INTERPRETING RISK: VARIATIONS AND EXPLANATIONS OF RESIDENT PERCEPTIONS OF HYDRAULIC FRACTURING IMPACTS

by

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ABSTRACT

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Hydraulic fracturing is a novel technological development that has pushed the extraction of energy resources forward. As technology improves and world oil and gas markets shift, more shale formations are being uncovered, and new drilling activities are seen as economically viable. I examine the ways in which residents perceive environmental and health risks of hydraulic fracturing in the Eagle Ford Shale region of Texas, and how these perceptions differ depending on social position and where the resident is receiving their information. To understand how residents perceive the environmental and health risks associated with the Eagle Ford Shale oil and gas boom, or if these perceptions differ by social status and information sources, I conducted a qualitative analysis of key informant and focus group interview data, coding for major themes found in interview transcripts. I found that groups in lower social positions had increased concern regarding environmental and health risk perceptions than those in higher social positions. Additionally, respondents in lower social positions discussed all environmental and health risk perceptions with a relatively higher breadth and depth than those in higher social positions. Regarding information sources, those in higher social
positions tend to receive more of their information on hydraulic fracturing from government officials and industry. Those in lower social positions receive more information from interpersonal networks, although they generally discussed a general lack of information concerning oil and gas development. These findings contribute to a relatively small field of growing research on resident perceptions in a hydraulic fracturing context. This research also brings attention to rural populations who are being uniquely impacted by hydraulic fracturing and provides insight into a region, the Eagle Ford Shale, where there is a need for more scholarly research.
Interpreting Risk: Variations and Explanations of Resident Perceptions of Hydraulic Fracturing Impacts

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Hydraulic fracturing has increasingly become a global phenomenon that has induced the public to be suspicious of the impacts of this process. As this new process has been fraught with controversy, it is important to gain further understanding of how different people perceive the risks associated with oil and gas development. Focusing on the Eagle Ford Shale region, located in South Texas, I examine how social position and source of information is related to perception of environmental and health risks. I do this by conducting a qualitative analysis of interviews from two counties experiencing hydraulic fracturing development, examining the most common environmental and health risk perceptions residents mention. The findings show that those in higher and lower social positions differed in the way they express environmental and health risk perceptions, and that each group receives information differently. This research provides evidence that different populations are being impacted by oil and gas development differently, and documents possible issues that industry and communities can work together on to alleviate.
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Research can oftentimes be a very isolating process. I give special thanks to my family, friends, and colleagues for helping me stay grounded in the world and allowing me to mostly maintain perspective.

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CHAPTER I
INTRODUCTION

Hydraulic fracturing\(^1\) is increasingly becoming a global phenomenon. As technology improves more shale formations are being uncovered, and new drilling activities are seen as economically viable. In this thesis, I examine the ways in which residents perceive environmental and health risks of hydraulic fracturing in the Eagle Ford Shale region of Texas, and how these perceptions differ depending on social position and where the resident is receiving their information. By doing so, this thesis addresses a call in the research for deeper examination of residents living in hydraulic fracturing communities (Anderson and Theodori 2009; Crowe et al. 2015a).

Figure 1 depicts 137 shale formations in 41 countries that have either shown promise for imminent resource extraction, or that have enough information to complete an assessment of resources contingent on sufficient investment, emphasizing the ubiquity of development around the world. Oil and gas development has increased significantly in North America over the past decade, and as shown in figure 2, there are large swaths of land identified as areas for shale development in North America. With this increase in shale plays more communities and community residents are affected by oil and gas

\(^1\) Hydraulic fracturing is a process in which a combination of water, sand, and chemicals (which aid in reducing friction, preventing micro-organism growth, preventing corrosion of pipes, or reducing buildup of mud) is vertically injected into a geologic formation at high pressure to enable production of oil and natural gas by causing cracks in the rock layer (Porter, 2013). In conjunction with improved hydraulic fracturing advancements, the recent advancement of directional drilling has allowed for the ability to turn the drill bit horizontally once the necessary depth is reached, greatly increasing production and, therefore, economic feasibility.
development, and are experiencing the related social, economic, and environmental costs and benefits that come with this activity.

Investigating risk perceptions\(^2\) at the local scale provides an important perspective on environmental and health impacts, but has only been minimally examined in hydraulic fracturing research. Understanding residents’ perceptions of oil and gas development can provide a perspective as to why there is support or opposition of hydraulic fracturing activity and, highlight the importance of understanding risk perception as it relates to hydraulic fracturing. Risk perception can also have an important influence on where policy is guided and the level of public support certain extractive industries achieve (Clayton et al. 2015).

Thus far, while not explicitly examining risk perceptions, studies in hydraulic fracturing communities have measured perceptions of residents regarding social, economic, and environmental impacts (Anderson and Theodori 2009; Brasier et al. 2011) or compared perceptions of community leaders to the broader public regarding their view of impacts (Crowe et al. 2015a). Few studies, though, have compared different residents’ risk perceptions to each other differentiated by social position (Crowe et al. 2015a).

In addition, the relationship that both social position and information source have with risk perception in hydraulic fracturing communities has not been studied extensively. We know from studies of interaction in other contexts outside of hydraulic fracturing communities, that those in lower social positions tend to have higher risk

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\(^2\) For the purpose of my thesis ‘perception’ and ‘risk perception’ are used interchangeably. This is because positive or negative perceptions expressed by individuals in relation to hydraulic fracturing can be seen as a measurement of their perceived risks of the activity. For example, an individual expressing that they perceive water impacts from hydraulic fracturing is considered a risk perception.
perceptions (Boholm 1998; Finucane et al. 2000; Savage 1993). Bolstering studies in other contexts, Crowe et al. (2015a) observed community residents had increased perceptions of impact regarding hydraulic fracturing compared to leaders, indicating a difference in perceptions by social position. Examined to a lesser extent in the hydraulic fracturing literature, the use of different information sources can also have a relationship with risk perception (Kasperson et al. 1988). Individuals develop their beliefs by taking information in, analyzing the source of information, and then determining the credibility of the source (Renn et al. 1992). Therefore, where individuals receive information, as well as previous experiences with the risk, can have a greater affect in influencing behavior than the actual information received (Clayton et al. 2015). My overall research question asks, how do social positions and information sources interact with how people perceive and articulate concerns about different types of risks associated with energy development?

In this thesis, I begin to answer the following two questions:

RQ1: How do residents’ perceptions of environmental and health risks in the Eagle Ford Shale region of Texas differ by personal experience and social status (defined as potential personal gain from drilling activity and position in community)?

RQ2: How does social status interact with the way that people receive information regarding hydraulic fracturing in the Eagle Ford?

These questions are important to examine in order to gain a deeper understanding of how people interpret the risks of energy development. Thus far the Eagle Ford Shale region has been understudied, yet the current oil and gas boom has made the state of Texas the top oil and gas producer in the country (Porter 2013). In addition, beginning to answer these questions will help untangle the risk perceptions of environmental and
health impacts people have around energy development, and how sources of information and social position are related to their perceptions. Findings from this research can inform policy makers and scientists of the varied ways people interpret risk. In addition to providing policy guidance, risk perceptions are important to examine because it may be the only substantial information available when other scientific information is not readily available regarding impacts in the community (Burdge and Ludtke 1994; Greider and Krannich 1985). Thus, resident perceptions can be an important pathway to understanding perceived risks from hydraulic fracturing, especially in the absence of other data sources. Lastly, the social sciences have contributed relatively little to energy research, which has meant a lack of research methods being utilized that can accurately capture perceptions of energy impacts (Sovacool 2014). Voices in rural communities experiencing hydraulic fracturing have also been examined to a lesser degree than other voices, both within sociology and greater societal discourses (Gurley 2015). Thus, this research will both contribute to academic research on hydraulic fracturing and provide insight into the perceived challenges rural communities face in understanding environmental and health impacts.

In chapter II I discuss how social positions and information sources are related to risk perceptions, followed by an examination of literature on hydraulic fracturing and risk perception. Chapter III provides a background of the study site—the Eagle Ford Shale region and details my methodological approach. Chapters IV and V present an analysis and discussion of each research question. Chapter VI provides concluding remarks, limitations of the study, and a discussion of the focus of future research.
Figure 1. Map of Basins with Assessed Shale Oil and Shale Gas Formations, as of May 2013 (Kuuskraa et al. 2013)

Figure 2. Map of Unconventional Shale Plays in the U.S. and Canada (Vengosh et al. 2014)\(^3\)

\(^3\) Map is based on data from Conti et al. 2013.
CHAPTER II

LITERATURE REVIEW

I begin this chapter by providing a broad overview of risk perception literature. I then specifically discuss literature that addresses how social position and information sources interact with risk perception. I then turn to research conducted thus far on risk perception of hydraulic fracturing, with a specific focus on perceptions of environmental and health impacts.

RISK PERCEPTION LITERATURE

According to Birkmann (2007), in analyzing risk perception it is important to understand both the type of hazard and what or who is being exposed to the hazard. For this research, the potential hazard is hydraulic fracturing, and the people in hydraulic fracturing communities as well as the surrounding environment are who and what is being exposed. The first part of this literature review will briefly examine three approaches that have been developed for understanding risk perception, and consider how each perspective provides an important contribution to how social position and information source interacts with risk perception.

*Technico-Scientific, Socio-cultural, and Cognitive Psychological Theories*

We live in a complex world where risk perceptions interact with multiple factors, which explains why we have a diversity of theoretical positions on understanding risk. These include technico-scientific, sociocultural, and cognitive psychological perspectives. While each theoretical perspective takes a distinct approach, all contribute to interpreting risk perception and together provide an important basis for understanding
risk perception.

In general, the technico-scientific view says that risk exists, there are vulnerable populations, and resilience of a system to the risk can be measured. In the technico-scientific tradition, expert opinion is highly valued, and literature tends to look at the accuracy of the risks’ measurement through conducting scientific calculations (Lupton 2013). In the technico-scientific tradition risk perception is primarily influenced by objective measurements, such as probability of an earthquake or drinking water quality. While a technico-scientific approach can provide concrete management steps, it might not consider perceived elements of risk.

Adger (2006) has argued that there can exist a tension between the objective and perceived elements of risk. The assessment of risk is subject to a higher degree of ambivalence as society grows in complexity and as risk becomes increasingly perceived through scientific knowledge rather than every day experience (Lupton 2013). At the individual level, perception of being vulnerable to one type of risk can increase perception of being vulnerable to all environmental risks in general (Adger 2006). Furthermore, the population that is being assessed might not understand the information being communicated because of either the scale or language used (Adger 2006). While the technico-scientific perspective is only one way to understand risk perception, it does emphasize the importance of understanding how those in power, or experts, can guide risk perception (Richards and Brod 2004).

The socio-cultural perspective approaches risk by recognizing individuals exist within social and cultural spaces, which allows for risk to be interpreted through social and cultural factors. While a natural event carries with it inherent disruptive properties
(e.g. increased wind velocity or precipitation), social and cultural factors determine vulnerability to these disruptions (Wisner et al. 2004). For example, in the case of hydraulic fracturing, social factors such as population density or wealth of the community or cultural factors like religion or tradition of oil exploration in Texas may contribute to the decision to develop a certain area for hydraulic fracturing, and influence the type of mechanisms to put in place that might lessen or increase vulnerability to the hazards associated with hydraulic fracturing. Defining ‘objective’ risk is a fluid process, as there is a lack of consensus on the perceived versus objective elements of risk, as social and cultural factors interact with risk. This perspective also argues that rather than just placing focus on the hazard that occurs, social factors can be analyzed to interpret how people are more or less vulnerable to a disaster (Wisner et al. 2004). Social factors that can increase vulnerability can include living in an unsafe building, having a dangerous occupation, or living in a politically tumultuous region (Wisner et al. 2004). Disaster or natural hazards exist, but risk perceptions are mitigated and interpreted by social and cultural processes, which can include, “poverty, marginalization, and intolerance…as well as the legacy of resource dependence” (Flint and Luloff 2005:405).

The cognitive psychological approach to risk emphasizes that the individual plays a role in defining the risk, rather than simply an actor playing out a role in their socio-cultural context or an actor without agency in the threat of a hazard, as the sociocultural and technico-scientific approaches argue. Risk calculations are made by experts and then can be compared with risk perceptions of individuals in the community (Lupton 2013). For example, Slovic’s (1987) seminal study investigated how people responded to different hazards by creating a “perceptions of risk” map that included 81 natural and
human hazards. This perceptions matrix explored the different ways that the public measures and interprets risk, providing support for a psychometric paradigm that could predict individual responses to new risks. Using this approach, respondents to a questionnaire are able to rank order the riskiness of different hazards, making it possible to reliably compare different groups of each other, and interpret the different factors experts and non-experts consider when determining riskiness of an activity (Slovic 1987). For example, experts tend to mainly consider how many fatalities are likely to occur from an activity, while laypeople may also consider threat to future generations or the potential for a catastrophe (Slovic 1987). Exploring the ways in which individuals perceive risk is valuable, especially if combined with an exploration of cultural and social factors the individual is situated in and understanding the hazard that is present.

Interpreting risk perception then, requires the ability to weave technico-scientific, socio-cultural, and cognitive psychological approaches together in order to gain a deeper understanding of how people formulate risk perceptions (Kasperson et al. 1988). The next section will examine the relationship between risk perception and social position and source of information.

RISK AS IT RELATES TO SOCIAL POSITION AND INFORMATION SOURCES

Fischhoff et al. (1981) provide a thorough explanation of the issues related to how societies analyze risk, as societies must consider tradeoffs and how to balance a multitude of risky behaviors. Fischhoff et al. (1981), argue there are five main reasons why it is challenging to have a consensus on risk perception: 1) there is uncertainty over what a “hazard” is, 2) there are different measurement tools used to analyze the “facts”, 3) different groups hold different values, 4) humans can be biased or make mistakes in
measurement so it is difficult to decide which information to trust, and 5) it is difficult to assess whether the right decision was made regarding how the risk was analyzed. Thus, understanding risk perception is complicated. Here I specifically consider how social position and information sources interact with environmental and health risk perceptions, the foci of my thesis.

Social Position

The literature shows potential gain from the activity causing a risk plays a role in the development of risk perceptions (Sjoberg 2000). For example, through a technico-scientific analysis a hazard, such as an aging oil well, may be identified, but there still needs to be an assessment of how likely the well is to leach chemicals into the surrounding environment and how desirable the impacts are relative to the benefits of the oil well and the costs of repairing or replacing it (Fischoff et al. 1981). That is, what are the potential gains? McDaniels et al. (1995) sought to measure perception in ecological risk management through surveying focus group participants. They found that risk perception is either heightened or lessened depending on perceived benefit (McDaniels et al. 1995). For example, survey respondents were found to perceive aerosol cans as more risky to ozone depletion than air conditioning, attributing this difference in risk perception to respondents placing increased benefit on air conditioning (McDaniels et al. 1995). While inherent risk of death or injury accompanies all activities, the level with which risk is perceived may be counterbalanced by a benefit like the reward of money or the ability to keep living in a place that is home. In their study comparing resident and community leader perceptions of a proposed gold cyanide process mine, Richards and
Brod (2004) also found that perceived economic benefits played an important role in the differences in perception. Although community leaders and residents did not significantly differ in risk perception, more leaders than residents perceived potential personal economic benefits from the mine, and among both groups perception of economic benefits was positively correlated with level of support for the mine (Richards and Brod 2004).

The individual values and tradeoffs adopted by individuals living in a stigmatized community can increase risk perception (Gregory and Satterfield 2002). So, for example, while an individual living outside an oil and gas region may only see the rates at which waterways are polluted, the lived reality of the individual in the oil and gas region is one in which they may have been around oil and gas wells for several years without incident, and benefited from the economic value brought to the community. Experts may determine hazard potential of a risk but individuals may base their risk perception on familiarity with the hazard as well as their experience in avoiding the risk. Based on a survey implemented on mortality causes and risk perception of technology, Bastide et al. (1989) found that risk perception is more likely to be amplified by those who are divorced, have lower incomes, or are unemployed, while those with higher education and higher income tend to have decreased risk perception. This suggests that social position, comprised of perceived benefit and position in the community, correlates to risk perception, and a risk does not simply act on a populace in a uniform way. Boholm (1998), referencing a connection Bastide et al. (1989:149) made between risk perception and Durkheim’s classical theory of anomie, stated:

In a state of anomie, due to a vulnerable and insecure social position, which might be triggered off by divorce, poverty, illness, or unemployment, individuals can
experience a sense of hopelessness which gives rise to a tendency to overestimate risks. In those cases in which studies of the perception of risks have included respondents with marginal social status, living in extremely poor conditions, their ratings with regard to perceived risks have indeed tended to be very high.

Examining the relationship between gender and ethnicity with risk, Finucane et al. (2000) discovered that white males perceived less risk than females and nonwhites, concluding that the difference emerged as a result of a difference in power, not simply a function of race or gender, called the ‘white male effect’. The researchers argue more power or having a higher socioeconomic status can then have an attenuating effect on risk perception (Finucane et al. 2000). Savage (1993) supports this finding in his study of resident perceptions of risk in Chicago, finding that women, people with lower income, lower education, younger people and African Americans had an increased fear of impacts.

Literature exploring environmental injustice has found that different populations are exposed to environmental and health risks in unequal ways, thereby showing a related increase in risk perception among those in lower social positions. Brulle and Pellow (2006) reviewed previous literature on environmental justice and inequality, finding that those in lower social positions are impacted by environmental risks differently than those in higher social positions. For example, Evans and Kantrowitz (2002) found that those who are poor are exposed to a disproportionate amount of unhealthy environmental conditions such as hazardous waste, and air and water pollution. Using an environmental justice framework to focus on hydraulic fracturing communities, Ogneva-Himmelberger and Huang (2015) found that those more susceptible to pollution exposure from oil and gas wells tended to be poor. Beck (1992) emphasizes the point of stratification of
environmental risks, in stating that populations are exposed to environmental risks based on how power is distributed in society, where those in higher social positions hold power and those in lower social positions are exposed to more risks.

In addition to gender, race, and poverty, agency—the ability one has to act independently and make choices—is also related to perception of risk, and one’s social position. Walker et al. (1998) found that compared to higher socioeconomic classes, disadvantaged populations were less likely to trust state agencies and experts, and less likely to feel like they could challenge authority, thereby lessening their feeling of agency. Determining the differing levels of support between community leaders and residents for a waste facility siting, Spies et al. (1998) found that residents were influenced most strongly by health, safety, and environmental risk perceptions, and leaders were more influenced by economic benefits and how satisfied they were with community participation in the decision making process. Because of leaders’ position in the community, they perceived that they were more responsible for the economic future of the community than residents, although their private economic interests in relation to the waste siting facility did not affect their perceptions (Spies et al. 1998). In the case of hydraulic fracturing it may be that leaders and residents may differ in their feeling of agency, impacting their perception of risk.

This brief review indicates risk perception interacts with a variety of variables, most notably for this study, with perceived benefit to be gained from the activity, socioeconomic characteristics, and position in the community.
Information Sources

The ways that perceptions of risk are related to information sources has also been examined in the literature. Risk perception can either be amplified or attenuated in the transfer of information, either through the media or informal personal networks (Kaspersion et al. 1988). In forming risk perception, individuals develop their beliefs through a process where they take information in, analyze it based on the source they received the information from, and determine how credible it seems (Renn et al. 1992). The source of information then matters in determining how the individual will interpret the risk.

When examining media as an information source, Tierney et al. (2006) found that the way in which media outlets reported impacts in the aftermath of Hurricane Katrina lead to an amplification of risks, irrespective of the actual impacts, as the media tended to sensationalize events. They found that the media tended to place emphasis on New Orleans as a place of lawlessness and rampant looting and violence in the absence of any concrete evidence that crime had been taking place, which Tierney et al. (2006) claim may have caused emergency responders to place more emphasis on maintaining the law rather than actually helping disaster victims. The media places emphasis on rare or dramatic risks, leading to media coverage defining the issue (Kaperson et al. 1988).

Examining media coverage of Love Canal and Three Mile Island, Kaspersion et al. (1988) observed that a large amount of information focused on a particular event can increase perceptions of risk. Combs and Slovic (1979) also found a relationship between media reporting and leading causes of death. They found that media tended to overemphasize homicides, natural disasters, and accidents as causes of death but underreported disease,
which may have an influence on perception of risks (Combs and Slovic 1979).

Informal social networks, such as those that exist among friends or coworkers, may also have an effect on amplifying or attenuating risk perception, and may be resistant to new information that disagrees with their risk perception (Kasperson et al. 1988). In effect, the values of the social network may become intertwined with the original perception of risk, leading to increased difficulty of changing risk perception when given new information (Kasperson et al. 1988). Coleman (1993) surveyed a sample of New York state residents on how interpersonal communication may impact how individuals perceive risks to society in general and to themselves, in relation to several common risks such as heart disease, smoking, AIDS, and others. She found that interpersonal communication only increased risk perception when talking about risks posed to society but was not a statistically significant indicator of risks posed to individuals (Coleman 1993).

Thus far this literature review has provided a background on different approaches to risk perception, and the ways that risk perception interacts with social position and information source. I now turn to discussing risk perception within hydraulic fracturing communities.

RISK PERCEPTION IN HYDRAULIC FRACTURING COMMUNITIES

Up to now, research conducted on risk perception in hydraulic fracturing communities have identified three main drivers of risk perception, including 1) socioeconomic factors, 2) information sources, and 3) the scale of development found in the community. I discuss each in detail below.
Researchers have discovered numerous socioeconomic demographics are related to risk perception of hydraulic fracturing. For example, using a nationally representative U.S. sample (N=1061), Boudet et al. (2013) examined public perceptions of hydraulic fracturing including: “top of mind” associations (affective imagery attached to hydraulic fracturing such as sights and smells); familiarity with the issue; levels of support/opposition; and predictors of these judgments. The researchers found that there was limited familiarity with the hydraulic fracturing process and uncertainty over whether they should support it (Boudet et al. 2013). Specifically, findings relevant to my study were that those who read newspapers more than once a week and those who associate the process with environmental impacts were more likely to oppose fracking. People more likely to support fracking tended to be older, hold a bachelor’s degree or higher, watch TV news more than once a week, and associate the process with positive economic or energy supply outcomes (Boudet et al. 2013). Davis and Fisk (2014) also analyzed national survey data of public attitudes towards hydraulic fracturing. They found that women and people in urban areas were slightly more likely to oppose fracking (Davis and Fisk 2014).

Using a mail survey, Jacquet and Stedman (2013) examined landowner perceptions of wind farm development and natural gas drilling in Pennsylvania and found that both the perceived positive and negative impacts of natural gas drilling was greater than for wind energy. These perceptions, along with place meanings that respondents ascribed to the area, explained attitudinal variation toward risk of hydraulic fracturing (Jacquet and Stedman 2013). Interestingly, factors that were perceived as having the
greatest impact on residents like traffic, crime, noise, and water, had little relation to residents’ attitudes towards natural gas and wind development, finding that those both for and against both kinds of development agreed on the negative effects (Jacquet and Stedman 2013).

Also in Pennsylvania, in the Marcellus Shale region, Brasier et al. (2013) explored the perception of risk of hydraulic fracturing by surveying residents on six dimensions of risk including: preventability of risks, knowledge of risks, weighing of costs and benefits, catastrophic potential, reversibility of harm, and inequitable distribution of benefits. Preventability and inequitable distribution of benefits were the only categories that respondents have increased perception of risk on. Brasier et al. (2013) found that the issue of preventability of risk was tied to trust in industry to address issues and government institutions to minimize risk through effective policies and regulations. The researchers also found that there was concern over inequality of impacts and that certain populations are profiting while others are harmed (Braiser et al. 2013).

Conducting focus group interviews with youth and educators in areas of the Marcellus Shale region that have been most heavily drilled, Schafft and Biddle (2015) discovered ambivalence over the benefits that oil and gas development has brought or will bring in the future. The youth interviewed attach positive descriptors to the economic opportunities brought by development, but were also troubled by the associated impact to the natural environment, which is often expressed in a way that suggests there has been massive physical alteration of the land and a change in landscape (Schafft and Biddle 2015). Schafft and Biddle (2015) also found that youth are generally concerned about accidents that could affect the water table. Interestingly, Schafft et al. (2014) found
similar perceptions of ambivalence among educators, observing that educators were positive about economic impacts but uncertain of current or future social and environmental impacts.

Crowe et al. (2015a) analyzed differences in levels of residents’ support and opposition to shale oil and gas development in the New Albany shale play by examining frames used by government leaders compared to general public frames. According to Crowe et al., (2015a) framing is the way that people use rhetoric and language to describe an event. Using interview, survey, and participant observation data they found that government leaders supported shale development on the whole, while the public was more split on its benefits (Crowe et al. 2015a). They determined that the gap in perception might be attributed to sociodemographic characteristics and role expectations, as government leaders are primarily concerned with the economic well-being of the community (Crowe et al. 2015a), and by extension, see more economic opportunity with the activity. In a related study, Crowe et al. (2015b) surveyed a sample of city and county level government officials across six different shale plays, including the Eagle Ford, seeking to understand perceptions of impacts and how this related to their stance on development. They found that leaders were less likely to want to ban shale development if they believed shale development would improve the community’s economy, infrastructure or environment, but were more likely to favor a ban if they had visited other communities with shale development (Crowe et al. 2015b). Furthermore, officials with higher education were more likely to desire a ban on shale development than those with lower education (Crowe et al. 2015b).
Information Sources

Related to information sources, terminology that is used has also been shown to have an impact on risk perceptions. Clarke et al. (2015) examined how terminology used to describe hydraulic fracturing can serve as issue frames, described above, and influence public opinion. Analyzing national U.S. survey data, they found that people are more supportive of energy processes when it is called “shale oil” or “gas development” compared to “fracking”, holding a higher perception of risks compared to benefits when it is called “fracking” (Clarke et al. 2015:137). The researchers concluded that using different terminology conjures up different social, economic, and environmental impacts, which may lead to miscommunication between different groups. For example, using the term “fracking” conjured negative associations associated with environmental impacts like water contamination, while “shale oil” or “gas development” conjured positive associations associated with economics, like jobs being created (Clarke et al. 2015).

Although the study does not measure risk perception, Theodori et al. (2014) compared public views on hydraulic fracturing of high well-density and low well-density communities in the Marcellus Shale using survey data of residents, thus far the only research found that asks survey participants to specifically identify information sources in the hydraulic fracturing context. They found that respondents in high well-density communities were more knowledgeable about the process of hydraulic fracturing than those in low well-density communities. Regarding sources of information, they found that newspapers, industry, environmental groups, and landowner groups were more likely to contribute to respondents’ knowledge of hydraulic fracturing than regulatory agencies,
extension, professors, or the film Gasland⁴ (Theodori et al. 2014).

In a study examining hydraulic fracturing and the relationship between information sources and belief superiority, Raimi and Leary (2014) conducted several online and in person surveys, either recruited through Amazon’s Mechanical Turk system or randomly asked to participate at an outdoor flea market in North Carolina. They surveyed individuals in order to determine belief superiority (belief that one’s own beliefs are more correct than others) by asking participants to read articles that either confirmed or contradicted their position on hydraulic fracturing. Raimi and Leary (2014) found that respondents who were high in belief superiority were more likely to think their attitudes on hydraulic fracturing were right, that others were less informed than them, and that respondents became even more certain of their belief after reading information on hydraulic fracturing, even if the information contradicted their belief. The researchers (Raimi and Leary 2014:84) conclude that the type of information a person is exposed to can influence their attitude, saying that;

If people who oppose fracking tend to read or hear only about the dangers of this process rather than the benefits, they may not only strengthen their attitude about the topic but also feel more superior about their position. Exposure to one-sided information is particularly likely with fracking because anti-fracking activism has received more press attention than pro-fracking arguments.

They attribute their finding that people who oppose hydraulic fracturing have greater belief superiority to evidence that possible negative impacts of hydraulic fracturing are more visible and concrete, such as images of people lighting their water on fire, but positive effects of hydraulic fracturing, like economic benefits, are harder to

⁴ Gasland is a documentary film by director Josh Fox focusing on communities impacted by hydraulic fracturing.
recall and present as counter arguments to concrete environmental impacts (Raimi and Leary 2014).

Malone et al.’s (2015) study is a pertinent example of how the public does not have enough information available in order to determine if there are environmental and health impacts related to hydraulic fracturing. Malone et al. (2015) developed a “Data Accessibility and Usability Index” on a 100 point scale to assess data quality from oil and gas companies based on five categories of data including wells drilled, violations, production, waste, and class II disposal wells. They assessed the quality and availability of data on unconventional oil and gas development in 10 states with drilling activity and derived an average score of 67.1 out of 100 across all 10 states, with Texas scoring the lowest score of 44, a value they deemed insufficient for data transparency (Malone et al. 2015). This study provides evidence for the need to explore how transmission of information operates at the local level, particularly important when Texas scores so low on data transparency.

*Scale of Development*

In addition to information sources, scale of development, which is related to how familiar an individual is with hydraulic fracturing, is related to risk perceptions.

Synthesizing information from risk literature, opinion surveys, and case studies of regulation of unconventional gas development in eight states, Graham et al. (2014) found that unconventional gas development is more likely than other forms of energy extraction

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5 Class II disposal wells are only used to inject fluids that are the byproduct of oil and gas development, and is composed mainly of salt water that is brought to the surface during the hydraulic fracturing process.
to be seen as risky. The researchers found that regulatory bodies are not widely trusted and are variable in their ability to manage unconventional gas development as there are not strong federal standards, which they say leads to more public support for stricter regulation (Graham et al. 2014). Perception of risks increase as unconventional gas development is more ubiquitous, although risk perception decreases when benefits are perceived, similar to research findings previously discussed (Graham et al. 2014). The researchers (Graham et al. 2014) conclude that risk perceptions of unconventional gas development will increase based on potential hazards of development, rather than on any evidence showing that there have been significant impacts.

Using survey data from 309 school districts in the Marcellus Shale, Schafft et al. (2013) analyzed the ways local school administrators perceive risk and opportunity of gas extraction. They found that perceptions of risk decrease as perception of economic opportunities increases, and that socioeconomic, environmental, and economic risk and opportunity were associated with the amount of local drilling being done (Schafft et al. 2013). Increased local drilling lead to increased environmental and socioeconomic risk perceptions but also increased perception of economic opportunity, while decreased drilling was related to inverse perceptions. Their findings suggest that since the extent of drilling is such an important predictor of perceived challenges and opportunities, perceptions will vary greatly across a region based on the stage of development, showing how perceptions may change greatly over time (Schafft et al. 2013). In a later study utilizing the same survey data, plus interview data, Schafft et al. (2015) found that respondents in areas with high levels of drilling were more likely to perceive positive local economic benefits, but also perceive increased inequality, increased vulnerability to
disadvantaged residents because of factors such as increased housing and rent costs, and more infrastructure issues, such as deterioration of roads.

The above studies of risk perception in hydraulic fracturing communities have found that multiple factors are related to risk perception, including socioeconomics, the information sources/terminology used to communicate hydraulic fracturing to the public, and the scale of development. Additionally, literature on resident perceptions in hydraulic fracturing communities have found several commonly expressed perceptions of specific environmental and health impacts to which I now turn.

RESIDENT PERCEPTIONS OF ENVIRONMENTAL AND HEALTH IMPACTS

Risk perceptions of environmental and health impacts are important to consider as they have a dual relationship with human and non-human populations, and provide an understanding of how ‘objective’ hazards are interpreted by the public. The published research to date on perceptions of environmental and health impacts of hydraulic fracturing has found that residents are concerned about issues related to water quality, quantity, air quality, and health, as discussed below.

Water Quality and Quantity

The research finds that in terms of environmental and health impacts residents in oil and gas communities appear primarily concerned with water quality and quantity. Water quality and quantity concerns appear to be fairly widely dispersed throughout the literature, with residents commonly citing uncertainty and concern that water quality is being degraded or that water supplies are diminishing too quickly.
For example, Anderson and Theodori (2009) and Brasier et al. (2011), in their studies of Texas and Pennsylvania residents respectively, found high levels of environmental concern regarding impacts of energy development on the availability of clean, fresh water. In addition, residents in many rural communities rely on private wells and are concerned with how their drinking water may be affected by the injection of chemicals underground during the hydraulic fracturing process (Brasier et al. 2011). For example, residents in a southwestern Pennsylvania community were surveyed on perceptions of how unconventional gas development is affecting water quality. Of the 143 respondents surveyed, 56 (39%) indicated a perceived change in water quality and quantity, and 63 (44%) did not report any issues, while the rest were unsure (Alawattegama et al. 2015). In another region in the Marcellus Shale in Pennsylvania, individuals expressed concern that surface water quality may be affected in much the same way that coal mining has left a scar on Appalachian communities, with a particular concern that companies will not take responsibility for their role in detrimentally impacting water quality (Brasier et al. 2011).

Ladd (2013) analyzed community stakeholder interviews in the Haynesville Shale formation in Louisiana. He examined perceived negative impacts of hydraulic fracturing and belief in if benefits outweighed costs of hydraulic fracturing. He found that while stakeholders viewed positive socioeconomic impacts of hydraulic fracturing, a large minority (31%) also perceived negative social, economic, and environmental impacts. The most common negative environmental impact perceived concerned water issues, such as use of freshwater or potential for contamination (80% and 63% of respondents respectively expressing these concerns) (Ladd 2013).
Similar to other regions that have dealt with an increase in hydraulic fracturing, preliminary evidence shows that residents in the Eagle Ford region are also concerned with water quality and quantity issues. Li et al. (2014) implemented a multi-stage probability sample of 1590 respondents in seven counties in the Eagle Ford region, including my two study sites (Karnes and La Salle counties), in order to investigate social and economic impacts of oil and gas development. Preliminary results suggest that water, both quality and quantity, air pollution, and general environmental impacts were some of the top concerns of residents, with the majority of residents believing that the situation for the environment has worsened since 2010, when the drilling activity began to really increase (Li et al. 2014).

*Air Quality*

Although found to a lesser extent in the research, air quality is also mentioned as an impact from hydraulic fracturing. After conducting 35 semi-structured interviews with different people affiliated with hydraulic fracturing in the Haynesville Shale region of Louisiana, Ladd (2013) found that 34% of people perceived dust and odors associated with hydraulic fracturing posed a threat to domestic livestock, pets, and wildlife, while 29% perceived hydraulic fracturing was contributing to greater levels of pollution, carbon dioxide, and climate change. Anderson and Theodori (2009) and Brasier et al. (2011), both studies mentioned in relation to water impacts, also found evidence of residents’ concern for air pollution in general related to hydraulic fracturing. Neither study discussed air quality impacts at length, as Brasier et al. (2011) mentioned that several interviewees mentioned air quality as a concern, while Anderson and Theodori (2009)
found that one respondent was particularly concerned about air quality.

**Health**

General health risk perceptions have been understudied in relation to hydraulic fracturing. Through surveying residents in a primary care medical office located in the Marcellus Shale region, Saberi et al. (2014) were able to explore the degree to which people believed their medical symptoms were related to unconventional oil and gas development. They found that 22% of respondents perceived unconventional oil and gas development to be a health concern, and 13% thought their medical symptom was a direct result of exposure to development. Respondents who were ill attributed a variety of their symptoms to oil and gas development, including sleeping difficulty, anxiety, ringing in ear, sinus problems, headaches, balance difficulty, trembling of hands, tingling of extremities, dizziness, seizures, nausea, vomiting, diarrhea, stomach pain, and palpitations (Saberi et al. 2014). The findings are particularly important according to the researchers because simply looking at medical records is unlikely to provide sufficient information on where individuals believe their symptoms to have originated, leading to the necessity to conduct more thorough reviews of health risk perceptions, which will allow health practitioners to more effectively treat symptoms that may be originating from unconventional oil and gas development (Saberi et al. 2014). In addition to Saberi et al. (2014), who explicitly examined health risk perceptions related to hydraulic fracturing, some of the previously mentioned studies that found environmental risk perceptions also discuss health concerns. Health risk concerns are mentioned in previous literature pertaining both to water and air quality (Anderson and Theodori 2009; Ladd
Anderson and Theodori (2009) found that respondents were concerned about the potential for gas leaks and explosions, as well as the location of injection wells and the possible impact this could have on increased cancer cases in the region. Additionally, Ladd (2013) found survey respondents were also concerned about well explosions, although only a minimal percentage (9%) perceived that there were adverse effects directly to human health.

CONCLUSION

The above literature review shows factors related to risk perception include socioeconomics, information sources, and scale of development (Clarke et al. 2015; Graham et al. 2014; Theodori et al. 2014). When specifically examining hydraulic fracturing, thus far the literature on residents’ perceptions of environmental and health impacts of hydraulic fracturing has focused on issues related to water quality and quantity, air quality, and public health (Anderson and Theodori 2009; Brasier et al. 2011; Ladd 2013; Saberi et al. 2014). Absent from the literature though, is a discussion of how social position and information sources are related to risk perception and how perceptions differ among community leaders and the broader public in hydraulic fracturing areas.

This gap in knowledge is important to fill as it will provide information on how different populations perceive they are being affected by hydraulic fracturing, a research avenue advocated for in previous research (Schafft 2015). Understanding risk perception of the public is also important because public opinion can have an impact on political, social, and economic actions taken to address a risk (Leiserowitz 2005). In addition, the Eagle Ford Shale region is as of yet an understudied region, and examining risk
perceptions is one way to understand the perceived impact of hydraulic fracturing in the region. I now turn to chapter III, which provides an explanation of the background and methods I used for my study.
CHAPTER III

METHODS

To understand how residents perceive the health and environmental risks associated with the Eagle Ford Shale oil and gas boom, and if these perceptions differ by social status and information sources, I conducted a qualitative analysis of key informant and focus group interview data, as well as incorporated descriptive statistics from survey data. In this section I give a background of the study site region, followed by my research questions, and an explanation of my methodology.

BACKGROUND OF EAGLE FORD SHALE REGION

The context for this research is the Eagle Ford region of South Texas, a region that has seen increasing oil and gas development since 2008. Specifically, I focus on two counties in the Eagle Ford Shale play; La Salle County located at the western end of the shale play and Karnes County located at the eastern end of the play (see figure 3). The Eagle Ford Shale play spans a region that starts at the Mexican border near Laredo in Gonzales County to Lavaca County at its eastern edge (see figure 3). The Eagle Ford Shale was selected due to the connection of this research to a larger study being conducted in the region6. Within the Eagle Ford Shale play, different regions produce natural gas, condensates, and oil. This allows producers to focus on areas that are

6 This larger project is funded by the US Department of Energy, through a partnership with the Houston Area Research Center (HARC), and is focused on assessing the perceptions of local residents of the oil and gas industry and the rapid expansion of development that is occurring in their communities. The goal of the larger project is to create a communications toolkit that will assist in improving the two-way communication between the oil and gas industry and residents of communities where this development is taking place.
producing the most economically valuable minerals at any given time. The northern arc produces primarily oil, while the southern arc produces mainly dry gas. Wet gas condensates are produced in the middle arc (Potterf et al. 2014). Most of the activity is in the western region, moving east, and Karnes County is referred to as “ground zero” for the activity (Morris et al. 2014).

The Eagle Ford Shale region has been particularly prolific, with Karnes and La Salle Counties yielding in the top five in production over the past five years in the state of Texas (Drillinginfo 2015). According to 2013 Census data, compared to the rest of Texas both Karnes and La Salle County have above average Hispanic populations, poverty rates, elderly populations, and jobs in mining, quarrying, and oil and gas extraction (Table 1). Karnes and La Salle Counties, compared to the state of Texas, also have below average household incomes, a smaller percentage of people that hold a bachelor’s degree or higher, and a smaller percentage of their population earning $50,000 or more (Table 1). Comparing both counties reveals that La Salle County has a much higher Hispanic population than Karnes County, while Karnes County has a higher median household income (Table 1). Additionally, Karnes County has a higher percentage of people earning $50,000 or more and that hold a bachelor’s degree, but a lower percentage of jobs in mining, quarrying, and oil and gas extraction compared to La Salle County (Table 1).

In terms of oil and gas production, La Salle and Karnes Counties have fairly equal trajectories of extraction from 1994 to 2014 (Figure 4). Karnes County extracts slightly more oil than La Salle County, while the reverse is true for gas extraction, although as of 2013 the trend appears to be changing in that Karnes County is also extracting more gas (Figure 4). Combining oil and gas production of counties in the Eagle Ford Shale, Karnes
and La Salle Counties place one and three, respectively, in terms of total yield over the
past five years (Figure 5). In 2014, La Salle County produced more barrels of oil than
Karnes County, but Karnes County produced a higher volume of gas (Table 2). Karnes
County has more oil and gas operators than La Salle County, but La Salle County has
more producing leases and drilled wells (Table 2). Both La Salle and Karnes County have
fairly similar scales of oil and gas development but there are a few important
demographic distinctions that make each county unique.

Figure 3. Map of Eagle Ford Shale
Table 1. Karnes and La Salle County Demographics

<table>
<thead>
<tr>
<th></th>
<th>La Salle</th>
<th>Karnes</th>
<th>Texas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Population</td>
<td>6,921</td>
<td>14,916</td>
<td>25,639,373</td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>83.2%</td>
<td>50.3%</td>
<td>37.9%</td>
</tr>
<tr>
<td>White, not Hispanic</td>
<td>15.6%</td>
<td>39.8%</td>
<td>44.8%</td>
</tr>
<tr>
<td>Persons 60+</td>
<td>18.7%</td>
<td>18.9%</td>
<td>15.4%</td>
</tr>
<tr>
<td>Poverty Rate</td>
<td>21.7%</td>
<td>23.3%</td>
<td>17.6%</td>
</tr>
<tr>
<td>Median Household Income</td>
<td>$26,756</td>
<td>$42,862</td>
<td>$51,900</td>
</tr>
<tr>
<td>Earning $50,000 or more</td>
<td>24.5%</td>
<td>43.3%</td>
<td>51.6%</td>
</tr>
<tr>
<td>B.A. or Higher</td>
<td>5.1%</td>
<td>11.2%</td>
<td>26.7%</td>
</tr>
<tr>
<td>Jobs in Mining, Quarrying, and Oil and Gas Extraction</td>
<td>13%</td>
<td>7%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Source: 2013 American Community Survey 5-year Estimates
Figure 4. Oil and Gas Production for La Salle and Karnes Counties, 1994-2014. Source: Texas Railroad Commission

Figure 5. Eagle Ford Cumulative Production (20:1 BOE) by County Source: Drillinginfo DI Analytics Production Dashboard.
Table 2. Karnes and La Salle County Oil and Gas Production as of July 2015

<table>
<thead>
<tr>
<th></th>
<th>La Salle</th>
<th>Karnes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Producing Leases</td>
<td>1565</td>
<td>1086</td>
</tr>
<tr>
<td>Producing Operators</td>
<td>38</td>
<td>60</td>
</tr>
<tr>
<td>Drilled Wells</td>
<td>6022</td>
<td>5729</td>
</tr>
<tr>
<td>Barrels of Oil Produced</td>
<td>231,775,121</td>
<td>80,988,642</td>
</tr>
<tr>
<td>Volume of Gas Produced</td>
<td>63,202,424</td>
<td>241,094,648</td>
</tr>
</tbody>
</table>

Source: www.texas-drilling.com and www.drillingedge.com

Both counties also have several sources of information that are publicly available. Karnes and La Salle Counties each have local newspapers. The Karnes Countywide (http://www.mysoutex.com/home_karnes) operates out of Kenedy Texas, and provides local news for residents of Karnes County on a weekly basis. The Frio-Nueces Current (http://frio-nuecescurrent.com) operates out of Pearsall, Texas and serves both Frio and La Salle Counties. In addition to a newspaper serving the county, Karnes County also operates a website (http://www.co.karnes.tx.us_) which has information on financial reports and budgets, as well as commissioner’s court minutes. La Salle County also operates a website (http://www.co.la-salle.tx.us) that contains information on financial reports, budgets, and commissioner’s court minutes. Karnes and La Salle Counties also operate Facebook pages, which provides community information.
METHODOLOGY

My two research questions are:

RQ1: How do residents’ perceptions of environmental and health risks in the Eagle Ford Shale region of Texas differ by personal experience and social status (defined as potential personal gain and position in community)?

RQ2: How does social status interact with the way people receive information regarding hydraulic fracturing in the Eagle Ford?

The data used to answer these questions come primarily from two interview data sets collected in the Eagle Ford Shale region. Data from key informants were collected through conducting 13 interviews with 17 key informants in two counties in the Eagle Ford Shale Play: La Salle and Karnes County. I focus on these counties to be comparable with the focus group data (discussed below). The interviews were conducted from May 2013 to January 2014, lasting an average of one hour each. Key informants were chosen to represent leadership positions in each county and included county judges, extension employees, school superintendents, chamber of commerce members, religious leaders, city managers, and social service workers.

In February 2014, eight focus group interviews were conducted, with groups ranging in size from two to 18, in La Salle and Karnes counties. Focus group participants were selected using purposive sampling to represent three groups of residents: landowners, elderly, and low income. These three groups were chosen because key informants indicated these groups as the most likely to be impacted by hydraulic fracturing activity in both positive and negative ways. In total there were 24 landowners, 11 elderly, and 19 low income participants in the focus groups. Focus groups lasted an average of one and a half hours, and were held at local restaurants during breakfast,
lunch, and dinner time, with meals provided by the research team.

All interviews were recorded and transcribed and form the basis of the analysis. Interviewees were assured confidentiality so all interviewees will only be identified by the group they are affiliated with. Key informants are identified as such because the different occupational roles filled by each key informant provides a diversity of perspectives that represents a group of people in a higher social status (Krannich and Humphrey 1986). Key informant and focus group interviews were coded both for perceived environmental and health risks and also for mention of information sources regarding hydraulic fracturing in the Eagle Ford. Information sources that can process and amplify risk perceptions can include media, scientists, industry personnel, interpersonal networks, cultural groups, politicians, and government agencies (Kasperson et al. 1988). I examined from what sources residents received their information to determine the relationship between information source and risk perceptions of hydraulic fracturing.

I coded the data into themes that emerged relating to perceptions of environmental and health impacts, and the sources of information identified by each respondent, similar to methods used by Anderson and Theodori (2009) and Crowe et al. (2015a), of coding into dominant themes. After the initial coding process into dominant themes, I coded for subthemes using a process comparable to Duerden and Witt (2010) called axial coding. Within certain dominant themes axial coding was used in order to identify commonalities that emerged, and split dominant themes into subcategories. I determined the frequency with which dominant themes emerged, and verified my findings using intercoder agreement, looking for the extent of the breadth and depth of the themes similar to the
methodology of Crowe et al. (2015a). After hand coding I used NVivo 10, a qualitative data analysis computer software package, to sort, reassess, and further analyze transcript data. Data was also analyzed to determine whether respondent’s perceptions and sources of information regarding hydraulic fracturing differ along social position by investigating differences in social status by comparing all four groups. Although I coded for all general data that emerged in the interviews, I paid particular attention to questions that focused specifically on my research questions.

Key informant interviewees were either asked directly about environmental impacts or about general impacts they have observed as a result of hydraulic fracturing. Some of the questions asked included (See Appendix A for full interview guide):

- Have you heard of other environmental issues with this activity?
- When you first found out about the oil and gas development, what was your first reaction?
- Have you heard anyone talk or do you have any personal knowledge about negative environmental impacts?

As with key informant interviews, focus group interviewees were either asked directly about environmental impacts or about general impacts they have observed. Some of the questions asked include (see Appendix B for full interview guide):

- How has oil and gas drilling impacted your life?
- What are the ways oil and gas activity has impacted the community?
- Are there any good impacts from oil and gas activity?

Focus groups required further analysis due to their unique nature. Rather than attempt to analyze each respondent in each focus group as an individual unit of analysis,
the focus group was considered the unit of analysis (Krueger and Casey 2000). In order
to consider the group as a unit of analysis, homogeneity of group participants was
established by sorting groups based on belonging to self-described groups of elderly, low
income, and landowner. Establishing homogeneity is important for analysis of focus
groups, but is also important for maintaining participants’ comfort as people in a focus
group may be influenced by others opinions (Krueger and Casey 2000). To establish
breadth and depth of a particular theme I examined the volume of conversation given to
each particular theme. This is partly determined by the number of times a theme is
discussed in a particular focus group. A descriptive count like this can provide useful
information about level of consensus on a particular theme and give an indication of
response patterns, and in conjunction with description of themes in a qualitative manner,
can provide a more complete analysis (Onwuegbuzie et al. 2009). Unfortunately, this
method of analysis does not allow for documenting focus group members who did not
contribute to a theme, nor does it allow for analysis of individual perceptions
(Onwuegbuzie et al. 2009). Little has been published in the way of focus group
qualitative techniques (Onwuegbuzie et al. 2009), although several studies have used
focus group methodology to examine hydraulic fracturing risk perceptions (Schafft et al.
2015; Williams et al. 2015).

SURVEY DATA – KARNES AND LA SALLE COUNTIES

For each research question I also consider survey data collected for both Karnes
and La Salle Counties. The data comes from a 2015 survey of residents and absentee
landowners in Karnes and La Salle Counties, Texas. The purpose of the survey was to
provide insights into the public’s perception of the energy industry. The survey followed a modified tailored design method, and data were gathered using mail survey techniques (Dillman 2000). An informational letter was first mailed to a random sample of 525 residents and absentee landowners in both Karnes and La Salle Counties in February 2015. A survey questionnaire was mailed in March 2015 to individuals in the sample, requesting that the adult with the most recent birthday respond to the questionnaire. The survey questionnaire contained 39 questions (see Appendix C for complete survey). Two follow-up mailings were conducted in April and May of 2015, with 71 questionnaires total being returned in Karnes County, and 44 in La Salle County (Theodori and Uzunian 2015). Due to a low response rate (11%), and a low number of respondents for each category, only descriptive statistics were computed, as the data are likely not representative of the entire county adult populations. Karnes County had a higher percentage of people responding to the survey age 60 and older, earning $50,000 or more, and with a bachelor’s degree or higher (Table 3). La Salle County had a higher Hispanic population compared to Karnes County (Table 3). Compared to census data available for each county, surveys in both counties represented a lower percentage of Hispanic people, were more educated, a higher percentage of persons 60 and older, and had a higher percentage of people earning $50,000 or more (Table 3).

Two questions were used from the survey to analyze source of information and environmental and health concerns. Questions 2 and 14 (see Appendix C) were used in the survey to examine what environmental and health concerns survey participants prioritize, as well as what sources of information they identified, respectively. Question 2 asked:
Several issues which may or may not be problems in your county are listed down the left hand side of the table below. Please indicate whether the large-scale development of oil and/or natural gas has affected the seriousness of the issue by selecting one of the following three choices – it is “getting better,” “staying the same,” or “getting worse.” Please circle the responses that best describe your answers.

Table 3. Karnes and La Salle County Survey Responses Compared to 2013 Census Data for each County

<table>
<thead>
<tr>
<th></th>
<th>Survey: La Salle County</th>
<th>La Salle County Census Data</th>
<th>Survey: Karnes County</th>
<th>Karnes County Census Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hispanic</td>
<td>52%</td>
<td>83.2%</td>
<td>12%</td>
<td>50.3%</td>
</tr>
<tr>
<td>Persons 60+</td>
<td>59%</td>
<td>18.7%</td>
<td>66%</td>
<td>18.9%</td>
</tr>
<tr>
<td>Earning $50,000 or more</td>
<td>58%</td>
<td>24.5%</td>
<td>85%</td>
<td>43.3%</td>
</tr>
<tr>
<td>B.A. or Higher</td>
<td>24%</td>
<td>5.1%</td>
<td>35%</td>
<td>11.2%</td>
</tr>
</tbody>
</table>

Source: 2013 Census

Response categories included “getting better,” “staying the same,” or “getting worse”. The mean response was used in order to compare what environmental and health impacts survey participants identified as problems for each county. On a scale of one to three, the means that are closer to one identify the environmental or health issue as “getting better” and those closer to three view the issue as “getting worse”. Question 14 asked: “Please indicate how much of what you know about the process of hydraulic fracturing comes from each of the following sources.” Response categories included “none,” “very little,” “some,” and “a great deal.” Those who responded “some” or “a great deal” were recoded into one category as they can be considered participants who
used the information source as a source of information, and those who responded “none” or “very little” were recoded into a category representing those who do not use the source of information.

In order to analyze the data by social position, the survey data was divided into two groups—those with a household income below $30,000, and those with a household income $30,000 and above. According to the 2015 federal poverty guidelines (ASPE, 2015) those at or below $28,410 household income with a family of five are considered below the poverty threshold. Based on interviews with low income individuals, many indicated they had, on average, at least three children, which if considering a two parent household, comprises a family of five, making the cut off reasonably close to the $30,000 or below household income separation made in the survey analysis. Question 39 asked: “Which of the following categories best describes your total 2014 household income from all sources before taxes?” Three response categories of “under $9,999”, “$10,000 to $19,999”, and “20,000 to $29,999” were condensed into one group, and the remaining eleven categories were combined to represent people earning $30,000 or more. Survey data provides supplementary context for qualitative data but also provides a view into additional voices in the Eagle Ford Shale.

In the following chapter I provide an analysis and discussion addressing my first research question.
CHAPTER IV

RISK PERCEPTION AND SOCIAL POSITION

In this chapter I address my first research question: How do residents’ perceptions of environmental and health risks in the Eagle Ford Shale region of Texas differ by personal experience and social status (defined as potential personal gain from drilling activity and occupation)? I begin by presenting dominant environmental and health perception themes that emerged in the data. I first present key informant findings, followed by data from landowners, low income, and then elderly focus groups. I then compare and contrast dominant themes across these four groups.

In order to more fully understand the context of the key informant and focus group interviews though, it is worthwhile to discuss other perceptions that came up during interviews. Table 4 below contains all themes that emerged related to environmental and health risk perceptions and the number of interviews and focus groups that mentioned each theme. For key informants, while environmental issues came up as a major topic, social and economic issues were brought up more frequently. Social issues included traffic and public safety issues, with a primary concern regarding increased truck traffic due to oil and gas development (Potterf et al. 2014). Regarding economics, key informants were generally positive about an increase in local job opportunities, but did express that not everyone was benefiting equally and that the increased cost of living was displacing local people. In focus group interviews, economic issues came up most frequently, followed by environmental and health, and lastly, social issues. Like key informants, focus group respondents were overwhelmingly positive about increased
employment opportunities, although were worried about increased costs of living and increased housing costs. Social issues brought up by focus group respondents included perceptions of a loss of community and worry over the impacts oil and gas workers were having on the community, as well as concern with increased traffic.

My analysis and discussion focuses on the dominant environmental and health risk perceptions identified by respondents, highlighted in bold. There is a need to focus on environmental and health risk perceptions though, because the oil and gas industry and hydraulic fracturing activists focus on environmental and health issues in public debate (Potterf 2014). In both focus group and key informant interviews, environmental and health issues are a main concern but for the most part, are secondary to economic and social issues.

Table 4. Number of Interviews/Focus Groups Dominant Theme Mentioned

<table>
<thead>
<tr>
<th>Theme</th>
<th>Key Informant (n=13)</th>
<th>Landowners (n=3)</th>
<th>Low Income (n=3)</th>
<th>Elderly (n=2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trash</td>
<td>5*</td>
<td>3*</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Water Quantity</td>
<td>3*</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Water Quality</td>
<td>2</td>
<td>2*</td>
<td>2*</td>
<td>1</td>
</tr>
<tr>
<td>Air Quality</td>
<td>1</td>
<td>2*</td>
<td>2*</td>
<td>2*</td>
</tr>
<tr>
<td>Earthquakes</td>
<td>0</td>
<td>0</td>
<td>2*</td>
<td>1</td>
</tr>
</tbody>
</table>

* Indicates that the theme was mentioned in both counties. Bold are dominant themes.
KEY INFORMANT RESULTS

Environmental or health issues overall was not a dominant issue for key informants, but of those identified, three main themes were relevant to environmental and health risk perceptions, including: 1) Trash, 2) Water Quantity, and 3) Water Quality. I discuss each theme below, and provide quotes that illustrate the theme.

Trash

Perceptions of increased trash as a result of oil and gas development was the most discussed theme by key informants. Nearly half (46%) of key informants expressed dismay over seeing more trash in the community with the hydraulic fracturing activity, but also mention increased trash issues on private property.

Key informants have observed increased trash in the community, particularly on the highway. The quotes below express frustration over seeing this increased trash;

[Respondent 1]: And that’s a problem, the trash.
[Respondent 2]: yeah, we have trash everywhere now. We had some before, but even on the interstate it’s not like it is now.

Key Informant, La Salle County

One other thing about environmental issues though that you question, the trash is just atrocious. Of course littering is always a problem, people do it, but that is going to create some sort of environmental issue. Trash isn’t meant to be on the road, it’s not meant for you to dump out of your truck in the Wal-Mart parking lot, so I can imagine that that is going to become a bigger and bigger issue.

Key Informant, Karnes County

Nobody cares. Nobody, when they're driving down the road they throw stuff out the window. And it's just… now a lot of it are these truck drivers. They, it's not their world so they're, it's out the window. And I guess that's, maybe that's probably my pet peeve. I hate it. That's one of those things I absolutely hate. I hate trash on the side of the road.

Key Informant, La Salle County
And, you know, we have, you know, you hate to say it, but you know, we have a lot of trash in our community that we never had before.

   Key Informant, Karnes County

We’ve had a lot of trash being thrown on the road and we’ve had to put a lot of staff on the country road picking up trash.

   Key Informant, La Salle County

Several of the key informants are also landowners who lease their property, and thus give access to oil and gas field workers to work on their property. The following quotes highlight these key informants’ perceptions of increased trash on private property;

   Well, they wanna come through my property with 4 or 5 hundred trucks to do this well on the other property. And I want ‘em to not litter on my property. And, they have all these truck drivers that may or not work for them, that may be subcontractors, but they still litter. My road, I have guys that… that, that work with me and I have ‘em pick up the litter. I'd like to take the trash over to their Head Quarters and kinda spill it in their lobby and say, "Pick it up."

   Key Informant, La Salle County

The following respondent discussed increased trash on their parent’s property;

   And it’s been very trashy. If you want to get trash all over the pad that you are working on then fine. But it better not go through fence, and it had been going through the fence, and so my Dad, who I take after, went down there and was very firm with the company man, and said, “I swear if this happens again I will lock this gate and you will not come back and I don’t care if you can’t drill or whatever. It’s not about the money.”

   Key Informant, Karnes County

These quote illustrate the frustration key informants have over the trash issue, seen particularly in the desire to go dump trash in the headquarters of the oil company they deal with or to simply lock the gate on them. The issue of trash, in general, evoked the highest number of key informants to comment on it and the strongest resentment towards environmental issues the key informants see resulting from oil and gas
Water Quantity

Second, key informant interviewees expressed negative risk perceptions around issues of water quantity related to oil and gas development. Water quantity was mentioned as an issue in three (23%) interviews. The following quotes summarize the concern these key informants have about water being removed from the water cycle.

When you are talking about the volume of water that is being pulled out of circulation, the environment is a concern because that water is going out so far that it is out of, you are taking it out of the natural, you know, rain and evaporation, and you know, you are taking it out of the cycle for a long time. So that is always a concern.

Key Informant, La Salle County

So my concern is more, you know, what’s going to happen to our water, what’s going to happen to, you know, to our infrastructure that’s already so overstressed?

Key Informant, Karnes County

Our biggest worry was water, always has been. We have too many animals out here; we’re high fenced so what do you do with no water? You know, the animals gotta be. They gotta have water to raise em, to take care of em, to do anything, to grow anything. Without that you’re, why have a ranch? To me, that’s actually one of our, one of my top priorities to be, to be honest with you. We have a, we have a number of programs that we do, that we are in the process of ramping up but most landowners don’t realize how much water is being diverted into the oil field and how much water will never come back because they’re using it.

Key Informant, La Salle County

[Respondent 1]: And if they don’t put it through some type of reclamation, which ninety percent of the companies do not, it goes into a deep well and you will never ever see that water again, ever. You will never ever see that water again. And I can’t, I can’t emphasize that enough.
[Respondent 2]: Aren’t there people using some of it now though?
[Respondent 1]: Ten percent.
[Respondent 2]: Ten percent, okay.
[Respondent 1]: There is an article in the, in the New Current, ‘bout six or eight months ago, uh, written by an, an oil company, uh, their marketing person, comparing the amount of water used to frack a well to the amount of water that is
used to grow one circle of peanuts and they were saying how much uh, how much less the oil company uses to, to frack one well, compared to grow one circle of peanuts. And they failed to tell everyone that every, every drop of the water that is used to grow that peanut crop is going back into the hydrologic cycle, every drop of it. And they fail to say that ninety percent of the water that they use to frack a well will never, you'll never see again. So it’s a, it’s a perception thing, nobody and it’s not a, ahh, I won’t say it’s not a blind eye; it’s just that’s it, people don’t know about it.

Key Informant, La Salle County

Responding to a local news article brought up in the previous quote on the use of water in agriculture versus hydraulic fracturing this respondent continues to expresses concern over how hydraulic fracturing removes water from the hydrologic cycle;

He [news reporter] did not address the fact that that frack water is now contaminated. And there's only about a 5% of the disposal companies that are recycling any of that water. So that water that they've used is now contaminated and it's now being disposed of in deep wells that we'll never, ever, ever see again. And people don't realize that. People are not realizing that that water is gone. And we'll never see it again.

Key Informant, La Salle County

These quotes show the worry that some key informant respondents have of hydraulic fracturing exacerbating water supply issues in the region. Although only mentioned by a minority of key informant respondents, they are concerned with the hydrologic cycle being overstressed by hydraulic fracturing.

Water Quality

While the third dominant environmental issue noted by key informants was water quality, only two (15%) indicated this as an issue, and the theme was only found in La Salle County. The main issue of concern regarding water quality was worry of water being contaminated. The following quotes express concern over the potential of
decreased water quality, both for the community residents and the oil and gas workers;

We’ve got actually a, a program coming up, in April I think where we will be doing some well water screenings for oil and gas by-products in the, in the well water, in well water. We did it once as a pilot last November I believe. And believe it or not, two of the samples came back that were contaminated, their well that they were using to drink water from had oil and gas by-products in it. So there is a, there is a correlation there and so we’re gonna have to really look into that.

Key Informant, La Salle County

One respondent expressed concern over exposing oil and gas filed workers to unsafe water;

Okay, potable water is water that you use, can be consumption, showering, washing clothes, the toilet, washing the dishes, brushing your teeth, and non-potable water is it can’t be on the human body, whatsoever. And what’s happened in the industry with TCEQ\(^\text{7}\) is that there is very few potable water haulers, so when you go to the campsite or where a drilling site, you’ve got people hauling water, but it’s not for brushing teeth and it’s not for drinking water, it doesn’t matter. They are showering. And what has happened is we have got some companies out there that haven’t been cooperating, exposing workers to water that is not safe.

Key Informant, La Salle County

The quotes illustrate concern primarily over potential risks perceived related to poor water quality. While these key informants expressed concern over the potential for water contamination, the majority interviewed did not view oil and gas activity as risky for water quality. Rather, it was trash issues that garnered the highest volume of environmental and health risk perceptions.

With all three themes environmental and health risk perceptions expressed by key informants, there is a significant concern among the community residents and oil and gas workers.

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\(^{7}\) The Texas Commission on Environmental Quality is the environmental permitting and enforcement agency of Texas. TCEQ is comprised of the Office of Air, the Office of Water, the Office of Waste, and the Office of Compliance and Enforcement.
informants occurred in less than half of the interviews. I now turn to presenting the findings for the focus group data.

FOCUS GROUPS RESULTS

I separate each focus group below, and provide quotes illustrating the top themes identified by each group.

LANDOWNERS

The top themes identified by landowners included 1) Trash, mentioned in all three landowner focus groups, 2) Air Quality, and 3) Water Quality, both mentioned in landowner focus groups across both counties. I discuss each theme below in order of its dominance in the data.

Trash

Similar to key informants, trash was the primary theme for landowners in all three focus groups.

The quote below provides a general description of the trash issue;

The first really bad session of trash came in when they [oil and gas workers] started doing the pipelines cuz they all came in, they get their, their trucks, they go into town, they’d eat, get whatever, get their ice bags, drive back out, all the ice bags would fly out everywhere, of course, so they mow over them, but that was the first big scene, we thought, “Oh my gosh,” but it was everybody in the heat of the day doing that work and everything, it held the ice, and that made it really bad with all those ice bags out there. Then all their food trash started getting out, they get more and more and more. So it just increased.

Landowners, La Salle County

The following two quotes illustrate how the onus is on the landowner leasing to
the ones who pick up the trash left by the oil and gas companies;

> [Respondent 1]: If, if you’re a landowner on a major road it’s a weekly chore to
go pick up trash out in the field that’s blown across the fence, and just…
> [Respondent 2]: It’s even, it’s even on county roads.
> [Respondent 1]: Yeah.
> [Respondent 2]: County roads too.
> [Respondent 1]: Farm to market roads.
> [Respondent 2]: And there has been an oil company, or several of them that have
hired men specifically to go around and get trash. You can pick it up today and
tomorrow for that, cuz they came through Monday morning, that, the oil field
truck and trailer…With five guys, and there’s already trash and the garbage in my
field…So the oil fields are trying but, you know, it’s like a vicious cycle with
trash.

Landowners, Karnes County

> [Respondent 1]: we’re constantly picking up trash
> [Respondent 2]: You know that is one thing, it’s really
> [Respondent 1]: It’s horrible out that way; it’s just trash everywhere
> [Respondent 2]: It’s every, it every day there’s, especially these plastic grocery
bags, millions of them you see
> [Respondent 1]: You see, the oil field don’t realize that cows will eat those and it
will kill them, so you know, we’re constantly out there, picking
> [Respondent 2]: It could kill them.

Landowners, La Salle County

The quotes suggest the oil and gas companies are trying to some degree to pick up
the trash, but to no avail. Similar to key informants, trash was the most dominant
environmental issue for these groups of landowners. Where these two groups diverge is
with the second most dominant theme—that of air quality.

*Air Quality*

Concerns over air quality were evident in the data in two ways—expressed by
discussing increased dust in the air and concerns over air toxicity. An increase in truck
traffic, one of the contributing factors to increased dust in the air, contributed to
landowner focus group respondents concern over dust in the atmosphere, and possible
related allergies. The following quotes highlight some of the concerns landowners expressed in La Salle County about dust as related to increased truck traffic as a result of oil and gas activity;

[Respondent 1]: When they [truck drivers] get ready to leave, I can look between
mine, my house and my neighbor’s house is just, dusty every afternoon, it’s a
cloud of dust.
[Respondent 2]: When you come in to Cotulla, it looks like Cotulla’s got a dust
bowl over the top of it, you know.
[Respondent 1]: It ends up sometimes, you can come in from San Anton and look
and sometimes it’s an orange cloud

Landowners, La Salle County

You can’t see going down that road sometimes when the dust is going, you can’t
see the trucks.

Landowners, La Salle County

One landowner group also expressed concern over air toxicity related to oil and
gas development, particularly concerned about a salt-water injection well being
constructed near their property. The following quotes show these concerns;

[Respondent 1]: All I had from the Railroad Commission when I complained
about the odor down there was, “Well you dropped your protest, live with it.”
[Respondent 2]: Yes, that’s what this [inability to voice concern] is.
[Respondent 1]: Cuz a lot of gas, gas smell?
[Respondent 2]: I don’t know but it’s enough to almost make you sick to your
stomach and, and also burn your eyes.
[Respondent 1]: That one [salt-water injection well] that, close by us over there
where that solid stuff goes in, you drive by there sometimes you can smell that
gas, I think they ought to have a fire burning over there sometimes, but…

Landowner, Karnes County

Landowners are concerned over the increased dust in the air due to truck traffic,
as well as one focus group mentioning the issue of air toxicity. This finding is different
than what was found in key informant interviews, where air quality was less of an issue.
Water Quality

Concerns regarding water quality were raised by landowners in two of the three landowner focus groups. Landowners hold risk perceptions over water possibly being contaminated by oil and gas development, as shown in the following quotes;

When that water is used for drilling purposes, when it comes back up, it’s considered contaminated water.

[Respondent 1]: My major concern is, is I don’t want my water contaminated and somebody can say until the cows come home that they’re not contaminating our water, when it’s contaminated it’s too late.

[Respondent 2]: Extremely hard to clean up.

Landowners, Karnes County

And to me it tastes funny…It’s just not like the water that was before.

Landowners, Karnes County

Generally, landowners express concern over the possible contamination of water from oil and gas development, although one landowner focus group does mention that they feel the drinking water does not taste the same.

Similar to key informant respondents, trash and water quality issues are brought up among landowner focus groups, although themes are not discussed in the same way as in low income focus groups.

LOW INCOME

The top themes identified by lower income focus groups included 1) Water Quality, 2) Air Quality, and 3) Earthquakes, all three mentioned in focus groups in both counties.
Water Quality

Water quality was the first dominant issue for those with low income—identified by focus group respondents in both counties. The following quotes illustrate the environmental and health risk perceptions low income focus group participants had regarding water quality.

[Respondent 1]: I read and I watch the news and hear about all these other places that have had uh, the fracking going on and you know, those people have already been through it, we’re just kind of starting out, but they’ve already done it and they say that there’s hazard in the water, but nobody will believe that, I mean, you know they’ll disprove that.
[Respondent 2]: Well they can taste it.

Low Income, Karnes County

I think, I think a lot of people are worried about it, but are we worried enough to actually find out who to go to and follow through with checking up on, “Hey come test the water,” and you know, things like that. I know for myself, I mean yeah it’s in the back of my mind, man what, you know what if, there’s hazards in the water but then it’s actual following through with, you know.

Low Income, Karnes County

In one low income focus group, one respondent expressed concern over water quality after being asked whether they had concerns related to drilling activity;

So, what is happening to our water. Now I know that, that our lines are old, some lines are old, I know that they’re replacing, but I don’t know, I told my husband the other day, I said, “Did I have that much dirt?” and I hadn’t been working outside in the yard, I said, “Boy, the water does not look clear.” So now every time I shower I look at the water and the water is not clear. And so I am not working outside because I like to work in my yard, and the water is not a clear color. So my concern is the water. You know, what are they going to do, and I know that they’re supposed to test the water, that’s one of the things that they’re supposed to do, and they used to send us right, like a report, and I haven’t seen a report in a long time as to the quality of water.

Low Income, La Salle County

In all three of the above quotes, there is a sense of uncertainty about the water quality—a sense that it is an issue but not having enough information to know how much
of a risk hydraulic fracturing is to water quality. Despite this uncertainty there is a real concern regarding water quality.

**Air Quality**

Air quality issues discussed by those in the low income focus groups focused on the dust brought on by hydraulic fracturing activity, how both the dust and flaring were contributing to increased medical issues, and how flaring is contributing to poor air quality. The quotes highlight some of the concerns low income respondents expressed about dust, allergies, and flaring.

For example, the following quotes describe the difficulty driving in the bad dust conditions and how increased dust in the air is affecting allergies;

Sometime last week or so, it was kind of, the wind was blowing harder than usual, and, so I’m driving to where I work, man it’s getting foggy this way, it was all the loose dust and it all looked white. It looked foggy, and it was all the dust. I had a bus driver that walks in there, I man, I can’t remember who it was, “This wind, this dust, this is taking me!” But it was bad.

Low Income, La Salle County

You know what else is bad is this dust. It’s messing with everybody’s allergies. Let alone the cars, but that dust is so bad.

Low Income, Karnes County

I was talking to somebody, they said her husband had gone to the Doctor and he had allergies and that his Doctor told him that in a few years, everyone in our, just about everyone in our community is going to have this problem…The allergies. And, um, the Doctor had told him that in a few years, a lot of people would have this because of all of this, because all those flames out there, they’re gonna cause these problems. That’s what she told me her Doctor said.

Low Income, La Salle County

[Respondent 2]: You see a lot of kids getting sick
[Respondent 1]: Yes, we see that a lot in school too.
[Respondent 2]: More than usual this year
[Respondent 2]: Ear infections, all that stuff…my great-grand-daughter, you
know, was taken in with 104 twice to the Doctor.

[Respondent 1]: One of my bus drivers, the baby had 108. And she was full of allergies herself too.

Low Income, La Salle County

One respondent referring to her own voice, which was raspy throughout the focus group, noted;

I’ve been like this since September, my voice. So it has to do with allergies. And there’s a lot of stuff up in the air, which we didn’t have before.

Low Income, La Salle County

Although it was only brought up in La Salle County, low income respondents expressed specific concern over air toxicity related to oil and gas development, such as the chemical discharges related to flaring. While not specifically noting H2S\(^8\), their quotes relate to the H2S gas and show the concerns low income respondents have about an increase in toxins in the atmosphere.

And I want to know what are they going to do to monitor our air control because if you’re here at night you see all those flames, of course they say, “That doesn’t do any, any harm, because it’s, you know, flushing out the bad gasses or whatever,” Well, I don’t care what they say, it’s still up in this, in the atmosphere. So it’s still here!

Low Income, La Salle County

My son…says it [H2S], he says it really does not harm us. Well, I have a question with that, you know, I don’t agree with that. And I understand the purpose of it, you know, the purpose of the flames, but there has to be something…

Low Income, La Salle County

[Respondent 2]: The gasses, you know, last week it was really bad. Even the house inside, I thought it was the sewer and it was not the sewer.

[Respondent 1]: And I guess we’ve gotten used to it but the, um, during the holidays my daughter and my son in law and her kids came down and he says, “Mom, I think it’s time that you moved out of here, that you go with us.” And I go, “Why, we’re fine here, we’re not, we’re in good health, you try to tell us that we’re elderly, but we’re not elderly yet okay? We’re party animals now.”

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\(^8\) Hydrogen sulfide (H2S), or sour gas, is a naturally occurring chemical found in the Eagle Ford Shale formation. Once it is released from the underground rock formations it can aggravate asthma, and cause nausea, headaches, and eye irritation (Morris et al. 2014)
[Respondent 2]: Ha ha ha.
[Respondent 1]: And she goes, “No mom, as soon as we open the doors to our vehicle we could smell gas.” I go, “I don’t smell anything” and my grandkids, “Grandma...” You’re used to it.
[Respondent 2]: Yeah cuz we’re already used to it.
[Respondent 1]: “You can smell fumes Grandma. You don’t smell them?” I said, “Just at the beginning but I don’t smell no more so I guess we’re safe.” “No Grandma, you’re not because we smell it. We smell it.” And some days are worse than others, right?

Low Income, La Salle County

[Interviewer]: Just to be clear when you, when you say you smell gas, you smell gas from the oil field?
[Respondent 1]: It’s like, like that, uh, sulfur type of a thing that, that smells. But, you know, I guess we’ve gotten so used to it that...

Low Income, La Salle County

The breadth and depth of the comments on air quality by those in the low income group shows the high level of concern this group of respondents have over air quality and uncertainty over whether there are associated detrimental health impacts.

Earthquakes

Low income respondents also expressed concern of earthquakes due to oil and gas development. The following quotes highlight perceptions the respondents had over the possibility of earthquakes.

Asked about the hydraulic fracturing drilling technology, these respondents noted;

[Respondent 1]: I’m worried about earthquakes eventually. The way they tell us that they’re, they’re drilling, you know, they’re going this way and, you know underneath the property, you know, because now we hear more of, of Karnes City, where my daughter used to live, earthquake [in] Pleasanton, which we never heard before and now they’re, I mean, you know, it’s a one, it’s a small trembler, you know, we never used to hear that.
[Respondent 2]: And, and I don’t know, but they told me there was a dormant volcano, dormant volcano in the valley.
[Respondent 1]: So there is some type of a small fault line that comes along the area, so that’s another thing too, after I saw that, that news thing on the lady in Karnes City where they had the earthquake, you know, what, what’s happening
underneath the ground, because if you’re taking something out, isn’t there a void underneath?

Low Income, La Salle County

This respondent discusses actually being in an earthquake, or what they perceived as an earthquake⁹;

It’s the most weird feeling, I was actually sleeping in the bed and it just jolted me, and, and my whole equilibrium was just like, “Wait, if something’s not right,” so I just laid there for a while cuz my first instinct was the plant across the street blew up or the eighteen wheelers collided or whatever, that was, and so right away I’m grabbing my cell phone and trying to call my husband, well I couldn’t get ahold of him and uh, I go in and turn on the news and they’re saying that there was an earthquake in and so I went, wow, I said, “I gotta call my neighbor” and I said, “Did you feel that?” She said, “Seven thirty?” I said “Yeah, seven thirty” She said, “Yeah, but I thought the dog was under my bed moving the bed!” And it was, it was a horrible feeling, I mean I can’t even imagine being a humongous earthquake but that was very scary when you don’t know, you know…

Low Income, Karnes County

In the first quote the respondent expresses a real concern that earthquakes could eventually become a problem with the increase in drilling related to hydraulic fracturing, while the second quote describes an earthquake that potentially happened in the area. In both instances there is a concern by those in the lower income group that earthquakes could be due to hydraulic fracturing.

ELDERLY

The last group analyzed is that of elderly focus group respondents. The three top themes found in transcripts related to environmental and health risks included 1) Air Quality, mentioned in both counties, 2) Water Quality, and 3) Water Quantity. Although

⁹ It is unclear which earthquake the respondent is referring to, but there have been 27 earthquakes in the Eagle Ford Shale region since 1983, and more than half have occurred after 2008, when the current oil and gas boom began (Chapa 2015).
other themes were mentioned in elderly focus groups, including trash and earthquakes, dominant themes were selected based on the relative proportion of conversation given to the particular themes selected.

Air Quality

As with low income respondents, elderly focus group respondents perceive environmental and health risks regarding the air quality in their communities. This was the only group that indicated an increase in skin rashes resulting from air pollution, in addition to allergies. The following quotes highlight some of the concerns focus groups expressed about dust, allergies, and skin rashes;

[Interviewer]: What other health concerns do you have?
[Respondent 1]: The allergies.
[Respondent 2]: A lot of people have allergies.
[Respondent 1]: Well it is, kind of, [I] didn’t have problems with my allergies and now I do in the morning, my eyes burn. My allergies, and…
[Interviewer]: Do you, do you talk to a doctor about that?
[Respondent 1]: Yes, but they say allergies.
[Respondent 2]: They don’t say much, they don’t say much, they are getting their money. It’s good for them, business.

Elderly, La Salle County

Another respondent wonders how long it is before the whole city is polluted and everyone is dealing with health issues, in response to several respondents discussing the increase in oil and gas production in the community;

One thing that occurs to me listening to those two stories is how long before all those pollutants are going to pollute the entire city so that we are all bringing this in and all having the allergies and all having the rashes. I mean it’s in the air, and the more trucks that come in, the more it’s just going in there, it doesn’t stay secluded where they put, where they plant some, you know, where they put the oil well, that, all that diesel fuel and everything else is permeating the entire environment.

Elderly, Karnes County
One respondent details a lengthy health problem, they stated resulted from air quality issues, summarized by the following quote;

Yeah, it started out with a rash on my leg. Just, I, I thought it was a mosquito bite, because it just itched and itched and itched and it just, it progressed up to my knees cuz I wear capri pants. Well next thing you know it’s on my throat, it actually looked like somebody had tried to hang me, it was just raw fiery, it burned, it blisters, then my arms, and uh, I mean, my body stayed red.

Elderly, Karnes County

The elderly focus group respondents were also the only focus group to specifically name H2S and their concerns about it. The following quotes show the concerns respondents had about an increase in toxins in the atmosphere, particularly from flaring;

I think a lot of people are concerned just like when they see all these, these fires [flares] popping all over the place…I can’t really say there never has been anything said about it, as to really why, is it dangerous? Or, why are those fires there? And then also why they’re just not there? They’re just not there, what’s happening?

Elderly, La Salle County

[Respondent 1]: Why do they have to have that much burning? Those big old fires!
[Respondent 2]: It’s what the H2S in it, it’s, it’s just the…
[Respondent 1]: Hydrogen Sulfide
[Respondent 2]: Hydrogen Sulfide
[Respondent 1]: You’d smell it otherwise.
[Respondent 2]: Yes, well we still smell it. Well when you come into, from coming from Karnes City into Kennedy, somewhere midway in there like where uh, close to the hospital or, you can smell that, it’s starting to smell already.
[Respondent 1]: ….around there it’s bad sometimes, um…
[Respondent 2]: Fortunately we have this constant, uh, light wind in this area, otherwise we’d probably have a real heavy plume of bad smells. As long as we don’t get bad headaches.

Elderly, Karnes County

[Interviewer]: So what are you smelling?
[Respondent 1]: H2S.
[Respondent 2]: H2S.
[Respondent 1]: Is that what it is? That smells?
[Respondent 2]: Yes.
[Respondent 3]: Yeah, and they burn it, they, you know, most of it they burn off, but it’s too bad to save or this and that, but a lot of people don’t know that when they, and they say they have to burn it off, and it’s better, but H2S forms another bad gas when it’s burned off.

Elderly, Karnes County

H2S if it doesn’t kill you right now, well, you’re okay, but what it produces when they burn it, it can have chronic effects, it’s chronic over time.

Elderly, Karnes County

Elderly focus group respondents are concerned with air quality issues but also express feelings of uncertainty over whether negative impacts can be attributed to air quality. Unlike all other groups, elderly focus group respondents also express concern over rashes as a result of bad air quality, emphasizing health concerns as a result of oil and gas development.

Water Quality

As with the key informants and other focus groups, water quality was also identified as a concern. Although not a risk perception reiterated in both counties, water quality still came up with relative frequency in La Salle County.

The following quote expresses uncertainty over whether oil and gas development will affect water quality;

[Respondent 1]: Excuse me, we are surrounded with the real, with the oil around here, everywhere around here, we’re surrounded. The town is not that big. I wonder in the years to come or probably it’s already here, they going to affect our ground water.
[Respondent 2]: That’s what father was afraid of. Because of the water, that’s gonna be contaminated. I don’t know if it’s affecting us.

Elderly, La Salle County

Health issues connected to water quality is also a perception expressed by some respondents, shown in the following quotes;
Like, even myself I had to go see a doctor, cuando fue [when went], Saturday? Because I believe it’s the water.

Elderly, La Salle County

One respondent mentions that studies had been done of chemicals in the soil related to oil development in reaction to people developing allergies;

[Respondent 1]: You know, in Mexico not too long ago too, people…used to go and do research or that with the whatever they were like oil chemicals and all that, they were affecting the people. They, they turn out with cancer and all that, so here, who knows what’s going to happen?
[Respondent 2]: But I think the water is not good, a lot of people have been having problems.

Elderly La Salle County

Like air quality issues, elderly respondents express uncertainty over water quality issues, and whether oil and gas activity is contributing to contamination of water.

Although they cannot attribute health problems to water quality issues, they still express perception that health issues could be linked to water quality.

*Water Quantity*

Lastly, although only mentioned in interviews in Karnes County, there was discussion dedicated to water quantity, shown in the following quotes;

They’re using all that water and, and to me that, why haven’t they figured that out, all this technology they should be able to do something and use that same water instead of wasting all this fresh water.

Elderly, Karnes County

Even the news is always talking about the drought and like last summer you know we were restricted in how, how much water we supposed, you know we were supposed to use because of the drought, in, in your home and here, you know, millions of gallons are going into the well.

Elderly, Karnes County

Elderly focus group respondents are worried about water use in hydraulic fracturing, but particularly concerned of water reserves related to the drought. Regarding
environmental and health risk perceptions, elderly focus group respondents were most concerned about air quality issues. To a lesser extent they perceived issues related to both water quality and quantity related to hydraulic fracturing development.

SURVEY DATA

In order to both supplement and add perspectives to those residents choosing to discuss hydraulic fracturing, survey data is used to compare and contrast community perceptions to the qualitative data. Survey data collected in both Karnes and La Salle Counties was analyzed for descriptive statistics. Tables 5 and 6 shows findings from question 2 in the survey of both La Salle and Karnes County respondents, which asked about issues that survey participants identify as a result of hydraulic fracturing in the community.

Table 5. Participants Identifying Issue as Problem in La Salle County *

<table>
<thead>
<tr>
<th>Issue</th>
<th>Household income &gt; $30,000 n=32</th>
<th>Household income &lt; $30,000 n=9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trash</td>
<td>2.79</td>
<td>2.67</td>
</tr>
<tr>
<td>Illegal Dumping</td>
<td>2.63</td>
<td>3.00</td>
</tr>
<tr>
<td>Water Quality</td>
<td>2.53</td>
<td>2.33</td>
</tr>
<tr>
<td>Air Quality</td>
<td>2.00</td>
<td>2.67</td>
</tr>
</tbody>
</table>

*Coded on scale where 1= “no problem at all,” 2= “slight problem,” 3= “moderate problem,” and 4= “serious problem.”

The descriptive analysis provides support for the qualitative analysis findings. In
both counties, those with lower income fairly consistently identify environmental problems as issues at a higher rate than those with higher income. Although illegal dumping was not mentioned in interviews, it is included in the survey analysis as an additional indicator for comparison of an environmental issue. The finding that those with higher income view trash as an issue more strongly than those with lower income in both counties is consistent with what was found in the qualitative analysis (2.79 versus 2.67 in La Salle County, and 2.58 versus 2.57 in Karnes County).

Table 6. Participants Identifying Issue as Problem in Karnes County *

<table>
<thead>
<tr>
<th>Issue</th>
<th>Household income &gt; $30,000 n=52</th>
<th>Household income &lt; $30,000 n=7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trash</td>
<td>2.58</td>
<td>2.57</td>
</tr>
<tr>
<td>Illegal Dumping</td>
<td>2.50</td>
<td>2.67</td>
</tr>
<tr>
<td>Air Quality</td>
<td>2.34</td>
<td>2.43</td>
</tr>
<tr>
<td>Water Quality</td>
<td>2.18</td>
<td>2.29</td>
</tr>
</tbody>
</table>

* Coded on scale where 1= “no problem at all,” 2= “slight problem,” 3= “moderate problem,” and 4= “serious problem”

In addition, key informant and landowner respondents prioritized trash over the other environmental and health issues in the survey. In both counties those with lower income view illegal dumping and air quality as an issue more strongly than those with higher income (3.00 and 2.67 versus 2.63 and 2.00 in La Salle County, and 2.67 and 2.29 versus 2.50 and 2.18 in Karnes County, respectively). This aligns with what was found in qualitative interviews as those in higher social positions, key informants and landowners,
mentioned environmental issues to a lesser extent than those in lower social positions; i.e. low income and elderly. Lastly, the survey findings are also consistent with the qualitative findings regarding water quality in Karnes County (2.29 lower income versus 2.18 higher income). They differ, however, in La Salle County, where those with higher income view water quality as more of an issue than those in a lower social position (2.53 higher income versus 2.33 lower income). Thus, the voices from the survey data generally amplify the same concerns found in qualitative data findings.

DISCUSSION

The analysis reveals some interesting findings relevant to my first research question: How do residents’ perceptions of environmental and health risks in the Eagle Ford Shale region of Texas differ by personal experience and social status (defined as potential personal gain from drilling activity and position in community)?

Table 7. Dominant Environmental and Health Themes by Group

<table>
<thead>
<tr>
<th>Key Informant (n=13)</th>
<th>Landowners (n=3)</th>
<th>Low Income (n=3)</th>
<th>Elderly (n=2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trash</td>
<td>Trash</td>
<td>Air Quality</td>
<td>Air Quality</td>
</tr>
<tr>
<td>Water Quality</td>
<td>Air Quality</td>
<td>Water Quality</td>
<td>Water Quality</td>
</tr>
<tr>
<td>Water Quantity</td>
<td>Water Quality</td>
<td>Earthquakes</td>
<td>Water Quantity</td>
</tr>
</tbody>
</table>

Table 7 reveals the different prioritization that each group gives to discussing environmental and health risk perceptions. Personal experience and power may play a
role in forming risk perception, as it is clear that those in higher positions of power—key informants and landowners—prioritize risk perceptions in different ways than low income and elderly respondents. Those in higher social positions in the community and who lease their land to the oil and gas industry most likely have a different relationship with the oil and gas industry. The difference in the prevalence of risk perceptions in interviews reveals important similarities and differences to previous literature that I discuss throughout the rest of this chapter. I first compare and contrast findings to previous research on risk perceptions of hydraulic fracturing, and then provide explanations for why different perceptions exist, according to literature exploring perceived benefits and socioeconomic status.

Risk Perception and Hydraulic Fracturing Literature

Across all interviews there is some overlap in the dominant risk perception themes, as all four groups indicated environmental and health risk perceptions around water quality as a result of oil and gas development. Some respondent’s express direct experience with degraded water quality, but most respondents focus their discussion on the possibility of water contamination due to hydraulic fracturing. That is, they tend to speak about the potential for impact. This finding is similar to what previous studies have found regarding risk perceptions of possible water quality impacts in hydraulic fracturing communities where the focus is on what may occur, a finding echoed in analysis of both interview and survey data (Anderson and Theodori 2009; Brasier et al. 2011).

While there was consistency among all four groups when discussing water quality, there were important differences between the groups when discussing air quality,
trash, water quantity, and earthquakes.

Air quality was a central risk perception brought up among low income and elderly focus groups and was their primary environmental and health risk perception, measured by the amount of attention this theme was given in interviews. Air quality was a secondary issue in the landowner focus groups and non-existent in key informant interviews. Survey data also showed increased concern of air quality issues among lower income groups compared to those with higher income. In previous literature examining perceptions in hydraulic fracturing communities, Ladd (2013) also found residents perceived negative air quality effects due to hydraulic fracturing, although past research has not uncovered the nuanced ways that air quality risks are perceived, as my research did, with the three focus groups discussing air quality perceptions around two main subthemes of either dust and allergies or air toxicity. Interestingly, for low income respondent’s, air quality was only a concern in La Salle County, which could be due to La Salle County having more producing leases compared to Karnes County (Table 2). Survey data also showed that those with lower income in La Salle County identified air quality as an issue at a higher rate than those in Karnes County (Table 5 and Table 6).

Differences in perceptions between Karnes and La Salle Counties could be due to having different histories of oil and gas development, different economic viability before development, and different demographic characteristics. Scale of development can have an impact on risk perception (Graham et al. 2014; Schafft et al. 2013), but risk perception between Karnes and La Salle County respondents was generally consistent, with the exception of air quality perceptions. While Karnes County has experienced more oil and gas development (Figure 4), La Salle County has also experienced a lot of development,
perhaps leading to the finding that risk perceptions do not differ between each county in major ways.

Trash was a dominant theme for key informants and landowner focus groups, both of whom perceived an increase in trash happening at either the community level or on private property. Low income and elderly groups did not perceive trash as a dominant environmental and health risk. This issue has not been discussed in previous studies of resident risk perceptions in hydraulic fracturing communities.

Key informant and elderly respondents expressed concern over hydraulic fracturing removing water from the hydrologic cycle, particularly in a water poor region, although this was consistently the least dominant theme among the groups. These concerns are consistent with previous research on perceptions of water quantity, and the threat of water being removed from the hydrologic cycle (Brasier et al. 2011; Ladd 2013).

Lastly, although a tertiary perception, the theme of earthquakes was prevalent in low income interviews, consistent with previous research on resident perceptions that indicate concern with earthquakes due to hydraulic fracturing (Ladd 2013).

When considering how the findings relate to the role of social position, there are two issues to note. First, key informant and landowner respondents, the two groups in higher social positions, prioritize types of environmental and health risk perceptions differently. Secondly, the relative breadth and depth of environmental and health risk perceptions of low income and elderly interviewees, the two groups in lower social positions, is higher compared to key informants and landowners. Below, I explore two possible explanations of why these differences exist related to social position. First, I examine the role of perceived benefit, followed by an exploration of relative
socioeconomic status and the role of power in affecting risk perception.

\textit{Perceived Benefit}

The feelings one attaches to any activity and the perceived benefits from an activity can influence risk perception. Slovic and Peters (2006) explain that feelings, and not just objective risk factors, associated with a certain activity can contribute to the level of risk attributed to that activity. For example, in this study, it is possible that the H2S smell that all three focus groups identify is not a significant risk to their health or the environment, but amplifies their perception of air quality issues in the community because of the feeling that the bad smell elicits. The role of perceived benefit in affecting risk perception is also important to consider (McDaniels et al. 1995; Richards and Brod 2004). According to several studies, perceived benefit lessens risk perception in general (Fischhoff et al. 1981; McDaniels et al. 1995; Richards and Brod 2004; Sjoberg 2000). A lot of groups are benefitting in some respect because of oil and gas development, but benefits are not distributed among the population in an equal way. Low income and elderly respondents may have amplified perceptions of air quality risks compared to key informants and landowners perhaps because they are not benefiting at a proportional level. All landowners that were interviewed are leasing their land for oil and gas development, and are receiving some royalty amount in return. Landowner respondents presumably may also be exposed to negative oil and gas development impacts that are happening on their property although they do not report higher environmental and health risk perceptions, illustrating the point that exposure to a possible risk is not the only important variable to consider, and that perceived benefit may also interact with risk
perception. Key informants are in positions of power in the community and most likely to receive benefits from oil and gas development such as increased tax revenues, which can lead to job security, or re-election. The benefit for low income and elderly respondents is not as clear or direct, and perhaps is non-existent.

Related to perceived benefit, past research has also explored how leaders tend to focus more on economic benefits, while residents have increased perceptions of environmental and health risks. My analysis, similar to previous research, points to an indication that risk perception between all four groups differ because leaders and residents differ in their perception of health and environmental risk (Richards and Brod 2004). Leaders perceptions are more impacted by economic benefits and residents perceptions tend to be more influenced by environmental and health risks (Spies et al. 1998). Key informant emphasis on increasing economic benefits to the community, and landowner emphasis on increasing economic opportunities for themselves, may lead them to perceive less environmental and health risks, whether they exist or not. Conversely, low income and elderly respondents’ minimal role in deciding policies or encouraging hydraulic fracturing development on private property that determine the economic future of the community may lead to their increased perception of environmental and health risks.

The following quotes suggest that not all groups in the Eagle Ford shale region are benefiting equally. Key informants tend to talk about the economic benefits from hydraulic fracturing and the unique opportunity it brings to some, particularly landowners, as shown in the following quotes;

…my Dad always told us that God never let us down and he wasn’t going to start now, and he didn’t. And I’m not saying that I think that he said, “Oh, you guys
have suffered, here let me send you all these oil wells,” but there is some really neat blessings that have come out of it that we would have never experienced, some things had this not happened. And it may not last forever, and who cares if it doesn’t. Um, we’ve gotten some fun things out of you know having some extra money. My Mom hadn’t had to worry about things. They’ve been able to make a lot of improvements to the property, and that story is true for many people.

Key Informant, Karnes County

We’ve got people that were, that have been farmers and ranchers all their lives that were lucky enough to hit oil. And many of these people have held onto the land for God knows how long, just to farm it and ranch it, and they’ve taken the good and the bad, so, and they became overnight millionaires. And they deserve every single penny.

Key Informant, Karnes County

This landowner emphasizes their belief that oil and gas development has improved the lives of almost everyone in the community;

Well I think even the smallest percentage people have, they’ve had a little extra money and stuff to make them feel a little comfortable with their life right now, make them live more comfortably. Some, more elaborate than others, and some just comfortable. But, it’s made everybody have a touch up and there’s a few that haven’t had anything, but they’re the ones that kind of live in the town itself maybe…

Landowners, La Salle County

Lastly, this landowner expresses the feeling that if you want to take part in the economic opportunities that come along with oil and gas development you just have to be willing to work;

But I think it’s been a good opportunity for things to grow and everything and even, the, I think, you know, you’ve got this, this group of people, and you’ve probably one third of them sit here and gripe more, but they’re the ones that don’t have a job, don’t want to work, that living off the government. The others that do have an opportunity can actually go get more jobs now, make better money and pay in advance of themselves.

Landowners, La Salle County

Although voiced by some key informant respondents, those in low income focus groups were also vocal about only certain groups benefiting from the activity;

[Respondent 1]: We got, our taxes are going up cuz we’re paying every year
because the boom is going on. But who’s getting the money from the boom?
[Respondent 2]: It’s not us
[Respondent 1]: We’re not. They’re not paying my taxes.

Low Income, La Salle County

Oh what was it, New York, the Wall Street Journal or one of those, anyway, and so they’re talking about how Cotulla, not, it’s not necessarily Cotulla, how, the county is very wealthy now, okay? And that is true. But the wealth is not, the, I interpreted it as, you know, like, they’re saying a lot of Cotulla people are rich, well, yeah, there’s a lot of millionaires now, there are. But that, that’s only a few. The majority is still local people and we still have our every day to day business, we still have our, you know, everything else, so the riches is not really the majority of Cotulla.

Low Income, La Salle County

Everybody says, Yeah, everybody gets money. My son lives in some of my property, I sold him a piece of property from a while back. He’s pooled in to an oil well and everybody says, “Oh you’re getting oil field money.” If you call a hundred and eighty dollars a month oil field money, and then you’re taxing me out the backside at the end of the year, well then, you’re, it’s not helping, you know? And a lot of people say, “Yeah, well you’re getting oil field money, but I’m like “Yeah, but it’s not like what you think.” Everybody says, “Oh you get oil field money, you’re doing good.” Well it doesn’t always go that way.

Low Income, Karnes County

Thus, the qualitative data, supported by survey data, details differences between those who perceive they are benefiting from oil and gas development and those not by social position, and provide one possible explanation for the differences in risk perception seen between the groups.

Socioeconomic Status

Related to previous research considering the different relationships leaders and residents have with risk perception, explained above, having a higher socioeconomic status and more power tend to lead to decreased risk perception (Bastide et al. 1989; Cutter 1981; Finucane et al. 2000; Savage 1993). Based on relative positions in the community and potential benefits, it is reasonable to say that those in key informant and
landowner groups have higher socioeconomic status compared to low income and elderly, which may be a contributing factor to lower risk perception. Thus, socioeconomic status and power can interact with risk perception.

Key informants and landowners described trash issues in the community that were non-existent in low income and elderly interviews. In addition, air quality was more of a central concern for low income and elderly respondents than for key informant and landowners, as well as earthquakes only being mentioned as a dominant theme in low income interviews. Trash is less of a health risk compared to air or water quality, but it is an issue that is visible and can be addressed more easily. Those with higher socioeconomic status can worry about aesthetic issues like increased trash, while those in lower social positions are confronted with poorer health (Evans and Kantrowitz 2002) and are therefore more concerned with what they may see as immediate causes of their poor health—air and water quality issues (Crowe et al. 2015a). Respondents in lower social positions may perceive environmental and health issues more acutely, as they perceive they are being impacted by hydraulic fracturing differently from those in higher social positions due to their lower socioeconomic status, which has been confirmed in previous literature exploring environmental justice in hydraulic fracturing communities in particular (Crowe et al. 2015a; Ogneva-Himmelberger and Huang 2015), as well as literature exploring exposure to environmental risks in general (Beck 1992). As reviewed by Brulle and Pellow (2006), previous literature exploring issues of environmental justice and environmental inequality has found that those in lower social positions often are impacted more severely by environmental and health issues. This may partially explain why low income respondents, in a lower social position, were the only group to mention
earthquakes as a dominant theme, and why lower social positions express risk perceptions regarding air quality issues with more regularity than those in higher social positions. Thus, trash issues may be less of a concern for those in lower social positions when confronted with other serious environmental and health issues, such as earthquakes or air quality. The following quotes from low income and elderly respondents highlight the disproportionate bearing of costs by lower income groups.

The following two respondents explains that those on a fixed income are suffering from the increased costs that comes from living in a community undergoing an oil and gas development boom;

The locals are left out in the cold because they have, I mean there is just no place to put somebody on a little fixed income anymore. You have to have the big bucks just to get in to any little teeny tiny house, so people are having to move in together, people having to move away, uh, it’s, it’s awful.

Low Income, Karnes County

I think the people, the people with fixed incomes are hurt, get hurt more by, by the situation.

Elderly, Karnes County

Even the oil and gas workers recognize the difficulty with which local people who are in a lower social position may have affording the increased cost of goods without an increase in salary, as shown in the following quote;

And I’ve been at the supermarket when even our, the oil workers, uh, I was uh, looking at the meat there, and then all the sudden there were two guys there and they were talking to each other and they, they were picking up, you know, food to look at, “Oh gosh look at that price, and look at this.” And they themselves said, “You know what?” I go, they go, “How do the people live with these prices? These are terrible prices!” So I turned around and I said, “Oh you don’t like the prices in the store?” He says, “Ma’am, I feel sorry for your people here.” I go, they go, “Well I feel sorry for you, don’t you have a family down…” “Yeah, but I mean, I have a mortgage, I have a back home.” He said, “Don’t they realize that the people that are making the money are the ones that are owners of our company? We’re working like, like you Ma’am, and I have-,” you know, one had five kids and the other had two kids, but they had mortgages, they had car
payments, and he says, “And we have to travel all the way over here to find jobs, but we still have obligations where we come from,” and he says, “And we make good money, we’re not lying, we make good money, but look at the prices here, how about the people that live here and don’t have good jobs, how do they survive these prices?”

Low Income, La Salle County

Although key informants tend to discuss the positive effects of oil and gas development with higher frequency, some also acknowledge the unequal bearing of costs by lower income residents related to social position, as shown in the following quotes;

It’s hard to be poor and live in the Eagle Ford and you can quote me saying that. It’s hard to be poor and live in the Eagle Ford. Your car can’t handle it and you can’t handle it psychologically, it’s a trip. Think about it. Your whole life has been turned upside down, your house, I mean the way you live and what you do is totally different, it’s changed for forever. And for them, not for the better.

Key Informant, Karnes County

It would be nice; this is my opinion, if there were more of a sharing with those in need. The haves get more; the have-nots aren’t getting any more.

Key Informant, La Salle County

Both those in higher and lower social positions recognize that those in lower social positions are bearing more of the costs of oil and gas development. Therefore, difference in socioeconomic status between groups may partially explain differences in risk perception.

The interaction between social position and environmental and health risk perception has been explained in two possible ways, either through perceived benefits or socioeconomic status. Theories on perceived benefits suggest that differences in environmental and health risk perceptions exist because each group views their ability to benefit from oil and gas development differently. Furthermore, theories that have examined the relationship between socioeconomic status and risk perception suggest that the differing social positions and relative power of each group partially explains the
relationship with risk perception. In the next chapter I explore the ways in which the source of information interacts with risk perception.
CHAPTER V

RISK PERCEPTION AND INFORMATION SOURCE

In this chapter, I address my second research question: How does social status interact with the way people receive information regarding hydraulic fracturing in the Eagle Ford? I first describe dominant information sources used by key informant respondents, followed by sources used by landowners, low income, and elderly focus group respondents. I compare and contrast the sources of information used by each group and describe the relationship found between the source of information and risk perception.

Table 8. Dominant Information Sources Mentioned

<table>
<thead>
<tr>
<th>Source of Information</th>
<th>Key Informant (n=13)</th>
<th>Landowners (n=3)</th>
<th>Low Income (n=3)</th>
<th>Elderly (n=2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government Officials</td>
<td>6* (46%)</td>
<td>1 (8%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Industry</td>
<td>5* (38%)</td>
<td>2* (15%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Interpersonal Network</td>
<td>0</td>
<td>0</td>
<td>2* (15%)</td>
<td>2* (15%)</td>
</tr>
</tbody>
</table>

* Indicates mentioned in both counties

KEY INFORMANTS

Key informants mentioned two sources of information most frequently. These included government officials and industry.
Six key informants (46%) describe receiving information about hydraulic fracturing from government officials or agencies. One key informant describes early development of the Eagle Ford Shale and the increase in meetings held by government officials to disperse information;

[Interviewer]: Before the last three years when it was very obvious what was going on, did locals wonder why are people coming in and buying property?  
[Respondent]: Uh huh, and then the community started having meetings and meetings, the city, the county, the housing authorities, because all this was happening, and that’s where you would hear all these stories.  
Key Informant, La Salle County

Traffic has increased as a result of oil and gas development, warranting the need to inform the public about changing driving behavior. The following key informant discusses the effort by government officials to put information in places that might be more visible, such as the newspaper or on billboards;

There has been…I’ve seen a lot of articles in the newspaper, you know, from the county, I’ve seen ads, you know they are putting stuff up on billboards, you know, about slowing down. Or, if you are driving slow, move over to the right, so, you know, somebody can pass you.

Key Informant, Karnes County

Key informants also describe receiving information from organizations that have been created by government officials. The following respondents discuss receiving information from the Middle Rio Grande Development Council (MRGDC), a group of local governments that has banded together under Texas law to deal with regional issues, and has existed since 1970 (http://www.mrgdc.org/). The Eagle Ford Consortium (EFC) grew out of the MRGDC. The EFC is an organization that seeks to improve
communication between the oil and gas industry and communities and improve employment of dislocated or underemployed workers, among other things (http://www.eaglefordconsortium.org/). Respondents receive information from the MRGDC, as shown in the following discussion regarding hazardous materials (Hazmat) being transported near a school;

[Interviewer]: Have you had any interactions [with groups like the Mid Rio Grande], like have you asked them for anything or told them about the Hazmat going right by the school?
[Respondent]: We’ve gone to the conventions, and everybody has talked about their problems, in the convention they’ve had people up on the stage that’ll try to answer what they’ve done to their area and how it’s worked for them, ya know. Things like that.

Key Informant, La Salle County

When asked about what groups have formed to provide information to the public, this key informant explains receiving information from government officials through the MRGDC, as shown in the following quote;

[Respondent]: Middle Rio Grande has had some different meetings and things where they go to Uvalde, Carrizo, here, all that. They have different meetings with different people in different areas, and the same type of thing, trying to get the word out, what do you need, what can we do to help each other, you know, this county and this county work together like this, and…
[Interviewer]: How successful do you think they are?
[Respondent]: I think it’s pretty good.

Key Informant, La Salle County

The following respondent describes affiliation with the Eagle Ford Consortium, and how the organization is a source of information;

[Interviewer]: Has the school had any involvement with the Eagle Ford Consortium?
[Respondent]: I’ve been to several conferences…it’s more of an informational thing, one of the superintendents will get up and say, “Well, we’ve got uh, this housing problem, this migrant population problem, we’ve got this problem, that problem, and uh, very few solutions. It’s mostly just from an educational
perspective talking about the problems.
[Interviewer]: Okay, are they set up to provide solutions?
[Respondent]: They are set up, and this is my opinion on it, they are set up to provide avenues of networking. Because that is a big deal in my mind, to be able to network properly to find solutions.

Key Informant, La Salle County

Lastly, the following respondent also describes the Eagle Ford Consortium as an information source;

[Interviewer]: So tell me more about the role of the Eagle Ford Consortium, like what have you worked with them to do?
[Respondent]: I mean, the, it’s purely informational. That’s all it is. It has no regulation ability, it is just a resource.
[Interviewer]: A resource for?
[Respondent]: Getting information to us, whether it is UTSA [University of Texas San Antonio] doing studies, or TCEQ, or getting oil to explain, it’s been basically a creative what they call collaboration in bringing everybody together to discuss their problems.

Key Informant, Karnes County

The quotes show the various ways government attempt to communicate information to key informant respondents. Key informants receive information from either government officials or organizations that were created to communicate information to the public and encourage information exchange, in particular their reliance on the EFC for this information.

Industry

Five key informants (38%) noted they receive information directly from oil and gas industry. The following quote describes the expectation one key informant has for how industry should act towards the community. The following quote describes one of the oil and gas companies, Chesapeake, holding a meeting with the local school in La Salle County to disperse information;
[Interviewer]: Did any of them [oil and gas companies] say, meet with the school and say, “This has been our experience in other communities, in terms of what you can expect will happen with the school.”
[Respondent]: Chesapeake did.

[Interviewer]: What did they tell you?
[Respondent]: Oh gosh, I can’t remember now, but uh, a lot about, not so much about in general, but about what it meant for their company to be coming in and what they would be doing and…they did come in early on and talk to us about some of their programs. And like I said, they want to expose kids to the science and the engineering part, so they are always, you know, usually happy to help if we want to bring in some kind of program along those lines.

Key Informant, La Salle County

This respondent describes a relationship with industry where they provide some information to the public, but are guarded about other information;

[Interviewer]: Do they [industry] make themselves available to answer any questions that the commission may have regarding the activity?
[Respondent]: Not really activity. They make themselves available to speak on issues, concerns, roads or areas and most of them are kind of private on their activity.

Key Informant, Karnes County

One respondent describes a situation where there is ample information provided by industry and how they attended several events with their parents to receive more information;

A lot of the major companies though, you know, had like open houses and had little events where they publicized in the paper and put signs up and whatever for people to come, you know, even if you didn’t have a well that Marathon was drilling you could still go to Marathon’s open house, and they gave presentations and, you know, I really think that there were several of them throughout the year. My parents did attend several different things because we were curious, you know, we have some friends who are in the oil and gas industry but not to this extent, and you know this is new technology for our area at least, and um, and so, I think that the information is available to be educated on what’s going on, and the pros and cons and the whole, you know, whole picture.

Key Informant, Karnes County

The following respondent explains a company holding an opening ceremony in order to disperse information about the plans they have for development;
[Respondent]: They [industry] speak for themselves and they got their representatives for their companies. We went to the grand opening out here at Anadarko, and that’s all they talked about. You know, all the projects, the oil, where it goes through, everything, how it is and how it came about.

Key Informant, La Salle County

The following key informant describes receiving information from her parents, but an oil and gas company being the original source of information;

[Interviewer]: So who did you hear the term [Eagle Ford] from?

[Respondent]: Uh, my parents. It would have been just visiting with them about what was going to happen, and that. And then they would have gotten that directly from…the land man, or the company man or whatever they call it, from Marathon, that is like my parent’s go-to person, has been a very helpful person and you know, we feel like very honest to us and has been very open, and so that’s where they would have gotten the information from is the people that would have approached them.

Key Informant, Karnes County

The quotes show how specific companies provide information to the key informant group. In addition to specific companies—an industry organization, The South Texas Energy and Economic Roundtable (STEER), is also mentioned as a source of information. STEER is an organization created by 11 of the largest oil and gas operators in the Eagle Ford Shale region as a way to engage stakeholders in different communities and bridge the gap between industry and community through coordinating communication, education, and public advocacy efforts (http://steer.com/). Asked about where they voice their concerns about issues in the community and where they can get information, the following respondent mentions STEER. The following quote explains attending a meeting with STEER and discussing several issues with them, highlighting that STEER is a source of information.

[We] just went two weeks ago tomorrow to Pearsall to a meeting and the organization is called STEER and they are for the oil and gas producer, but they are the go between like all of the service companies, the land owners, to try to figure out how they can work out the problems such as all of our road problems that we have. Trash was one of those that they discussed. So they are the go
between and if you have a problem then you need to call them. They will go to
the producer and try to get the producer to do what needs to be done but then you
also as an individual need to do it.

Key Informant, La Salle County

The above analysis shows key informants are receiving information
predominantly through two channels. Government officials are the first most common
source of information, followed by industry. A similar pattern is apparent with the
landowners interviewed, as I detail below.

LANDOWNERS

While landowners receive their information from a similar source as key
informants—industry—they also differ from key informants, as they describe
government official information sources as sometimes showing a lack of concern. With
that said, although landowners communicate in a different way than key informants, as
detailed below, industry are still considered the primary source of information.

Industry

Similar to key informants, landowners receive information from industry. The
following quote describes a relationship the landowner had with industry personnel, and
states that they communicate with industry often;

[Interviewer]: So how often then do you two talk with industry officials, or, the
company that you’re working with?
[Respondent]: Well when they were really active it was all the time, you know, I
was always talking with the, uh, the construction foreman or the land man or
somebody. I see the operators, or, the pumpers, whatever you want to call them, I
see them, talk to them all, quite often.

Landowners, La Salle County

The following landowners describes industry being extremely responsive to
questions asked;

We have a really good um, we live out on our land and so we see the day to day activity and we see the trucks that come and go and we have been very fortunate that we have a good relationship, our, our company is Marathon and I mean, I could pick up my phone right now and I probably have ten different types of contact numbers of different people that I have called, spoke to, that have said, keep my number, we have an intermediate contact that, you know, if, if, like when we, when I had questions on something we usually did, will call, you know, if he’s not available we’ll leave a voicemail and he usually, and he’ll, I mean, it may be a couple of days but he’s really good about getting back to us, and if he can’t answer it he’ll say, well, you know, call this person or let me, you know, I’ll get somebody.

Landowners, Karnes County

Although the relationship below between landowner and industry is described as complaining about an issue, the quote also suggests that landowners are receiving information from industry.

[Interviewer]: Could you just walk us through how you deal with the oil company, who it is you talk with?
[Respondent]: You pick up the phone and call the person that you’ve been talking to before or the person that first come out has a represent. If you find out who their representative above them is and you start talking to them. Before you do anything you start talking to them or call but like they come out there with a crew and to do something else, you say “wait a minute, this wasn’t in the contract, we talked about this.” And they send somebody out and you start talking again. You just have to keep on top of it. That’s why I’m saying you gotta spend all your time watching em. Everytime. Even though they’re supposed to go by contract.

Landowners, La Salle County

These quotes show that landowner focus groups primarily receive information from industry. Landowners are put in the position where they have to interact with industry because there is development occurring on their land. Therefore, quotes in this section tend to show landowners as communicating with people about problems they are having.
Landowner focus groups sometimes indicate they receive information from elected officials or government agencies, but more often discuss government officials as lacking information. The following landowner discusses how government officials are a reliable source of information and a resource to ask questions of, shown in the following quote:

To kind of get back to your question, if you have problems or a question, you need to go to your community leaders, your, your mayors or your commissioner’s court or your judge, that would be a place that you should be going

Landowners, Karnes County

Although my research question focused on sources of information, it is important to note that respondents discussed lack of information from government officials. While some landowners go to government officials for information, others see government officials as incompetent, as shown in the following quote:

[Interviewer]: How many of you have problems and gone to government officials?
[Respondent 1]: Well we don’t have government officials that you can go to right now.
[Respondent 2]: …but she’s speaking the truth. (Laughter)
[Interviewer]: So are you, are you saying that your government officials aren’t there or that they’re not competent, or not…
[Respondent 1]: They’re not competent.
[Respondent 2]: They’re not competent, they’re not there, they’re not readily available.
[Respondent 1]: haven’t gone for oil field business to commissioners court but I have with several other issues and here I am five or six years down the line, and never got anywhere.
[Respondent 2]: That’s pretty much what the commissioner’s court does.
[Respondent 1]: Yeah, they, they let you speak and then they deep six it.
[Respondent 2]: And that’s questionable that they let you speak.

Landowners, Karnes County

One key informant also describes a lack of information from the Railroad
Commission\textsuperscript{10} in the following quote;

[Interviewer]: So how responsive have you found them, the Railroad Commission?
[Respondent]: The Railroad Commission? I might as well have wasted, I wasted my time calling them. Ha ha. They never resolved anything except that I’m in no danger, I just have to put up with whatever is going on.

Landowners, Karnes County

The findings show landowner focus group respondents primarily receive information through industry. Landowner focus groups also express that government officials sometimes distribute information but are primarily seen as having a lack of concern.

LOW INCOME

As I detail below, low income focus groups only mention interpersonal networks as a dominant source of information. While low income respondents do discuss government officials and industry, they are mentioned as sources that do not provide a lot of information.

*Interpersonal Networks*

Low incomes focus groups identify receiving information through interpersonal networks either through friends, family or in public spaces such as a bar, shown by the following quotes.

[Interviewer]: How do you get your information about what’s happening, like where does your information come from?
[Respondent1]: Until something is developed and sent and we’re notified it’s at

\textsuperscript{10} The Texas Railroad Commission is a state agency that regulates the oil and gas industry, gas utilities, pipeline safety, safety in the liquefied petroleum gas industry, and surface coal and uranium mining.
school or, you know…
[Interviewer]: So through your work, through gossip?
[Respondent] 2: Through drama and gossip.
[Interviewer]: Through drama and gossip!
[Respondent 2]: Through texting.

The following respondent describes receiving information on air and water quality from her son, a family member that is as part of her interpersonal network;

Okay, no, no, well, my son because he’s working up there [West Texas], he says it’s, he says it [flares] really does not harm us. Well, I have a question with that, you know, I don’t agree with that.

The following low income respondent also describes receiving information from a family member, her dad, before the oil and gas boom started;

[Respondent 1]: I know my, my dad used to have a plumbing business here and he just kept telling us something is happening there and nobody’s talking. When something is happening people are buying up land, they’re buying a home, but they weren’t talking, and then this.

One focus group respondent describes their experience of receiving information informally in a public space at a bar before the oil and gas boom started.

You know, how I found out some of this stuff? At a bar. There was a guy who was here, I remember it was about six, seven years ago, we were at Cartas, it was called Cartas, and this guy worked testing the grounds, way back, this was about six years ago, no about seven, might have been eight, it was about seven or eight years, and this guy was here drinking in a bar, this guy “Well you know here in about five years,” dijo [said], “Man, ya’ll are going to have a lot of people here.

Interpersonal networks are the most common source of information for low income focus groups. They describe receiving information through sources they do not know that well, like at an informal setting like a bar, but also directly from family
members.

**Government Officials**

As previously noted, when asked about information they receive from government officials, low income respondents tend to speak of a lack of information coming from government officials. The following quote describes a failure by the city to advertise public meetings regarding the start of the oil and gas boom and what the community may expect to happen;

[Interviewer]: Was there any attempt by city or county officials to have meetings to inform the residents, this is starting, umm, this is, or by industry, did industry come in and say, “There is going to be activity going on, this is what you can expect in your community.”

[Respondent]: I got a feeling they did but they just went to the city, you know, it really wasn’t publicized, and you know, a lot of us working, I by myself, I hardly have time to look at the local newspaper, the only local newspaper that we have. You know, so there wasn’t anything posted out in town saying, you know, “There’s a city meeting”.

Low Income, La Salle County

Low income respondents feel like city council meetings are not advertised sufficiently, as shown in the following quote;

[Respondent 2]: They’re [city council] not gonna advertise it [public meeting]; let you know, because really everything they want to do…

[Respondent 1]: It’s like every second Tuesday of the month or every other Tuesday or every Thursday or whatever…

[Respondent 2]: I think they put a sign there on the, on the city office but, I mean, who’s going to go and sit there and read...  

[Respondent 1]: Not everybody goes into the office.

Low Income, La Salle County

The following quote also shows the concern that government officials are not adequately sharing information with the public;

[Respondent 1]: They [elected officials] gonna get the information first before anybody else
[Interviewer]: Right
[Respondent 1]: It’s supposed to go to the city, you know
[Interviewer]: Right
[Respondent 1]: And the city is supposed to no, notify the public but they’re not, they only gotta “we told so and so we did it.” that’s it.

Low Income, La Salle County

The following low income respondent further describes only some people receiving information in regards to impacts from hydraulic fracturing, such as elected officials;

[Interviewer]: So some people knew.
[Respondent 2]: Uh-huh, some people knew.
[Respondent 1]: The commissioners knew.

Low Income, Karnes County

The analysis shows that while government officials are discussed frequently in low income interviews, they are cited as a source that regularly does not provide adequate information. Thus, differing from key informants and landowners, low income respondents indicated they receive their information predominantly through interpersonal networks, while government officials are more often seen as a source that lack information or are unwilling to provide it, a similar pattern as with the elderly focus group respondents, to which I now turn.

ELDERLY

Elderly focus group respondents, like low income respondents, mention interpersonal networks as the most common information source, and while they discuss government officials in their interviews, it is in reference to them as sources that do not provide information.
Interpersonal Networks

The following quotes illustrate the primary ways elderly respondents indicated they receive information, through interpersonal networks, describing it as the best way to receive information, as seen in the following quote;

[Interviewer]: What about communicating with seniors, like what is the best way to get, get information to you?
[Respondents]: To the seniors?
[Interviewer]: Yeah.
[Respondent 1]: Como se dice [how do you say]...word by mouth?

Elderly, La Salle County

The elderly respondents below describe going to church with an elected official but communicating with them in an informal capacity and also having conversations amongst each other;

[Respondent 2]: How do you get your concerns, do you talk with city officials about your concerns?
[Respondent 1]: I don’t. I’ve never gone over there.
[Respondent 2]: Well we go to church with one of them, one of the persons who’s uh, on the- Planning...Planning commission.
[Respondent 1]: We air our concerns that way with him. I’m not sure it gets back because, sometimes it’s just a rant, you know, that you...
[Respondent 2]: And it’s the old adage, money talks.
[Respondent 1]: The love of money is the root of all evil.
[Respondent 2]: We talk about all this among all of us, you know, when we get together but I guess we just don’t go to where we’re supposed to really go and complain and sometimes if you go complain I think they won’t do anything about it.

Elderly, Karnes County

This latter comment in reference to government officials explains, in part, why the elderly focus group respondents do not use government officials as a source of information, as I detail below.
Government Officials

The following quotes illustrate the perception that government officials do not share information with elderly respondents.

[Interviewer]: So when you have these, these concerns and these, these issues, do you express them to the government officials or…
[Respondent 1]: They won’t listen.
[Respondent 2]: No
[Respondent 1]: They won’t listen, the only time they worry, this, this is my, my point of view of things. The only time they worry is when their election is coming, they are after you. And here, they, they get like little groups, it’s a small town, to form for him to vote for him, and they don’t do nothing. They don’t do anything. They don’t do anything.

Elderly, La Salle County

The following elderly respondents describe how government officials do not provide information to everyone, describing a situation before the current oil and gas boom when property was more affordable and government officials were not sharing information with the public that a boom was about to occur.

[Interviewer]: What about if you had the chance to talk with, or, public officials said, let’s have a public meeting, we, we want to hear your concerns. Assuming they want to hear them. What, what would you tell them?
[Respondent 1]: I would ask if some people were given this knowledge ahead of other people because I know some people bought a lot of property that there was, there was really nothing that, at the time, that it would be good for and now they’ve profited so on it. And it, it’s just certain people that did this, so…
[Respondent 2]: Prior knowledge.
[Respondent 1]: Right, but how come everybody wasn’t notified of this?
[Respondent 2]: There was rumors floating around but most of us ignored it.
[Respondent 1]: I guess so. Some people took it to heart and they did something about it and they bought up property and now they’re wealthy.
[Respondent 2]: So what kind of people, I don’t want to ask you for names, but what kind of people were those, were they government officials, um, business leaders?
[Respondent 1]: No, one that I know is just a, a realtor.
[Respondent 2]: Somebody in the know.
[Respondent 1]: Somebody in the know….

Our county and city officials have been known to take advantage of stuff like that though.
As with low income respondents, elderly respondents describe not receiving information from government officials. The perception is either government officials are withholding information or will not listen unless they are up for election, thus they are more typically sources that do not provide enough information. Elderly respondents are most likely to use interpersonal networks for information.

I now turn to findings from the survey data to see how those who chose to voice their opinion regarding hydraulic fracturing via the survey feel about information sources.

SURVEY DATA

Tables 9 and 10 show findings from question 14 (Appendix C), which asked respondents to: “Please indicate how much of what you know about the process of hydraulic fracturing comes from each of the following sources”. The sources listed in Tables 9 and 10 are considered relevant to the qualitative analysis.

Survey results provide support for the findings from the qualitative analysis. In both counties the oil/natural gas industry is more frequently a source of information for those with higher income (78% in Karnes County and 60% in La Salle County). As discussed earlier in the thesis and as can be seen in Figure 5, Karnes County is the most prolific oil and gas producing county in the Eagle Ford, which may partially explain the difference in the percentage of the survey respondents who consider oil/natural gas industry a source of information. This survey finding also aligns with what was found in
Table 9. Percentage of Respondents in La Salle County Indicating Source of Information.

<table>
<thead>
<tr>
<th>Source of information</th>
<th>Household income &gt; $30,000 n=32</th>
<th>Household income &lt; $30,000 n=9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil/Natural Gas Industry</td>
<td>60%</td>
<td>44%</td>
</tr>
<tr>
<td>Neighbors</td>
<td>40%</td>
<td>78%</td>
</tr>
<tr>
<td>Friends in Community</td>
<td>38%</td>
<td>68%</td>
</tr>
<tr>
<td>Landowner Groups/Coalitions</td>
<td>33%</td>
<td>62%</td>
</tr>
<tr>
<td>Elected County Officials</td>
<td>30%</td>
<td>25%</td>
</tr>
<tr>
<td>Elected City Officials</td>
<td>27%</td>
<td>25%</td>
</tr>
</tbody>
</table>

Table 10. Percentage of Respondents in Karnes County Indicating Source of Information.

<table>
<thead>
<tr>
<th>Source of information</th>
<th>Household income &gt; $30,000 n=52</th>
<th>Household income &lt; $30,000 n=7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil/Natural Gas Industry</td>
<td>78%</td>
<td>67%</td>
</tr>
<tr>
<td>Friends in Community</td>
<td>68%</td>
<td>50%</td>
</tr>
<tr>
<td>Neighbors</td>
<td>65%</td>
<td>60%</td>
</tr>
<tr>
<td>Landowner Groups/Coalitions</td>
<td>56%</td>
<td>33%</td>
</tr>
<tr>
<td>Elected County Officials</td>
<td>22%</td>
<td>40%</td>
</tr>
<tr>
<td>Elected City Officials</td>
<td>14%</td>
<td>40%</td>
</tr>
</tbody>
</table>
the qualitative analysis, as key informant and landowner groups, those most likely in the higher income category, frequently talked about industry as a source of information. The survey data is not as consistent with the qualitative findings for both counties regarding government officials as a source of information. In La Salle County, the findings align with what was found in the qualitative analysis, as those with higher income more frequently use government officials as a source of information (30% higher income versus 25% lower income). This finding is reversed for Karnes County though, differing from what was found in the qualitative analysis (22% higher income versus 40% lower income). Regarding interpersonal networks, like neighbors or friends in the community, lower income respondents in La Salle County receive more information from interpersonal networks (78% indicating neighbors and 68% indicating friends in lower income versus 40% indicating neighbors and 38% indicating friends in higher income, respectively), while in Karnes County higher income residents receive information from interpersonal networks (50% and 60% lower income versus 68% and 65% higher income, respectively). Similar to the qualitative analysis, survey participants with lower income in La Salle County more frequently used interpersonal networks to receive information, but the finding is again reversed in Karnes County, as those with higher income more frequently use interpersonal networks as a source of information. Lastly, landowner groups/coalitions was found as a source of information in survey data, but was not found in the qualitative analysis. In La Salle County more low income than high income respondents used landowner groups/coalitions as an information source (62% versus 33%), while in Karnes County more high income residents versus low income residents used them as an information source (56% versus 33%). Survey results generally support
what was found in the qualitative analysis.

DISCUSSION

Examining sources of information regarding risk perception revealed interesting results relevant to my second research question: How does social status interact with the way people receive information regarding hydraulic fracturing in the Eagle Ford? Those in key informant groups tend to derive information from more formal channels like government officials or industry, while landowner groups only discuss industry as a source of information. Interpersonal networks are stated more frequently as an information source among elderly and low income respondents. Conversely, for elderly and low income respondent’s government officials and industry are not a source of information. Lastly, even though information is sometimes received through more formal channels like government officials or industry, the media and scientists are not spoken about as major sources of information.

The different ways in which respondent groups receive information allows for the ability to explore similarities and differences to previous literature. I first compare findings to the existing study on information sources in hydraulic fracturing communities and then compare and contrast findings to previous literature on information sources in general as they relate to risk perceptions and social status, and provide explanations for my findings.

Overall, government officials, industry, and interpersonal networks were found to be the dominant sources of information, although not prevalent amongst all four groups (Table 8). Theodori et al. (2014) also found industry to be a consistent source of
information for the general public, aligning with the finding among key informants and landowners that industry is a major source of information. Theodori et al. (2014) also found the media to be the highest contributor of information, yet it is not a dominant source of information for all four groups in the qualitative analysis. This discrepancy may be due to the fact that respondents were never directly asked if they used the media as an information source, as questions were generally left open ended. Theodori et al. (2014) compared high well density to low well density counties, and found that high well density counties were significantly more likely to report the natural gas industry as a source of information compared to low well density counties. As stated previously, Karnes County has a higher scale of development compared to La Salle County (Figure 4), but scale of development did not reveal any differences in the qualitative analysis. This may be because La Salle and Karnes County do not differ enough in oil and gas well density and production to observe any meaningful differences. The survey data did reflect the findings of Theodori et al. (2014) though, as a higher percentage of respondents in Karnes County indicated the oil/natural gas industry as a source of information compared to La Salle County.

As shown in previous research, risk perception can be transformed in the transfer of information (Kasperson et al. 1988), and perceptions are often formed based on the individual analyzing the source of information and determining how credible it is (Renn et al. 1992). One possible explanation for why there are few environmental and health risk perceptions among all groups could be that they are not receiving information from the media, although as described in Chapter III there are several sources of media available in both counties. The media tends to sensationalize events and focus on risks
and might be a contributing factor to higher risk perceptions if they were found to be a dominant source of information (Tierney et al. 2006). Although it was not found as a dominant theme as a source of information though, it is interesting to note that the only groups to even mention media as a source of information, low income and elderly respondents, were the groups that perceived higher environmental and health risks. If media is transferring information that indicates the existence of more environmental and health problems as a result of oil and gas development, but respondents are not receiving that information, then there is not a chance for risk perception to be transformed. Media is commonly cited as a source of information that can amplify risk perception (Tierney et al. 2006), so it is important to emphasize that discrepancy in risk perception among all four groups cannot be explained by the relationship between media and risk amplification.

It is also interesting to consider the perception of a general lack of information from media and scientific sources from all four groups considering a major news study concerning impacts from hydraulic fracturing in the Eagle Ford Shale, specifically focused on Karnes County, was published a week before focus group interviews were conducted. A news report completed in 2014 by the Weather Channel and the Center for Public Integrity (Morris et al. 2014) found multiple air quality impacts in the Eagle Ford Shale after conducting an analysis that looked at industry practices and residents’ experiences. Based on information obtained from Texas regulatory agencies, including the Texas Railroad Commission, they found that there are only five permanent air monitors in the entire region, an area that encompasses 26 counties, leading to a general lack of knowledge about the extent of the pollution (Morris et al. 2014).
According to the 2014 report, air quality is a concern in the Eagle Ford Shale. The report notes that according to TCEQ there have been several H2S emission events, which are unplanned releases that are not part of standard operations. From 2009 to 2013 emission events went from 1012 to 2023, and the amount of air pollutants released during events increased by 39%. Evidence of further environmental and health issues in the Eagle Ford Shale is shown in that almost 300 complaints have been filed by residents to TCEQ since 2010 (Morris et al. 2014). Several highly visible media outlets including the Huffington Post and National Public Radio as well as local news sources like the San Antonio Express covered this report. Given that this report, representing both a media and scientific information source, was published one week before the interviews were conducted, it is meaningful to note that none of the groups cited this study as an information source. This indicates that those interviewed may not pay attention to information from the media even when it is highly salient to their life or that this report did not make it into local media sources.

Interpersonal networks can also have an effect on risk perception as the values of the social network may become intertwined with the risk perception (Kasperson et al. 1988). Differences in risk perception among groups may be attributed to each group relying on different interpersonal networks as their source of information. For example, Crowe et al. (2015a) found that community leaders who had visited another community undergoing shale development were more likely to support a ban of hydraulic fracturing in their own community. Although interpersonal networks were not found as a major source of information among key informants and landowners, this does not preclude them from having interpersonal networks. It may be the case that each group has their own
unique interpersonal network. Some of these networks though may overlap in the similarities they share regarding belief systems. So it is possible that landowner and key informant groups share interpersonal networks with similar belief systems, while the same can be said for low income and elderly groups. As there is not a consistent, formal source of information like scientists or the media providing information or driving risk perception among all four groups, the variability in environmental and health risk perceptions may be attributed to the variability in source of information, particularly interpersonal networks.

Related to interpersonal networks, risk perception differences can be attributed to belief superiority, as Raimi and Leary (2014) found that those high in belief superiority on attitudes towards hydraulic fracturing were more likely to think they were better informed than others. They also concluded that if people oppose hydraulic fracturing and only tend to use information sources that discuss negative impacts then it will strengthen their attitude (Raimi and Leary 2014). Low income and elderly respondents receive more information than key informants and landowners from interpersonal networks, a source of information that more commonly discusses negative environmental and health impacts of hydraulic fracturing, as shown in the analysis. Repetition of negative examples of environmental and health impacts could be leading to higher belief superiority among low income and elderly focus groups that hydraulic fracturing is causing more environmental and health impacts. Conversely, key informants and landowners are receiving more information from industry and government officials, sources of information that tend to focus more on economic benefits of hydraulic fracturing and downplay negative environmental and health impacts. For each group, the source of
information may be acting as a force that confirms their already held beliefs, increasing their belief superiority on hydraulic fracturing, and in turn interacting with risk perception.

Another explanation for why most groups—low income, elderly, and landowners—mentioned a lack of information from all sources could be related to Texas ranking low on data transparency with regards to hydraulic fracturing activity (Malone et al. 2015). According to Malone et al. (2015), Texas ranks last in data transparency amongst ten states undergoing oil and gas development. In addition to not receiving information from media and scientists, respondents may experience an overall lack of information being delivered, which supports Malone et al.’s (2015) claim.

Lastly, key informants and landowners gather information from “authoritative” sources like STEER, the Eagle Ford Consortium, government officials, or industry. Flynn et al. (1994) states that leaders may be more knowledgeable because they more actively communicate with private interests looking to develop. This may provide a partial explanation of why key informant and landowners differ from low income and elderly groups in environmental and health risk perceptions. It may be that low income or elderly are less knowledgeable about development plans because they are not having as much direct communication with developers, so are not as aware of the potential economic gains from oil and gas development. And even if they were aware of development plans, they would not necessarily be able to benefit. Additionally, as oil and gas developers are not as willing to discuss environmental and health risks, this could be leading to a dearth of knowledge about those risks among the leader groups like key informants and landowners, as one of the dominant sources of information for them is industry.
As the analysis in this chapter shows, information source and risk perception interact in several important ways. Each group is receiving information from a variety of sources, including government and industry authorities, and interpersonal networks, which may provide some explanation as to the similarities and differences in risk perception amongst each group. Additionally, media and scientists were not found to be a source of information, and there was a lack of information in general. In the following chapter I explore and summarize ways that social position and source of information interact with environmental and health risk perceptions.
Hydraulic fracturing is a novel technological development that has pushed the extraction of energy resources forward. Proponents of hydraulic fracturing say that the extraction of oil and gas resources has allowed for improved energy security in the U.S. and an increase in gross domestic product (Potterf et al. 2014). Oil and gas industry supporters also claim that the process is safe and provides benefits to many people (API 2015; Porter 2013), and countries like the United Kingdom and China have recently committed increased resources to the development of hydraulic fracturing (Smith-Spark and Boulden 2013; Lee and West 2014). There have also been multiple negative environmental and health impacts examined in the biophysical science literature as a result of hydraulic fracturing (e.g. Adgate et al. 2014; Ellsworth 2013; Ferrell and Sanders 2013; Korfmacher 2013; Northrup and Wittemyer 2013; Vengosh et al. 2014), but there exists disagreement over the ubiquity and scale of these impacts and whether negative impacts can simply be managed by ensuring better practices (EPA 2015; Sovacool 2014b; Wang et al. 2014). Thus, there is great debate over the costs and benefits of hydraulic fracturing.

Given the disagreement of impacts of hydraulic fracturing in the research and in public opinion, it is important to consider how human populations perceive development at the local level. In addition to environmental and health risk indicators measured by biophysical scientists, understanding the perceptions of those people being directly affected by oil and gas development helps us understand the nuanced ways that a
population is impacted. Environmental and health risks are not perceived uniformly within a population (Crowe et al. 2015a), and there is also growing concern that populations in hydraulic fracturing communities are impacted unequally (Ogneva-Himmelberger and Huang 2015). There are many factors that cause certain populations to be more vulnerable to oil and gas development than others, some of which have been identified in this research. Understanding risk perceptions allows for the ability to understand one way that populations are impacted differently.

Using qualitative analysis of both key informant and focus group interviews I addressed two questions: 1) How do residents’ perceptions of environmental and health risks in the Eagle Ford Shale region of Texas differ by personal experience and social status (defined as potential personal gain from drilling activity and position in community)?, and 2) How does social status interact with the way people receive information regarding hydraulic fracturing in the Eagle Ford?

I found that key informant and landowner respondents, the groups in higher social positions, generally prioritized environmental and health risk perceptions differently from elderly and low income respondents, those respondents in lower social positions. Those in a higher social position talked about trash more often than respondents in lower social positions, but those in a higher social position did not bring up air quality as a concern in interviews. Respondents in lower social positions discussed all environmental and health risk perceptions with a relatively higher breadth and depth than those in higher social positions, evidenced by the frequency with which environmental and health risk perceptions are brought up in elderly and low income/low income interviews. Possible explanations for this finding are that perceived benefits lessens risk perception (Fischhoff
et al. 1981; Sjoberg 2000; McDaniels et al. 1995; Richards and Brod 2004). Related to this is the finding that community leaders have also been found to be more influenced by economic benefits, while residents tend to be more influenced by environmental and health risks (Spies et al. 1998). Additionally, those community residents with higher socioeconomic status or more power tend to have decreased risk perception (Bastide et al. 1989; Cutter, 1981; Finucane et al. 2000; Savage 1993). Despite these findings, it is important to restate that social and economic issues, such as increased traffic and a higher cost of living, were perceptions mentioned much more frequently by both key informant and focus group interviewees. Therefore, environmental and health risk perceptions generally were a less prevalent aspect of what residents and community leaders perceived as risks related to hydraulic fracturing.

I also found compelling differences between respondents in higher social positions and those in lower social positions regarding sources of information. Key informant and landowner respondents tend to receive more of their information regarding hydraulic fracturing from government officials and industry while low income and elderly receive more information from interpersonal networks. In general, low income and elderly mention a lack of information about oil and gas impacts. Interestingly, the media and scientists were not raised as major sources of information among all groups. Lack of information and media and scientists not being mentioned as sources of information may partially be explained by Texas’ low data transparency score (Malone et al. 2015). A lack of media as information source can also explain why there are relatively few environmental and health risk perceptions across all groups, as media can sensationalize events and increase risk perception (Tierney et al. 2006). Although key
informants and landowners do not discuss interpersonal networks as a dominant source of information, another possible explanation for difference in risk perception among groups may be attributed to each group relying on different interpersonal networks as explained in the Chapter V discussion (Crowe et al. 2015a; Kasperson et al. 1988). Lastly, source of information for each group may be confirming their already held beliefs, which may be increasing their belief superiority regarding hydraulic fracturing (Raimi and Leary 2014).

My research explored an understudied region that has been undergoing a dramatic shift as a result of a novel technological development. Previous research has explored resident risk perceptions in hydraulic fracturing communities (Brasier et al. 2011), but no previous research has been uncovered that considers how community residents’ perceptions of risk differ along lines of social status and information source. My findings contribute to the existing research in several ways. In general, there are relatively few studies that consider resident perceptions in hydraulic fracturing communities. Thus, this research is contributing to a relatively small field of growing research on resident perceptions in a hydraulic fracturing context. In addition, no studies have been found that have considered how environmental and health risk perceptions of residents are differentiated based on sources of information and social position. Therefore, understanding environmental and health risk perceptions can inform researchers as to where future attention is needed.

My research also has important applications to finding solutions in communities impacted by oil and gas development. Voices in rural communities are captured to a lesser extent than other perspectives, both within sociology and broader societal
discourses (Gurley 2015). Therefore, this research brings attention to rural populations who are being impacted by hydraulic fracturing. Furthermore, resident perceptions are important to capture especially when other data is unavailable in order to understand the impacts of hydraulic fracturing (Burdge and Ludtke 1994; Greider and Krannich 1985). Resident perceptions of the drilling impacts are, as of yet, one of the more reliable measurements of environmental and health impacts in the Eagle Ford Shale. Lastly, it is particularly important to examine environmental and health risk perceptions because they are the issues that anti-fracking groups use to attack hydraulic fracturing. Understanding environmental and health risk perceptions may lend credibility to anti-fracking groups or provide contradictory information that may require a change in discourse among activists. Understanding risk perception of the public is important because public opinion can have an impact on political, social, and economic actions taken to address a risk (Leiserowitz 2005).

FUTURE RESEARCH

Although this thesis provides initial insight on environmental and health risk perceptions of residents in a hydraulic fracturing community, several questions remain that should be addressed in future studies. My research captured community leaders and those residents identified as being uniquely impacted by hydraulic fracturing. It would be fruitful if future research considered a more representative sample of the population, and examine if environmental and health risk perceptions from this larger, representative sample differ from my findings. Furthermore, both La Salle and Karnes Counties have high Hispanic populations compared to the rest of the state, as noted in Table 1 in
Chapter III. Future research in a context with such a diverse population might consider different methods that capture populations whose primary language is not English. In addition, based on my findings, there is an indication that certain populations, in this case the elderly and low income, perceive environmental and health risks of hydraulic fracturing differently, which may be related to spatial inequality. As the study design did not consider spatial differences, future research may want to consider how spatial distance to oil and gas well pads may also have an effect on risk perceptions similar to the research done by Jacquet (2012) in the Marcellus Shale and Ogneva-Himmelberger and Huang (2015) in Pennsylvania, Ohio, and West Virginia. Lastly, individual agency was also not captured in interviews, but may play a role in forming risk perception. Those in lower social positions may feel like they are less capable of challenging authority, which lessens their feeling of agency, and thereby increases their perceptions of risk (Walker et al. 1998). For future research, it would be interesting to consider the relative feelings of agency that each group might feel they have related to their social position and how this relates to perceptions of environmental and health risks in the community. Several respondents mentioned the power the oil and gas industry wields in the state of Texas. Considering the relative power of the oil and gas industry in Texas and examining agency among respondents could reveal meaningful similarities and differences in risk perception. Lastly, due to environmental and health risk perceptions being mentioned to a lesser extent compared to other perceptions, there is a general lack of quotes as data. Future research might consider measuring environmental and health risk perceptions explicitly rather than measuring all risk perceptions related to hydraulic fracturing.
Regarding research on information sources, future studies could also examine government and industry transparency as my analysis indicated that several groups—elderly, low income, and to a smaller extent landowners—feel there is a lack of information. Lack of transparency can prevent the public from being able to meaningfully engage in strategies that mitigate potential impacts from industry, such as increased regulation of industry (Malone et al. 2015). Additionally, risk is interpreted through communication networks and can then be amplified or attenuated through influences such as the amount of trust and confidence an individual places in a certain institution and their managers (Kasperson et al. 1988; Kasperson et al. 2003). The amount of trust individuals place in authorities and experts affects risk perception, influencing the action an individual will take on a perceived risk (Wachinger et al. 2013).

Further, it is not just the information being transmitted that is important, but also the degree to which that information is believed (Theodori et al. 2014). The amount of trust respondents place in different information sources was not looked at in the qualitative analysis for this thesis, but for future research may be important to consider as an influence of the information source an individual chooses. Lastly, attitudes toward environmental policy should be examined in future studies. Pro-environmental policy attitudes are related to opposition or support of hydraulic fracturing, which has important implications for what policies are supported or not at the local level (Davis and Fisk 2014). These findings suggest that values and beliefs influence how the public perceives risks of hydraulic fracturing (Davis and Fisk 2014). For example, a policy requiring more stringent regulations on hydraulic fracturing may increase risk perception because of the implications the policy might mean to those affected by hydraulic fracturing (Davis and
Thus, there are multiple avenues for future research to be explored critical to understanding resident perceptions in hydraulic fracturing communities.

CONCLUSION

Oil and gas development is a complex process that does not impact all residents or locales in a uniform way. Environmental and health risks vary depending on the location, and an individual’s perceptions are filtered by many different factors. As we presume to live in a democracy, understanding the perceptions of residents has important policy implications, as the collective will of organized people can guide policy in a specific direction, especially when considered alongside scientific findings. Pidgeon (1998:5) emphasizes this point by saying:

…balancing and integrating the best available scientific judgments and evidence on the one hand with aspects of ethical or other values on the other hand, is perhaps one of the most difficult questions to be faced by democratic governments and their regulators today.

In La Salle and Karnes Counties, two rural places that do not have robust biophysical scientific data available on impacts of hydraulic fracturing both as a result of being rural areas and a relatively short history of hydraulic fracturing, it is particularly important to understand resident perceptions in order to discern proper policy steps to take.

My results suggest that different populations are being impacted in varied ways, and that steps can be taken in order to further protect populations that perceive they are more vulnerable to oil and gas development. My findings can both challenge industry claims that environmental and health impacts are non-existent, and provide industry with a roadmap on what problems might need to be addressed. Perhaps, elected officials could
also adapt communication strategies, in light of my finding that residents feel they have a lack of information from government officials. Moving forward, my results suggest that in order to lessen perceptions of impacts from oil and gas development it is crucial for industry to integrate local perspectives into planning stages of oil and gas development, as well as regularly check in throughout the extraction process. Industry might not be concerned with environmental and health risk perceptions of residents, but integrating local perspectives will allow oil and gas companies to address the needs of locals and partially sustain their own objectives of remaining in business by appeasing some of the concerns voiced by those who oppose hydraulic fracturing. This study fills missing gaps in the literature and provides issues that industry and/or government entities may want to address as hydraulic fracturing ebbs and flows in scale in the United States.
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APPENDICES
Engagement for Effective Communication: Development and Testing of Best Communication Practices in Eagle Ford Shale Communities

Community Leader Interview Guide

Introductions and Rapport Building
Tell me about your role in the community.
- What is your day-to-day work like?
- What are your goals for the community?

Tour of Events and Current Context
- We are interested in knowing when you first found out that the most recent oil/gas development was going to start?
  - What was your first reaction?
  - Is that how you feel currently? (If no, what has changed?)
- Did you feel like you had enough information about what was happening?
  - Where did you get your information?

Today, how is the community different as a result of oil/gas development?
- What has changed for the better? (Probe for specifics)
- What has changed for the worse? (Probe for specifics)
- Are these changes things that you expected when things were starting out? What (if anything) has surprised you?
- How has this development affected you and your work?

How would you describe the relationships between your organization (or community government) and the oil/gas companies active in this area?
- How has this relationship changed over time?
- Do you feel that you have a good working relationship with the industry?
- Are there any ways this relationship could be improved?

Concerns and Problem Solving
Looking to the future, what are the most beneficial things you expect might come from
expanded oil & gas development in this area?

- What steps have been taken to make sure that those benefits occur?
- Are there other things that you think could be done in the future to maximize the benefits?

As a community leader/member, what are the biggest concerns (risks?) you might have about future gas/oil development?

- What do you most worry about happening?
- Have you been able to do anything to address these concerns?

Who have you worked with to address these concerns? (Use specifics from previous question)

- Have you sought information or assistance from anyone? (Universities? State agencies? Others?)
- Have you tried working directly with the oil & gas companies to address these concerns?
  - If yes:
    - Did they understand your concerns?
    - Did they respond to your concerns? If yes, how so (detail)
  - If no:
    - Why not?
    - What have you tried?

Please describe the level and type of communication you believe your community has with the industry currently.

*If applicable and needed:* Can you think of an example of an event where you worked with energy companies to address and fix a community concern or issue related to oil and gas development?

- Was it successful?
- Why do you think this collaboration was un/successful?

*If the environment hasn’t already come up:* Are there any concerns by community
members about what oil/gas development might do to their local environment?

- What is the nature of the environmental concerns?
- Have any steps been taken to address these concerns?
- Have they been effective?
- Do you feel like additional steps need to be taken?
  - If yes: From your perspective, how can this problem be solved?
  - If no: How do you think you’ve been able to avoid these issues?

**Closing Questions**

Do you have any advice for community leaders in other places where oil/gas development is just beginning?

Is there anything I haven’t asked about that you think I should know?

Do you know anyone who is knowledgeable about these issues that you would recommend we talk with?

Would you be interested in working with us in the future to get information to answer questions you might have about managing the impacts of energy development in this community?

**Additional Questions of Interest IF time**

It seems like there are positive and negative aspects to most types of development. Can you think of things that can be done to make sure the benefits outweigh the risks?

- What can the oil companies do?
- What can community leadership do?

What people in this community are most positive about the oil and gas development?
What people are most critical?
Why?
Interviewee Information Sheet:

Name:

Time:

Government/Company affiliation:

Position or title:

Town of employment:

Place of interview:

MP3 File Name:

General Comments/Notes:
APPENDIX B

Engagement for Effective Communication: Development and Testing of Best Communication Practices in Eagle Ford Shale Communities

**Focus Group Interview Guide**

Introduction and Rapport Building

- How has oil and gas drilling impacted your life? (probe for specifics)

Current Impacts on Community

- What are the ways oil and gas activity has impacted the community?
  - Has there been an increase in fatalities?
  - Has the rent gone up? Housing?
  - Increased Crime?
    - Perpetrated by locals or outsiders?
  - Concerns about water quality or quantity? Air quality concerns?
  - What keeps you staying here?

- Are there any good impacts from oil and gas activity?
  - Do you think things will change for better?

- Were there changes happening before oil and gas industry came? How has the community changed as a result of oil and gas activity?
  - What was communication like before activity?
  - Did you feel like you had enough information about what was happening?
    - Where did you get your information?

Communication with city officials or industry

- Do you the have opportunity to share concerns with city officials?
  - Who have you worked with to address these concerns? (Use specifics from previous question)
    - Have you sought information or assistance from anyone? (Universities? State agencies? Others?)
    - Have you tried working directly with the oil & gas companies to address these concerns?
• If yes:
  • Did they understand your concerns?
  • Did they respond to your concerns? If yes, how so (detail)

• If no:
  • Why not?
  • What have you tried?

• When drilling activity started, were there any public meetings by city officials or industry detailing what the community can expect?
  o Was this helpful or successful?

• When you have an issue who you talk to? Where do you get information from?

Closing Questions
• When did you first hear the term Eagle Ford?
  o What did you think when you heard the term?
• If you could talk to elected officials what would you want them to know?
• Is there anything I haven’t asked about that you think I should know?
Public Perceptions of Oil and Natural Gas Development  
A Survey of Texas Residents in the Eagle Ford Shale Region

Please respond to each question by writing or circling the response that best describes your answer. All responses will remain confidential. Your responses will be most useful if you answer every question.

1. Please read the following statements and indicate whether you “strongly disagree,” “mildly disagree,” are “unsure,” “mildly agree,” or “strongly agree.” Please circle one answer for each item.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Strongly disagree</th>
<th>Mildly disagree</th>
<th>Unsure</th>
<th>Mildly agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. The oil and gas industry is important to the local economy.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>b. Not enough information concerning oil and gas development in the Eagle Ford Shale is being made available to the general public.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>c. Even when carefully controlled, oil and gas development is likely to upset the quality of life in a local area.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>d. Because industry has to be competitive, it is unfair to expect oil and gas companies to tell the public about their plans.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>e. All in all, the benefits of oil and gas development in the Eagle Ford Shale are greater than the costs.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>f. The oil and gas industry must adopt and use more environmentally-friendly drilling practices in the Eagle Ford Shale.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
g. Too little attention is being paid to the social costs of oil and gas development in the Eagle Ford Shale.  

| 1 | 2 | 3 | 4 | 5 |

h. The oil and gas industry has little interest in our natural environment.  

| 1 | 2 | 3 | 4 | 5 |

i. Oil and gas companies in the Eagle Ford Shale will do only what’s required by law.  

| 1 | 2 | 3 | 4 | 5 |

j. In the long run, I’m sure that people in the Eagle Ford Shale will be better off if our energy resources are developed.  

| 1 | 2 | 3 | 4 | 5 |

k. People who object to oil and gas development in the Eagle Ford Shale should move someplace else.  

| 1 | 2 | 3 | 4 | 5 |

l. Oil and gas industry operators in the Eagle Ford Shale are too politically powerful.  

| 1 | 2 | 3 | 4 | 5 |

m. Decisions about oil and gas-related development should be made solely on economic grounds.  

| 1 | 2 | 3 | 4 | 5 |

2. Several issues which may or may not be problems in your county are listed down the left hand side of the table below. In **PART I**, please indicate whether you believe the issue was “no problem at all,” a “slight problem,” a “moderate problem,” or a “serious problem” in your county before the large-scale development of oil and natural gas. In **PART II**, please indicate whether the large-scale development of oil and/or natural gas has affected the seriousness of the issue by selecting one of the following three choices – it is “getting better,” “staying the same,” or “getting worse.” Please circle the responses that best describe your answers.

| 1 | 2 | 3 | 4 | 5 |

**Please respond to PART I and PART II**

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<th>PART I</th>
<th>PART II</th>
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</table>
Before the large-scale development of oil and natural gas, the issue was:

Because of the development of oil and natural gas, the issue is:

<table>
<thead>
<tr>
<th>Issue</th>
<th>No problem at all</th>
<th>Slight problem</th>
<th>Moderate problem</th>
<th>Serious problem</th>
<th>Getting better</th>
<th>Staying the same</th>
<th>Getting worse</th>
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<tbody>
<tr>
<td>a. Traffic congestion</td>
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<td>1 2 3 4</td>
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<td>b. Quality of local schools</td>
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<td>c. Property crimes such as</td>
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<td>vandalism or theft</td>
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<td>d. Availability of good jobs</td>
<td>1 2 3 4</td>
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<td>e. Traffic accidents/safety</td>
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<td>f. Availability of affordable housing</td>
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<td>1 2 3 4</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td></td>
</tr>
<tr>
<td>g. Water quality</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td></td>
</tr>
<tr>
<td>h. Medical and health care services</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td></td>
</tr>
<tr>
<td>i. Air quality</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td></td>
</tr>
<tr>
<td>j. Trash on roadsides</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td></td>
</tr>
<tr>
<td>k. Prostitution</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td></td>
</tr>
<tr>
<td>l. Man camps</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td></td>
</tr>
<tr>
<td>m. Young people leaving</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td></td>
</tr>
<tr>
<td>community after high school</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n. Local tax rates</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td></td>
</tr>
<tr>
<td>o. Spending in local</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td></td>
</tr>
<tr>
<td>businesses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. Please read the following statements and indicate whether you “strongly disagree,” “mildly disagree,” are “unsure,” “mildly agree,” or “strongly agree.” Please circle one answer for each item.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Strongly disagree</th>
<th>Mildly disagree</th>
<th>Unsure</th>
<th>Mildly agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. We already know enough about the potential impacts of oil and natural gas extraction to speed up development in the Eagle Ford Shale.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>b. I worry that there will be some sort of catastrophic accident involving oil and natural gas extraction in the Eagle Ford Shale.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>c. Any negative impacts of oil and natural gas extraction in the Eagle Ford Shale can be fixed.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
d. Continued development of oil and natural gas in the Eagle Ford Shale will create long lasting environmental problems.  

<table>
<thead>
<tr>
<th>No trust</th>
<th>Very little trust</th>
<th>Some trust</th>
<th>Great deal of trust</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

e. Extraction of oil and gas from shale reservoirs, such as in the Eagle Ford, should be encouraged to decrease our reliance on imported energy sources.  

<table>
<thead>
<tr>
<th>No trust</th>
<th>Very little trust</th>
<th>Some trust</th>
<th>Great deal of trust</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

f. Continued development of oil and natural gas in the Eagle Ford Shale will create long lasting social problems.  

<table>
<thead>
<tr>
<th>No trust</th>
<th>Very little trust</th>
<th>Some trust</th>
<th>Great deal of trust</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

g. The oil and gas industry will provide economic opportunities that will help keep our children in south Texas.  

<table>
<thead>
<tr>
<th>No trust</th>
<th>Very little trust</th>
<th>Some trust</th>
<th>Great deal of trust</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

h. Continued development of oil and natural gas in the Eagle Ford Shale makes me optimistic about the future of south Texas.  

<table>
<thead>
<tr>
<th>No trust</th>
<th>Very little trust</th>
<th>Some trust</th>
<th>Great deal of trust</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

4. Overall, how much trust do you have in each of the following groups as sources of information about the positive and negative impacts of oil and/or natural gas development?

<table>
<thead>
<tr>
<th>No trust</th>
<th>Very little trust</th>
<th>Some trust</th>
<th>Great deal of trust</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Oil/natural gas industry</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>b. Texas Railroad Commission</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>c. U.S. Environmental Protection Agency</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>d. Texas Commission on Environmental Quality</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>e. Texas A&amp;M AgriLife Extension</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>f. Environmental groups/organizations</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>g. Scientists/researchers</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>South Texas Energy &amp; Economic Roundtable (STEER)</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>i.</td>
<td>America’s Natural Gas Alliance (ANGA)</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>j.</td>
<td>My county government</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>k.</td>
<td>Our local city government</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>l.</td>
<td>Texas State Legislature</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>m.</td>
<td>Eagle Ford Consortium</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

5. Of the groups listed in question 4, which one do you believe is MOST trustworthy?

_______________________________________________________

*(please specify)*

6. For each of the following items, please indicate how satisfied or dissatisfied you are with how the oil and gas industry is performing in this area. Please circle one answer for each item.

<table>
<thead>
<tr>
<th></th>
<th>Very dissatisfied</th>
<th>Dissatisfied</th>
<th>Neither dissatisfied nor satisfied</th>
<th>Satisfied</th>
<th>Very satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Extent to which the industry knows about its impacts on local communities.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>b.</td>
<td>Extent to which the industry listens to concerns raised by local community residents.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>c.</td>
<td>Extent to which the industry responds to concerns raised by local community residents.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>d.</td>
<td>Extent to which the industry shares information about its activities with local communities.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>e.</td>
<td>Extent to which the industry’s communications are interesting and helpful.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>f.</td>
<td>Extent to which crises are handled appropriately through communication by the industry.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
7. Below is a list of eight actions you may or may not have taken in response to the exploration and production of oil and/or natural gas in or near your community. In PART I, please indicate whether or not you have engaged in such an action. In PART II, please indicate your likelihood of doing it in the future. Please circle the responses that best describe your answers.

<table>
<thead>
<tr>
<th>Actions</th>
<th>PART I</th>
<th>PART II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attended a public meeting to get information and learn more about the drilling and/or production of oil and natural gas.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not likely Somewhat likely Very likely</td>
</tr>
<tr>
<td></td>
<td>1  2  1  2  3</td>
<td></td>
</tr>
</tbody>
</table>
b. Contacted a local elected official or governmental agency to complain about an oil and natural gas drilling and/or production issue. | 1 | 2 | 1 | 2 | 3

c. Voted FOR a political candidate because of his/her position on the drilling and/or production of oil and natural gas. | 1 | 2 | 1 | 2 | 3

d. Voted AGAINST a political candidate because of his/her position on the drilling and/or production of oil and natural gas. | 1 | 2 | 1 | 2 | 3

e. Attended an energy industry-sponsored meeting to get information and learn more about the exploration and/or production of oil and natural gas. | 1 | 2 | 1 | 2 | 3

f. Attended a public meeting to OPPOSE the exploration and/or production of oil and natural gas. | 1 | 2 | 1 | 2 | 3

g. Attended a public meeting to SUPPORT the exploration and/or production of oil and natural gas. | 1 | 2 | 1 | 2 | 3

h. Wrote and mailed a letter to the editor of your local newspaper OPPOSING the continued exploration and/or production of oil and natural gas. | 1 | 2 | 1 | 2 | 3

8. How has the drilling and production of oil and/or natural gas in or near your community affected the amount of stress in your life?

1  Greatly increased the amount of stress
2  Somewhat increased the amount of stress
3  Neither increased nor decreased the amount of stress
4  Somewhat decreased the amount of stress
5  Greatly decreased the amount of stress

9. Using a scale of 1 (FAR TOO LITTLE EFFORT) to 7 (FAR TOO MUCH EFFORT), please circle the number that best indicates how much effort you feel each of the following agencies and groups makes to include local residents’ input in concerns regarding the oil and gas industry development in and/or near your
community. Please circle one answer for each item.

<table>
<thead>
<tr>
<th>Federal and State Agencies</th>
<th>Far too little effort</th>
<th>About right level of effort</th>
<th>Far too much effort</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Environmental Protection Agency</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Texas Railroad Commission</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Texas A&amp;M AgriLife Extension</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Texas Commission on Environmental Quality</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Texas State Legislature</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Groups and Organizations</th>
<th>Far too little effort</th>
<th>About right level of effort</th>
<th>Far too much effort</th>
</tr>
</thead>
<tbody>
<tr>
<td>f. Oil and gas industry</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Environmental groups/organizations</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>h. Scientists/researchers</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. South Texas Energy &amp; Economic Roundtable (STEER)</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>j. America’s Natural Gas Alliance (ANGA)</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>k. County government</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>l. City government</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>m. Eagle Ford Consortium</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10. How satisfied or dissatisfied are you with the following aspects of communication regarding recent oil and gas industry activity in/near your community? Please circle one answer for each item.

<table>
<thead>
<tr>
<th></th>
<th>Very dissatisfied</th>
<th>Dissatisfied nor satisfied</th>
<th>Satisfied</th>
<th>Very satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Oil and gas industry officials getting information out to the public</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
11. How much influence do you feel each of the following should have on management decisions pertaining to oil and gas development occurring in/near your community?

<table>
<thead>
<tr>
<th></th>
<th>Oil and gas industry officials soliciting input from the public</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fairness of the communication process (all citizens’ voices and concerns are heard and considered)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Effectiveness of county government in communicating information about oil and gas development</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Effectiveness of city government in communicating information about oil and gas development</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Availability of information about oil and gas development</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Freedom to express my opinion about oil and gas development</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
12. How much influence do you feel each of the following actually have on management decisions pertaining to oil and gas development occurring in/near your community?

<table>
<thead>
<tr>
<th></th>
<th>No influence</th>
<th>A little influence</th>
<th>Moderate influence</th>
<th>Major influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Residents of local affected communities</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>b. Officials of local affected communities</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>c. Environmental interest groups</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>d. Commercial resource industries (agriculture, timber, etc.)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>e. Statewide public opinion</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>f. National public opinion</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>g. State natural resource agencies</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>h. Federal natural resource agencies</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>i. U.S. Congress</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>j. Texas State Legislature</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
13. Oil and natural gas development in the Eagle Ford Shale (as well as in other shale reservoirs) relies heavily on the practice of hydraulic fracturing. On a scale from 1 to 7, where 1 is Extremely Unfamiliar and 7 is Extremely Familiar, how would you assess your familiarity with the process of hydraulic fracturing?

Extremely Unfamiliar-----------------------------------------------Extremely Familiar

14. Please indicate how much of what you know about the process of hydraulic fracturing comes from each of the following sources.

<table>
<thead>
<tr>
<th>Source</th>
<th>None</th>
<th>Very little</th>
<th>Some</th>
<th>A great deal</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Newspapers</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>b. Internet websites</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>c. <em>Gasland</em> and/or <em>Gasland 2</em> (the films by Josh Fox)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>d. Texas A&amp;M AgriLife Extension</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>e. Oil/natural gas industry</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>f. Regulatory agencies</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>g. Conservation/environmental groups</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>h. Social media</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>i. University professors</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>j. Landowner groups/coalitions</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>k. Neighbors</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>l. Friends in community</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>m. Elected county officials</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>n. Elected city officials</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>o. Religious leaders</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

15. Please indicate how much trust you have in each of the following to deliver unbiased, factual information on hydraulic fracturing.

<table>
<thead>
<tr>
<th>Source</th>
<th>No trust</th>
<th>Very little trust</th>
<th>Some trust</th>
<th>A great deal of trust</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Newspapers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Internet websites</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>c. <em>Gasland</em> and/or <em>Gasland 2</em> (the films by Josh Fox)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>d. Texas A&amp;M AgriLife Extension</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Oil/natural gas industry</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Regulatory agencies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Conservation/environmental groups</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h. Social media</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. University professors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>j. Landowner groups/coalitions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>k. Neighbors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>l. Friends in community</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>m. Elected county officials</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n. Elected city officials</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o. Religious leaders</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
16. The term “frac flowback water” refers to water that returns to the surface after a well is hydraulically fractured. On a scale from 1 to 7, where 1 is Extremely Unfamiliar and 7 is Extremely Familiar, how would you assess your familiarity with the management and disposal of frac flowback water in the Eagle Ford Shale?

Extremely Unfamiliar--------------------------------------------------------Extremely Familiar

1 2 3 4 5 6 7

17. Technologies that remove contaminants from frac flowback wastewaters in oil and natural gas field operations currently exist and continue to be refined. On a scale from 1 to 7, where 1 is Extremely Unfamiliar and 7 is Extremely Familiar, how would you assess your familiarity with frac flowback wastewater treatment technology?

Extremely Unfamiliar--------------------------------------------------------Extremely Familiar

1 2 3 4 5 6 7

18. Given what you currently know about wastewater treatment technology, do you believe that treated wastewater from hydraulic fracturing operations could safely be used for the following purposes?
<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Re-use by oil and gas industry operators</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>b. Watering of livestock</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>c. Industrial use (e.g., manufacturing, etc.)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>d. People’s drinking water</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>e. Municipal uses (e.g., watering of golf courses and city parks, etc.)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>f. Irrigation of farmland and/or rangeland</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>g. Maintenance of stream flows/reservoir levels</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>h. Home irrigation purposes (e.g., watering lawns and shrubs, etc.)</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Finally, we need to ask some questions about your property, your household, and you. This information, as with all information provided in this survey, will be used only for statistical analyses and will remain strictly confidential.

19. Do you or members of your immediate household own any parcel of land in the Eagle Ford Shale play?
   
   1  No  
   2  Yes ➔ **If Yes:**

   a. How many acres do you or members of your immediate household own?
      
      ______________________ (acres)

   b. Do you live on this land?
      
      1  No  
      2  Yes  

20. Do you or members of your immediate household own the mineral rights to any parcel of land in the Eagle Ford Shale play?
   
   1  No  
   2  Yes
21. Have you or members of your immediate household been approached by landmen seeking to lease any of the land for oil/gas drilling or for laying pipelines?
   
   1 No
   2 Yes

22. If you were asked to sign an Eagle Ford Shale lease to allow oil/gas drilling or the laying of pipelines on your land, would you consider signing?

   1 Yes: I have already signed a lease
   2 Yes: I have not signed a lease, but would consider signing
   3 No: I would not consider signing a lease
   4 Don’t know

23. If you have already signed a lease, how satisfied are you with the terms of the lease?

   0 I have not signed a lease
   1 Very dissatisfied
   2 Dissatisfied
   3 Neither dissatisfied nor satisfied
   4 Satisfied
   5 Very satisfied

24. Have you had any Eagle Ford Shale drilling or pipeline development on the land you own?

   1 No
   2 Yes ➔ If Yes, how satisfied are you with this activity?

      1 Very dissatisfied
      2 Dissatisfied
      3 Neither dissatisfied nor satisfied
      4 Satisfied
      5 Very satisfied

25. Have you received any royalties or lease payments for drilling or pipeline development on the land you own in the Eagle Ford Shale?

   1 No
   2 Yes ➔ If Yes, how satisfied are you with these royalties or lease payments?
1  Very dissatisfied
2  Dissatisfied
3  Neither dissatisfied nor satisfied
4  Satisfied
5  Very satisfied

26. Are you (or were you ever) employed in an occupation related to the oil and gas industry?

1  No
2  Yes

27. Are any of the following types of people who you know employed (either full-time or part-time) in an occupation related to the oil and gas industry?

<table>
<thead>
<tr>
<th>Type</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Family members</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>b. Close friends</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>c. Acquaintances</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

28. How old are you?  __________

29. Are you:

1  Male
2  Female

30. Do you:

1  Own a single-family house
2  Rent a single-family house
3  Own a mobile home/house trailer
4  Rent a mobile home/house trailer
5  Own a townhouse/apartment
6  Rent a townhouse/apartment
7  Other (please specify)  __________

31. Which of the following best describes where you live?

1  I live within the city limits
2  I live outside the city limits
32. Are there any children (under 18) living in your home?
   1  No
   2  Yes

33. What is your current marital status?
   1  Married
   2  Living with partner (but not married)
   3  Divorced/separated
   4  Single
   5  Widowed
   6  Other (please specify) ________

34. What is the highest level of education that you completed?
   1  Did not complete high school
   2  High school or equivalent
   3  Some college or post high school training
   4  Associate’s or 2-year vocational degree
   5  Bachelor’s degree
   6  Graduate/professional degree

35. What race do you consider yourself?
   1  American Indian
   2  Asian
   3  Black or African American
   4  Hispanic
   5  White
   6  Other (please specify) ________

36. Please circle a number between 1 (Very Liberal) and 7 (Very Conservative) that corresponds to your political views.

   Very Liberal----------------------Moderate----------------------Very Conservative
   1   2   3   4   5   6   7

37. Which of the following best describes the political party with which you most affiliate?
   1  Constitution Party
   2  Democratic Party
   3  Green Party
   4  Libertarian Party
   5  Republican Party
   6  Other (please specify) ________
38. Which of the following are current sources of income in your household?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wages and/or salary</td>
</tr>
<tr>
<td>2</td>
<td>Income from business</td>
</tr>
<tr>
<td>3</td>
<td>Interest and/or investments</td>
</tr>
<tr>
<td>4</td>
<td>Income from rental properties</td>
</tr>
<tr>
<td>5</td>
<td>Supplemental security income</td>
</tr>
<tr>
<td>6</td>
<td>Other disability benefits</td>
</tr>
<tr>
<td>7</td>
<td>Social Security payments</td>
</tr>
<tr>
<td>8</td>
<td>Retirement pension payments</td>
</tr>
<tr>
<td>9</td>
<td>Unemployment benefits</td>
</tr>
<tr>
<td>10</td>
<td>Food stamps</td>
</tr>
<tr>
<td>11</td>
<td>Public assistance/welfare</td>
</tr>
<tr>
<td>12</td>
<td>Other ____________ (specify)</td>
</tr>
</tbody>
</table>

39. Which of the following categories best describes your total 2014 household income from all sources before taxes?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Under $9,999</td>
</tr>
<tr>
<td>2</td>
<td>$10,000 to $19,999</td>
</tr>
<tr>
<td>3</td>
<td>$20,000 to $29,999</td>
</tr>
<tr>
<td>4</td>
<td>$30,000 to $39,999</td>
</tr>
<tr>
<td>5</td>
<td>$40,000 to $49,999</td>
</tr>
<tr>
<td>6</td>
<td>$50,000 to $59,999</td>
</tr>
<tr>
<td>7</td>
<td>$60,000 to $69,999</td>
</tr>
<tr>
<td>8</td>
<td>$70,000 to $79,999</td>
</tr>
<tr>
<td>9</td>
<td>$80,000 to $89,999</td>
</tr>
<tr>
<td>10</td>
<td>$90,000 to $99,999</td>
</tr>
<tr>
<td>11</td>
<td>$100,000 to $109,999</td>
</tr>
<tr>
<td>12</td>
<td>$110,000 to $119,999</td>
</tr>
<tr>
<td>13</td>
<td>$120,000 to $129,999</td>
</tr>
<tr>
<td>14</td>
<td>$130,000 or more</td>
</tr>
</tbody>
</table>

You have now completed the survey. **THANK YOU** very much for your time and effort!