Chapter 1: A Burning Issue: Flaring and Venting in Texas

"It doesn't have to be like this, but the excuses for flaring are all too familiar. The gas price is too low, pipelines are too expensive, upfront costs to use or convert the gas locally are too high. And the excuses will keep coming until we finally face reality: We cannot drill our way out of the coming climate crises… It is time to face the issues of air pollution and greenhouse gas emissions from oil and gas exploration. Too much time and energy, literally, have already been wasted."

- Dr. Gunnar Schade, Professor of Atmospheric Science, 2014

While air pollution has steadily declined in the United States since the 1970s, since the shale oil boom, when oil and gas in tight shale formation became reachable due to the development of new "fracking" technologies, rural air pollution has dramatically increased from oil and gas extraction industry venting and flaring practices. Natural gas and oil is produced on a construction area known as a drilling pad using one or more drilling rigs on top of one or more holes in the ground, known as wells. When extracting oil and gas from a well, natural gas is sometimes released or leaked into the air (a practice known as venting), or it is burned and released into the atmosphere using a flare stack (a practice known as flaring). Even though natural gas has economic and use value, many companies fail to build pipeline or, when pipeline is otherwise unavailable, fail to rent or buy the equipment necessary to collect and store extracted gas, and instead choose to vent and flare (see Figure 1.1: Gas Flare in Texas Permian Basin). Venting and flaring is a growing concern because in addition to wasting a valuable, finite natural resource, it creates air pollution and emits greenhouse gasses.

1.1. Common Explanations of Venting/Flaring

Although natural gas extracted along with oil and other petrochemicals at extraction sites has economic value, companies may choose to vent or flare for three primary reasons. First, it is common for operators to flare gas the first few days after drilling is completed in order to test the pressure and composition of extracted natural resources. However, some other companies choose to forgo this unnecessary waste and instead use portable green completion equipment. Second, since wells must go through a costly process to be shut-in[1], operators flare gas to maintain a safe pressure during emergencies and repairs. Third, out of perceived economic interests and administrative costs, some companies choose to immediately vent and flare extracted natural gas, rather than immediately invest in and build the infrastructure and technology necessary to effectively capture, store, and transport the gas to be sold on the market.

[1] Shutting in a well is a process by which a well is plugged at a specified level and filled with concrete to prevent natural gas from escaping. Depending on the depth of the well, shut in costs can be anywhere from $569 - $527,829 (Joyce 2015).

Figure 1.1: Gas Flare in Texas Permian Basin

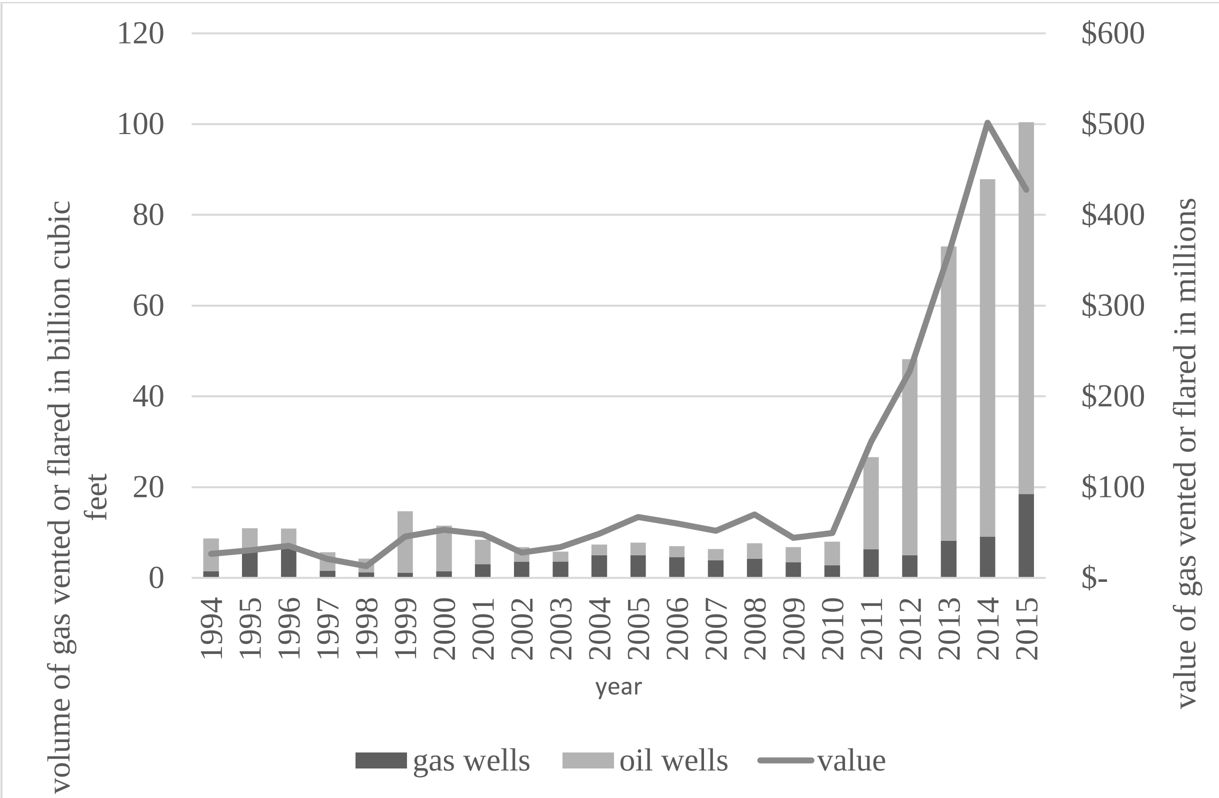
Reference: Thornberrey, Blake. Retrieved March 16, 2018 [https://www.flickr.com/photos/91657289@N02/9647210402/in/photolist-fGutxQ-9NELbX-9NDgMs-9NyTno-9NDUEY-9NAw5D-ddjmLt-XiShmr-p3eGDB-8h2puk-azpVf5-qrgppp-qpakcW-Wb5gbw-bF4356-fGvTVJ-nhcppX-qrrquz-EpYUp-qrnPPA-9GhVQ1-6n1kRi-oy7Gat-Cu3zn7-ZUn5LW-QFZix-SpLrcJ-Du3xLd-c1RCrm-c1RCzC-c1RCUS-vHm7i-6xPMTk-c1RCMq-c1RCv9-6n1kKi-qrrrgz-8hNB22-e6csnQ-c1RCms-6E8rCP-9kqhjC-6SzCJf-5VcDi9-7SoW57-7mAjGW-TFjEuj-SpLqp1-SpLqGW-SpLpLN].

1.2. Modern Venting and Flaring Patterns in Texas

As fracking technologies have opened up oil and gas development in previously unreachable areas, the practice of venting and flaring has become a growing economic concern for states with finite oil and gas reserves. Prior to the beginning of the shale oil boom in 2005, the United States Energy Information Administration (2017) estimated 96,408 million cubic feet of natural gas worth nearly $836 million was flared or vented[2] at extraction sites across the United States; by 2015, the amount tripled to 289,545 million cubic feet worth over $1,233 million. A large amount of that gas has been increasingly flared in Texas, which is the largest producer of oil and gas in the United States. As described below (See Figure 1.2: Estimated Waste from Flaring and Venting in Texas from 1994-2015), while prior to the shale oil boom in 2005, the Texas Railroad Commission estimated 7,743 million cubic feet of natural gas worth nearly $57 million was wasted by flaring or venting at extraction sites in Texas; by 2015 the amount grew over tenfold to 100,388 million cubic feet worth over $427 million.

[2] Federal and state records do not differentiate between venting and flaring estimates.

Figure 1.2: Estimated Waste from Flaring and Venting in Texas from 1994-2015



References: Texas Railroad Commission Production Data Query Dump, United States Energy Information Administration Natural Gas Prices

1.1. The Importance of this Research

Flaring is problematic, as it wastes energy resources, creates health hazards and contributes to climate change. While urban air pollution in the United States has steadily declined, flaring has dramatically increased the number of toxic air pollutants in rural areas in Texas due to shale gas development. In 2012, flaring conducted in the Eagle Ford Shale, which is just one of Texas' many oil and gas shale plays, led to over 15,000 tons of pollutants being released into the atmosphere, which is more than high-polluting Texas oil refineries (Tedesco and Hiller 2014). Flaring releases a large amount of air pollutants into the atmosphere including carbon dioxide, methane, and other volatile organic compounds such as benzene, ethlylbenzene and n-hexane. In fact, flaring is the largest industrial source of volatile organic compounds and the largest source of methane emissions by the oil and gas industry (EPA 2017). The magnitude of methane emissions from flaring is particularly problematic because global climate change is a growing concern. According to the Environmental Protection Agency (EPA 2015), over the course of 100 years, methane contributes to climate change over 25 times as much as carbon dioxide. In short, there is ample research from atmospheric scientists that venting and flaring from the oil and gas industry has a negative impact on the surrounding natural environment.

While natural scientists continue to explore venting and flaring (Howarth, Santoro, and Ingraffea 2011. Buzcu-Guven, and Harriss 2012; O'Sullivan and Paltsev 2012; Elvidge, Zhizhin, Baugh, Hsu and Ghosh 2015), social scientists have yet to fully explore the phenomenon. The primary purpose of this research is to bring social organizations into the analysis of industry venting and flaring practices. It is critical to include human organizations in venting and flaring studies because venting and flaring is not a natural phenomenon- it is the result of the purposeful and accidental actions of man-made organizations. As such, the social organization is the primary unit of analysis. This study advances knowledge of how the characteristics of organizations and their interconnected external environment relate to extreme pollution by particular industrial facilities. I take an "open systems" approach to organizational behavior, meaning I conceptualize organizational behavior as the result of the historical development of informal norms and formal rules both within the organization and between organizations. I elaborate my theoretical framework below.

1.2. The Pathways to Pollution Framework

Explanations of why particular industrial facilities pollute more than others can be broken down into three lines of sociological research: global, national/local politics, and organizational (Grant, Jorgenson, Longhofer 2018). First, from the global perspective, the most geopolitically powerful "core nations" (which includes the United States), develop relations such that they are consistently responsible for consuming most of the world's basic resources (Chase-Dunn and Gimes 1995). Furthermore, global institutional norms and the strength or weakness of social ties with international environmentalist regimes relates to the degree to which a facility pollutes (Hironaka 2014; Shandra, Leckband, McKinney, and London 2009). Second, from the national/local politics perspective, national political-regulatory systems (Prechel 2015), and the political actors involved in environmental decision making (Bullard 1990; Mohai, Pellow and Roberts 2009; Pellow 2000) relate to extreme pollution. When political checks and balances to corporate power are put into place, there are more incentives to adhere to environmental norms, thus extreme pollution is less likely to occur. Third, from the organizational perspective, the characteristics of organizations relate to extreme pollution (Grant et al. 2002; Grant, and Jones 2003; Grant and Jones 2004; Grant et al. 2010; Prechel 2015; Prechel and Istvan 2016; Prechel and Touché 2013; Prechel and Zheng 2012). This research finds large, complex, financially constrained organizations pollute the heaviest because they are subject to resource dependence (i.e., the degree to which an organization depends on their external environment to survive) and organizational inertia (i.e., the extent to which an organization resists change).

In the process of identifying the global, political, and organizational factors contributing heavy pollution, social scientists have identified several structural determinates of disproportionate pollution by heavy polluting facilities, known as hyper-polluters. Rather than examining global, national, and organizational variables as competing predictors, recent research shows different variables work together to predict hyper-polluter emission rates and develop four different types of structural "causal recipes": coercive, quiescent, expropriative, and inertial (Grant, Jorgenson, Longhofer 2018). Examining an international sample of the world's powerplants, those with the highest emission rates are (Grant, Jorgenson, Longhofer 2018:65-66): "(a) located in the world-system's core zone and in nations that are disengaged from global environmental norms and lack a system of political checks and balances (coercive configurations), (b) located in the world-system's core zone and in nations that are disengaged from global environmental norms and owned by dominant utilities (quiescent configurations), (c) located in nations lacking a system of political checks and balances and owned by dominant utilities and are old (expropriative configurations), or (d) located in the world-systems' core zone and owned by dominant utilities and are old (inertial configurations)." In short, the pathways to pollution framework demonstrates that various global, political, and organizational structural configurations relate to extreme pollution by particular industrial facilities. This dissertation expands the pathways to pollution framework by examining how the global and political environments in which the industrial organization is embedded, and the organizational characteristics facilities and the companies that directly operate them relate to venting and flaring in Texas. I conclude by describing the configurations leading to extreme venting and flaring in Texas and developing various policy recommendations to minimize routine venting and flaring.

1.3. Data

This research involved both primary and secondary source analysis. Primary data sources were collected from a variety of resources including industry reports, newspaper articles, law reviews, court records and Texas Railroad Commission archival documents obtained through Public Information Act requests for documents related to venting and flaring laws and policies. Secondary sources were analyzed upon being merged together using a geographic information system and unique well, lease, and operator identifiers. Wells are the surface locations for the hole in the ground were oil and gas is extracted. Leases are one or more wells upon which an operator can legally extract oil and gas according to Texas Railroad Commission and mineral rights contracts and laws. Operators are the company with direct legal responsibility for lease operators according to Texas Railroad Commission records. Secondary sources involved various Texas Railroad Commission datasets, the American Community Survey, the National Center for Charitable Statistics database, the LexisNexis Corporate Affiliations database, and the United States Energy Information Administration Intrastate and Interstate Natural Gas Pipeline Shapefile. A detailed discussion of the datasets used and how they were merged together is in the Appendix.

1.4. Organization of this Thesis

This dissertation is organized as follows. In the next chapter, I explore the politics of venting and flaring by the oil and gas extraction industry in Texas from the 1880s to 2010s. Using historical archival documents, I show that while in the late 1940s, anti-flaring policies forced companies to invest in the technologies and infrastructures necessary to collect natural gas that is otherwise vented or flared, amendments to statewide rules in the 1990s pursued by industry leaders created new opportunities for companies to legally vent or flare natural gas. The third chapter examines the communities most exposed to Texas oil and gas extraction industry venting and flaring practices. I use cross-sectional geographic datasets to map where most venting and flaring occurs and the types of communities most exposed. I find that political inequalities relate to environmental inequalities produced by the oil and gas extraction industry. The fourth chapter explores the types of facilities and operators responsible for venting and flaring most of the gas they produce. Using hierarchal cross-sectional data, I show that specific coercive, quiescent, expropriative, and inertial structures factors relate to oil and gas extraction industry venting and flaring practices. I conclude by developing five policy recommendations to minimize extreme routine venting and flaring practices. Since this thesis is organized like a book, methodological discussions and details are kept in the Appendix rather than the main text.

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