms included throat irritation, sinus problems, nasal irritation, eye burning, severe headaches, loss of sense of smell, persistent cough, frequent nose bleeds, swollen painful joints.[9] Rabinowitz, et al. (2015) found an increased number of reported upper respiratory symptoms and skin conditions among residents who lived less than 1 km (3,280 feet) from an active well when compared with residents who lived more than 2 km (6,561 feet) from an active well.[10] McKenzie, et al. (2012) found elevated risk of health effects from natural gas development for residents living less than half a mile from wells. They primarily considered the subchronic non-cancer hazard index, which was primarily driven up by exposure to trimethylbenzenes, xylenes, and aliphatic hydrocarbons, and chronic hazard index measurements, which were driven up by benzene exposure.[11]

Another dimension of health impacts related to oil and gas development is noise levels. Boyle, et al. (2017) conducted a pilot study investigating the 24-hour noise levels of a compressor station relative to residential homes both indoors and outdoors.[12] His study determined that homes up to 600m away (about 1,968 feet) experienced outdoor noise levels that exceeded the U.S. Environmental Protection Agency's

recommended limit of 55 dBA 100% of the time.[12] In addition to these punctuated periods of noise, the regular day-to-day operations at the site cause what has been described as "buzzing" throughout the night makes it difficult to sleep. Recent studies have increasingly focused on "non-auditory" effects of noise on health including annoyance, sleep disturbance, daytime sleepiness, hypertension, cardiovascular disease, and diminished cognitive performance in school children.[13] Many residents living in close proximity to oil and gas development sites in Los Angeles routinely complain of noise from routine operations.

Air Quality and Toxic Exposure

Three of the studies investigated levels of volatile organic compounds (VOCs) and endocrine disrupting chemicals that exceeded regulatory agency minimum standards. Haley, et al. (2016) discussed how exposures of hydrogen sulfide combined with VOCs could produce potentially new harmful exposures that could be detected at distances up to 2 km (about 6,561 feet).[7] Macey, et al. (2014) investigated several jurisdictions with setback regulations for oil and gas operations and conducted air monitoring sampling to examine if the setbacks were adequate.[14] The findings revealed high concentrations of carcinogenic VOCs at distances greater than the setback regulations, including formaldehyde at 2,591 feet and benzene up to 885 feet away from wells. The study also discussed how health-based risk levels that most regulatory agencies rely on for setting limits on air emissions are very limited in providing a sense of the human health impacts.[14] The risk level standards do not account for more vulnerable subpopulations like children and the elderly. Additionally, the number of compounds that are required for monitoring and toxicity reporting is relatively small when considering the vast number of chemicals required for oil and gas operations.[14] Kassotis, et al. (2014) found elevated levels of endocrine disrupting chemicals in water sources 1 mile away from oil and gas operations with known spills or incidences.[15] The study noted that near one of the investigated facilities contaminated by endocrine disrupting chemicals (EDCs), some of the animals in the area were no longer producing live offspring.

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Explosion Risk and Hazards

Haley, et al. (2016) considered the minimum distance that might be required in case of a blow-out or explosion event by investigating historical evacuation data.[7] For example, an explosion in the Barnett Shale in northern Texas produced a 750-foot burn crater.[16] Their findings determined that the average evacuation zone for such incidences is 0.8 miles, or 4,224 feet. A blowout in Wyoming County, PA required a 1,500 foot evacuation zone, which required the evacuation of only 3 families.[17] Considering that in Wyoming County the population density was only 71.2 people per square mile[1816] compared to a densely populated neighborhood in South Los Angeles with a population density of over 20,000, if a similar event were to happen, the same distance of 1,500 feet would require evacuation of 100,743 people. A very recent example of natural gas pipeline explosion accident comes from rural Colorado. On April 17, 2017, a one-inch abandoned pipeline exploded under a home in Colorado, leveled the house, killed two people and badly burned a third person. The gas well head was located just 178 feet from the home.[19]

Dense Population of the City of Los Angeles and Close Proximity to Oil and Gas Facilities Magnifies Health and Safety Risks

Four studies investigated the relationship between health outcomes and the number of wells within a certain radius of residential homes (Table 3). The studies were concerned with birth outcomes and childhood leukemia and were conducted in Pennsylvania and Colorado. The density measures ranged from 3.36 – 125 wells per square mile. To compare to Los Angeles, the four extraction facilities in South Los Angeles that extract from the Las Cienegas oil field, the 2nd largest gas producing field in Los Angeles, each have 22 to 36 oil and gas wells operating less than 100 feet from residential homes. The Inglewood oil field has over 1000 wells operating well within 1 mile of residential homes, recreation parks, and other sensitive land uses.

The studies that investigated poor birth outcomes found that mothers in the sampling population who lived near the highest density of active wells were 1.3 more likely to give birth to a child who had congenital heart defects (CHD) and 2 times more likely to give birth to a child with neural tube defects (NTD),[22] higher incidences of LBW and SGA,[23] and increased rate of preterm birth.[24] McKenzie, et al. (2017) found that increased well density was associated with increased risk for acute lymphocytic leukemia in people ages 5-24.[25]

Delphi Technique

In addition to peer review studies, a consortium of experts in environmental studies and public health have also assessed and considered policy recommendations to address the health and safety consequences of close proximity to oil and gas development. The Environmental Health Project (EHP) is a public health organization that utilized the Delphi Technique to arrive at an expert consensus on an appropriate setback distance for unconventional oil and gas development from human activity.[21] "The Delphi is an accepted method for reaching convergence of expert opinion about a specific topic," and in this study, consensus was defined as 70% agreement of panelists. The process resulted in an 89% participant agreement that 1 to 1.25-mile distance (6,600 feet) from unconventional oil and gas development is an acceptable minimum to protect human health. Additionally, the study recommends greater setback distances for settings where vulnerable subpopulations might gather, such as schools, day care centers, and hospitals.

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Existing setback laws

It is clear that throughout the scientific literature that researchers agree the existing setback laws in various jurisdictions throughout the U.S. are inadequate to protect the health and safety of residents who live, work, and play near oil and gas operations. Existing setback laws range from 150 to 1,500 feet. States like Arkansas, Colorado, and Ohio have varying setback distances from different sensitive land uses.[7,14] Pennsylvania and Texas have state level setback laws for any oil and gas operations near residential land use. Several municipalities in Denton County, Texas, have enforced stronger setback laws. In response to override these municipalities, the Texas state legislature subsequently passed HB40

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which preempts regulation of oil and gas operations by municipalities. Haley, et al. (2016) determined that based on historical catastrophic events, thermal modeling, vapor cloud modeling, and air pollution data, these existing setbacks laws are not sufficient to protect potential risks and threats to human health from hydraulic fracturing operations.[7] Macey, et al. (2014) considered the concentration of VOCs in five different states and determined that the setbacks in those states were inadequate to prevent exposure to formaldehyde and benzene.[14] Majority of the established setback laws were typically decided by negotiations between stakeholders, like residents and policymakers, and not supported by scientific, empirical data.[23] The state of Maryland is one example of a jurisdiction that scientifically investigated the health and safety impact of oil and gas operations. In July of 2014, the University of Maryland School of Public Health conducted another study that focused on public health impacts.[26] Among the 52 recommendations that resulted from the investigation, the researchers recommended a minimum 2,000-foot setback between dwellings and well pads and non-electric motor compressor stations. In 2017, Maryland became the second state in the country to ban hydraulic fracturing.[27]

Conclusions

While few studies have investigated the relationship between the proximity of oil and gas operations and human health impacts, this body of literature does highlight a clear public health concern and that existing setback laws are not adequately protecting public health and safety. **The growing body of scientific literature recognizes that a setback distance between oil and gas operations and locations where people live, work, play, and learn are *necessary* to protect human health and safety. Setbacks are especially crucial to protect vulnerable populations, such as children, elderly, and the chronically ill or disabled.** The 2,500-foot setback recommendation incorporates recognition of Los Angeles' population density and the vulnerability of residents, schoolchildren, and the elderly from health hazards and possible disasters related to oil development. The current literature has identified that existing laws are not adequate for low density, rural communities. This finding underscores the need for a stronger setback in Los Angeles' densely populated urban environment. Many of the impacted communities are in close proximity to a large number of wells and other oil and gas development facilities and are already overburdened by exposure to cumulative environmental health impacts from other industrial and transportation sources. These marginalized communities have long endured environmental injustice. **The scientific literature and published reports make a strong case for a far more protective health and safety setback for the City of Los Angeles than currently exists in other jurisdictions, and creates a substantial basis for the 2,500-foot setback proposed by community advocates.**

Table 1. Comparison of studies and reports by distance to active oil and gas wells with consideration to population density.

Green-blue shaded rows are non-peer reviewed reports. Light blue shaded rows are peer reviewed publications that have relevant setback considerations or recommendations.

*Population density values based on 2010 U.S. Census Fact Finder Population density data.

Citation	Health Impact / Exposure Finding	Distance with health / exposure finding impact / recommendation	Converted to feet	Pop Density 2010 of investigated counties/states (residents per sq.mi.)) *
SW Pennsylvania EHP Technical Reports [21]	Delphi Technique	1 to 1.25 mile	6,600 feet	--
Haley, et al., 2016[7]	Exposure to hydrogen sulfide combined with VOCs could produce potentially new set of exposures - detected at distances of 2 km	2 km	6,561 feet	--
Haley, et al., 2016[7] & Heinkel-Wolfe, 2013 [14]	Considered blow-out and evacuation data, average evacuation zone was 0.8 miles. Explosion in Barnett Shale produced a 750-ft burn crater.[14]	0.8 miles	4,224 feet	--
Kassotis, et al., 2014[16]	Elevated levels of endocrine disrupting chemicals in water sources 1 mile from sites that had known spills/incidents - animals no longer produced live offspring… Location: Garfield County, Colorado	1 mile	5,280 feet	19.1
Webb, Ellen, et al. 2017	Literature review on neurodevelopmental and neurological effects of chemicals associated with UOG operations and their potential effects on infants and children. Made a recommended minimum setback of 1.6 km.	1.6 km	5,249 feet	--
Rabinowitz, et al., 2015[10]	Significant respiratory and dermal impacts Location: Washington County, PA	Less than 1 km	3,280 feet	242.5
McKenzie, Witter, Newman, & Adgate, 2012[11]	Significantly increased risk of pediatric sub-chronic non-cancer hazard & Chronic hazard indices	Less than ½ mile	2,640 feet	Rural areas and towns, population <50,000 in 57 counties
Macey, et al., 2014[14]	Monitored high concentrations of VOCs - up to 2,591 ft Location: Counties in 4 states – AR, PA, CO, OH	2,591 ft	2,591 feet	137.45 (average)
2,500 FEET RECOMMENDATION FOR CITY OF LOS ANGELES				8,092.30
University of Maryland School of Public Health 2014[26]	Recommended min setback distance of 2,000 ft from well pads Location: state of MD	1,000 ft	2,000 feet	594.8
Boyle, et al., 2017[12]	Unhealthy noise levels Location: Doddridge County, WV	< 600m	1,969 feet	25.7
Steinzor, Subra, & Sumi, 2013[9]	Significantly higher rates of health symptoms in households within 1,500 ft of an active well Location: 14 counties in PA	1,500 ft	1,500 feet	165.1

Table 2. Studies investigating the relationship of health outcomes and proximity to concentration of wells

Citation	Health Outcome	Measurement Used	Well Concentration/ Density (by wells per sq mile)	Pop Density 2010 of investigated counties/states (residents per sq.mi.)) *
McKenzie, et al., 2017[25]	In rural Colorado, People ages 5-24 had a 3-4 times higher risk for developing acute lymphocytic leukemia Location: state of Colorado	>33.6 wells in 16.1 km or 10 miles	3.36 wells	48.5
Stacy, et al., 2015[23]	Birth outcomes by concentration of wells. Those with 6+ wells within mile had higher incidence of SGA and LBW in SW Pennsylvania Location: 3 counties in PA (Butler, Washington, Westmoreland	6+ wells per 1 mile	6 wells	277.0 (average)
Casey, et al., 2016[24]	Mothers who lived in the highest exposure quartile were 1.4 times more likely to give birth to children who were considered low birth weight (LBW) and smaller than gestational age (SGA). Location: 40 counties in PA – Using state population density	Highest exposure quartile had 124 wells within 20 km; lowest had 8 wells within 20 km	About 10 wells	283.9
South Los Angeles – Jefferson Drill Site (example for comparison)		**36 wells within 1 mile**	**36 wells**	**21,848**
McKenzie, et al., 2014[22]	In rural Colorado, mothers who lived in higher exposure tertile had 1.3 higher chance of giving birth to a child with congenital heart defect (CHD)2.4 higher chance of having Neural Tube Defect. Even in the 2nd tertile of highest exposure, mothers were 1.2 more likely to give birth to a child with CHD. Location:	Highest exposure tertile had 125-1400 wells within a mile, the next highest tertile had 3.63-125 wells within a mile.	125 wells	Rural areas and towns, population <50,000 in 57 counties

*Population density values based on 2010 U.S. Census Fact Finder Population density data.

References

1. Shonkoff SBC & Gautier D, Chapter 4: A Case Study of the Petroleum Geological Potential and Potential Public Health Risks Associated with Hydraulic Fracturing and Oil and Gas Development in the Los Angeles Basin. https://ccst.us/publications/2015/vol-III-chapter-4.pdf [Accessed December 22, 2016]
2. Liberty Hill Foundation. (2015). Drilling Down: The Community Consequences of Expanded Oil Development in Los Angeles. https://www.libertyhill.org/sites/libertyhillfoundation/files/Drilling%20Down%20Report_1.pdf. [Accessed June 9, 2017].
3. Los Angeles Times. Mapping LA, South L.A.: University Park. [Accessed May 27, 2017] (http://maps.latimes.com/neighborhoods/neighborhood/university-park/
4. Webb, Ellen, et al. (2017). "Neurodevelopmental and neurological effects of chemicals associated with unconventional oil and natural gas operations and their potential effects on infants and children." *Reviews on Environmental Health.*
5. U.S. Environmental Protection Agency (2008) Sector Performance Report. Page 86. https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P1001IJT.txt. [Accessed June 9, 2017].
6. Stringfellow, W. T., Camarillo, M. K., Domen, J. K., & Shonkoff, S. B. (2017). Comparison of chemical-use between hydraulic fracturing, acidizing, and routine oil and gas development. *PloS one*, *12*(4), e0175344.
7. Department of Geological and Geothermal Resources. (2016). 2016 Production/Injection Database "2016 Production Access Database.zip" (Last Modified: 4/3/17) [Accessed December 12, 2017] ftp://ftp.consrv.ca.gov/pub/oil/new_database_format/.
8. Haley, M., McCawley, M., Epstein, A. C., Arrington, B., & Bjerke, E. F. (2016). Adequacy of current state setbacks for directional high-volume hydraulic fracturing in the Marcellus, Barnett, and Niobrara Shale Plays. *Environmental health perspectives*, *124*(9), 1323.
9. Steinzor, N., Subra, W., & Sumi, L. (2013). Investigating links between shale gas development and health impacts through a community survey project in Pennsylvania. *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy*, *23*(1), 55-83.
10. Rabinowitz, P. M., Slizovskiy, I. B., Lamers, V., Trufan, S. J., Holford, T. R., Dziura, J. D., ... & Stowe, M. H. (2015). Proximity to natural gas wells and reported health status: results of a household survey in Washington County, Pennsylvania. *Environmental Health Perspectives (Online)*, *123*(1), 21.
11. McKenzie, L. M., Witter, R. Z., Newman, L. S., & Adgate, J. L. (2012). Human health risk assessment of air emissions from development of unconventional natural gas resources. *Science of the Total Environment*, *424*, 79-87.
12. Boyle, M. D., Soneja, S., Quirós-Alcalá, L., Dalemarre, L., Sapkota, A. R., Sangaramoorthy, T., ... & Sapkota, A. (2017). A pilot study to assess residential noise exposure near natural gas compressor stations. *PloS one*, *12*(4), e0174310.
13. Basner, M., Babisch, W., Davis, A., Brink, M., Clark, C., Janssen, S., & Stansfeld, S. (2014). Auditory and non-auditory effects of noise on health. *The Lancet*, *383*(9925), 1325-1332.
14. Macey, G. P., Breech, R., Chernaik, M., Cox, C., Larson, D., Thomas, D., & Carpenter, D. O. (2014). Air concentrations of volatile compounds near oil and gas production: a community-based exploratory study. *Environmental Health*, *13*(1), 82.

15. Kassotis, C. D., Tillitt, D. E., Davis, J. W., Hormann, A. M., & Nagel, S. C. (2014). Estrogen and androgen receptor activities of hydraulic fracturing chemicals and surface and ground water in a drilling-dense region. *Endocrinology*, *155*(3), 897-907.
16. Heinkel-Wolfe P. 2013. Few answers in April gas well Blowout [news story]. Denton Record-Chronicle. Denton, TX. 27 July 2013. Available: http://www.dentonrc.com/news/news/2013/07/27/few-answers-in-april-gas-well-blowout [Accessed November 22, 2017].
17. Legere, L. (2013). Wyoming County well malfunction causes spill, evacuation. The Times-Tribune, March 15, 2013. http://thetimes-tribune.com/news/wyoming-county-well-malfunction-causes-spill-evacuation-1.1458575 [Accessed November 22, 2017].
18. U.S. Census Bureau. 2010. Population, Housing Units, Area, and Density: 2010 – County –County Subdivision and Place – 2010 Census Summary File 1. Wyoming County, Pennsylvania.
19. Kelly, D. (2017). Deadly House explosion in Colorado traced to uncapped pipe from gas well. Los Angeles Times, May 2, 2017. http://www.latimes.com/nation/nationnow/la-na-colorado-explosion-20170502-story.html. [Accessed June 9, 2017].
20. Fry M. Urban gas drilling and distance ordinances in the Texas Barnett Shale. Energy Policy 2013;62:79–89.
21. Health and Unconventional Oil & Gas Development: Delphi Study Results. *South West Pennsylvania Environmental Health Project Technical Reports*, Issue 4. [Accessed November 22, 2017] http://www.marsparentgroup.com/uploads/3/0/3/4/30347031/issue_4_-_health_and_unconventional_oil___gas_development_-delphi_study_results.pdf.
22. McKenzie, L.M., Guo, R., Witter, R.Z., Savitz, D.A., Newman, L.S., Adgate, J.L. (2014). Birth outcomes and maternal residential proximity to natural gas development in rural Colorado. *Environmental Health Perspectives*, 122:412-417.
23. Stacy, S. L., Brink, L. L., Larkin, J. C., Sadovsky, Y., Goldstein, B. D., Pitt, B. R., & Talbott, E. O. (2015). Perinatal outcomes and unconventional natural gas operations in Southwest Pennsylvania. *PLoS One*, *10*(6), e0126425.
24. Casey, J. A., Savitz, D. A., Rasmussen, S. G., Ogburn, E. L., Pollak, J., Mercer, D. G., & Schwartz, B. S. (2016). Unconventional natural gas development and birth outcomes in Pennsylvania, USA. *Epidemiology (Cambridge, Mass.)*, *27*(2), 163.
25. McKenzie, L. M., Allshouse, W. B., Byers, T. E., Bedrick, E. J., Serdar, B., & Adgate, J. L. (2017). Childhood hematologic cancer and residential proximity to oil and gas development. *PLoS One*, *12*(2), e0170423.
26. Milton, D., et al. (2014). Potential Public Health Impacts of Natural Gas Development and Production in the Marcellus Shale in Western Maryland. Maryland Institute for Applied Environmental Health, School of Public Health, University of Maryland, College Park. http://www.marcellushealth.org/uploads/2/4/0/8/24086586/final_report_08.15.2014.pdf. [Accessed June 12, 2017].
27. Henry, D. April 4, 2017. Maryland governor signs fracking ban into law. The Hill. http://www.marcellushealth.org/uploads/2/4/0/8/24086586/final_report_08.15.2014.pdf. [Accessed June 12, 2017].