The Potential Impact Radius of a Natural Gas Transmission Line and Real Estate Valuations: A Behavioral Analysis

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The Potential Impact Radius of a Natural Gas Transmission Line and Real Estate Valuations:

A Behavioral Analysis

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Business Administration
Department of Information Systems and Decision Sciences
Muma College of Business
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To address these questions, a Qualtrics survey that included three video tour treatments of a residential property was sent to three groups. A control group was presented a video tour without any residential disclosure notice. A second group was presented a video tour with an audible notice that the residence is located within 500 feet of a natural gas transmission line. A third group was presented a video tour with an audible notice that the residence is located within the potential impact radius (PIR) of a natural gas transmission line.

Each respondent was asked to state a fair offer value for the residential property shown in their respective video. No statistically significant difference was found in the fair offer value mean between the control group and the group with notice the residence is located within 500 feet of a natural gas transmission line was found. No statistically significant difference was found in the fair market value between the group with notice the residence is located within 500 feet of a natural gas transmission line and the group with notice the residence is located within the potential impact radius (PIR) of a natural gas transmission line was found. A statistical significance was found where the control group was compared to the group with notice the residence is located within the potential impact radius (PIR).
CHAPTER ONE:
INTRODUCTION

Once installed, natural gas transmission lines are not visible; they are odorless and silent. A potential homebuyer without prior knowledge of a nearby natural gas transmission line is unaware of its existence. Ohio does not require a seller of a residential property to disclose the proximity of the subject residence to a natural gas transmission line. Also, Ohio does not require a seller of a residential property to disclose that the subject residence is located within a potential impact radius (PIR) of a natural gas transmission line. But, what if legislation required these disclosures?

Background: The Increase in Natural Gas Pipeline Infrastructure

Natural gas supplies 25% of all the energy Americans consume and is the second largest source of energy behind oil (US Department of Transportation, 2019). Fortunately, natural gas is a fuel source the United States has in abundance. Advancements in extraction techniques have allowed production companies to access massive reserves that were inaccessible a little more than a decade ago. Marcellus Shale Formation and the Utica Shale Formation are two large, overlapping natural gas deposits that are accessible. These formations are found in New York, Pennsylvania, West Virginia, and Ohio. The accessibility of this resource has resulted in shifts from coal burning power plants to cleaner burning, relatively inexpensive natural gas fueled power plants. The U.S. Energy Information Administration (EIA) expects the share of U.S. total utility-scale electricity generation from natural gas-fired power plants to rise from 35% in 2018 to 37% in 2019 and to 38% in 2020. EIA forecasts that the share of electricity generation from
coal will average 24% in 2019 and 22% in 2020, down from 27% in 2018 (US Energy Information Administration, 2019).

The increased supply in natural gas is changing the landscape of home heating fuel choices. Natural gas is less expensive and labor-intensive to supply than home heating oil or propane, both of which are delivered manually by truck. The northeast part of the United States traditionally has relied on propane and heating oil for their home heating fuels. Massachusetts provides an example of the cost savings for making the change to natural gas in Figure 1 (Commonwealth of Massachusetts, Energy Policy Planning and Analysis Division, 2018).

Table 1. “Household Heating Costs” (December 26, 2018) at https://www.mass.gov/info-details/household-heating-costs. Based on a 2186 square foot house

<table>
<thead>
<tr>
<th>Heating Fuel</th>
<th>2018/2019 Winter Projected Cost (2186 square foot home)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>$983</td>
</tr>
<tr>
<td>Heating Oil</td>
<td>$1,642</td>
</tr>
<tr>
<td>Propane</td>
<td>$2,118</td>
</tr>
</tbody>
</table>

Natural gas is extracted from the ground. Transportation of natural gas is required to supply the extracted gas to the market to meet demand. One mode of transportation of natural gas is the use of a network of pipelines. The focus of this research concerns how pipelines are used to bring natural gas to the market.

According to the Pipeline and Hazardous Materials Safety Administration (PHMSA), 2.6 million miles of pipelines deliver trillions of cubic feet of natural gas and hundreds of billions of ton/miles of liquid petroleum products each year (US Department of Transportation, Pipeline and Hazardous Material Safety Administration, 2019). Natural gas transmission lines make up approximately 300,000 miles of this infrastructure (Interstate Natural Gas Association of America, n.d.). These pipelines are large diameter ones, generally 6 to 48 inches, intended to
transport natural gas for long distances at high pressure. These transmission pipelines are different than natural gas distribution pipelines, which are low-pressure service pipelines that deliver natural gas to individual homes and businesses. During the 20-year period from 2015 through 2035, an estimated 264,000 to 329,000 miles of natural gas transmission pipeline will be added to the existing infrastructure (Petak, 2016). From this overall mileage, approximately 18,000 to 29,000 miles, or roughly 900 to 1,450 miles per year, of high-pressure natural gas transmission lines will be installed (Petak, 2016).

Natural gas transmission line routing presents a logistical issue. Pipeline operators must balance the safety of the public against the cost of installation. Pipeline construction costs can be calculated by the linear foot. It follows that the shorter the pipeline, the lower the cost for installation. Safety, accessibility, policy and geological features may require a pipeline construction company to alter the direction of a pipeline. From the perspective of a pipeline operator, the most direct route for a pipeline will cost the least to install.

Recent technological advances have allowed for oil and gas extraction in areas that previously were inaccessible. The Marcellus Shale Formation and Utica Shale Formation benefitted from the technological advances. These formations were found under populated residential areas. Residential developments were established above these formations without the contemplation of a future natural gas transmission lines. The introduction of new natural gas transmission lines into these densely populated areas has presented a safety concern for the respective residential homeowners. The pipeline operators are required to perform a cost/benefit analysis, considering public safety and project feasibility.
Regulation in High Consequence Areas

The U.S. Department of Transportation’s Pipeline and Hazardous Materials Safety Administration (PHMSA) designates higher populated areas along a natural gas transmission line as “High Consequence Areas (HCAs)” (49 CFR §192.903 (Subpart O)). An HCA is an area identified along a pipeline right-of-way at greater risk of an impact due to fire and explosion resulting from gas transmission pipeline leaks. These HCAs are placed in four classifications based on the number of onshore dwelling units within 220 yards (200 meters) per 1-mile (1.6 kilometer) section of pipeline (49 CFR §192.5).

Table 2. Class designation of high consequence areas

<table>
<thead>
<tr>
<th>Class Designation</th>
<th>Number of Dwelling Units per Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10 or fewer building units per section</td>
</tr>
<tr>
<td>2</td>
<td>More than 10 but less than 46 building units intended for human dwelling</td>
</tr>
<tr>
<td>3</td>
<td>46 or more units intended for human occupancy; and In an area where the pipeline lies within 100 yards (91 meters) of a building or a small, well-defined outside area (such as a playground, recreation area, outdoor theater, or other place of public assembly) occupied by 20 or more persons on at least 5 days a week for 10 weeks in any 12-month period.</td>
</tr>
<tr>
<td>4</td>
<td>Any class location unit (1, 2, or 3) where buildings with four or more stories above ground are prevalent</td>
</tr>
</tbody>
</table>

Within these HCA areas, the pipeline construction company is required to establish a detailed map to address properties located within a “Potential Impact Radius” (PIR) of the proposed pipeline. A PIR is the radius of a circle within which the potential failure of a pipeline could have significant impact on people or property. An example of a PIR located within an HCA is graphically depicted in Figure 1.

The PIR is determined by the formula PIR = 0.69* (square root of (MAOP*d^2)), where r is the radius of a circular area in feet surrounding the point of failure, p is the maximum allowable operating pressure (MAOP) measured in the pipeline segment in pounds per square
inch (psi) and d is the nominal diameter of the pipeline in inches (49 CFR §192.903 (Subpart O)). The PIR formula (note that 0.69 is the coefficient for natural gas):

\[
\text{PIR} = 0.69 \sqrt{\text{MAOP}(d)^2}
\]

**Figure 1.** Graphic depiction of a Potential Impact Radius (created by author)

The chart below (Figure 2) depicts a PIR with varying pipe diameters and maximum allowable pressures.

**Figure 2.** Potential Impact Radius calculation chart (created by author)
The interesting part of the PIR equation is that the PMHSA requires the pipeline construction company to take additional measures to inspect and maintain the pipeline in those HCAs that have properties located in PIRs. However, the PMHSA does not, require the disclosure of the PIR information to the landowners who have residences located within those zones. Public recording of this information also is not required. Generally, future purchasers of those properties are not aware of the status of the potential residential purchase in a PIR. In fact, the document placed on record within a county recorder, register of deeds, or similar local recording agency does not require a description of the size of the pipe, the maximum allowable operational pressure, or the location of the pipeline across a property. Without these items, a buyer does not have the facts available to make a PIR calculation. This lack of transparency puts potential buyers in a position of making a purchase decision without knowledge of whether the residence they intend to buy is located within a PIR.

**The Access Granting Process**

Each pipeline requires a landowner to grant access to the property, called an easement. The landowner also must grant a right to the pipeline construction company to enter the property to place the pipeline in the ground and allow for future maintenance, called a right of way. For the purpose of this paper, the terms “easement” and “right of way” may be used interchangeably. In situations where some landowners along a pipeline route do not agree to grant an easement, a court action can be taken by the pipeline construction company through a condemnation proceeding, which also may be called a “partial taking.” The term partial taking is because only part of the property is transferred. The pipeline construction company only gains access to the area needed to construct and maintain the pipeline. The remainder of the property stays with the landowner. The term “taking” is a reference to the Fifth Amendment to the United States
Constitution, which limits the search and seizure capabilities of a government with respect to the citizens it serves, by stating, “... nor shall private property be taken for public use, without just compensation” (U. S. Constitution Amendment V). Whether this easement is granted by the landowner or ordered by a court, there is a question regarding what is “just compensation” for the granting of this right to property.

The landowner negotiates compensation in exchange for an easement. The easement agreement generally provides compensation to the landowner for the property encumbrance, compensation for damages to land and crops, compensation for damages due to runoff and water contamination, compensation for a construction company’s land and water usage, and compensation to restore the property to its original condition by the conclusion of the construction phase. As part of the easement procurement negotiation with a landowner, the construction company discloses the length and location of the pipeline and the diameter of the pipe, but it is not required to disclose the maximum allowable operating pressure of the pipeline. The pipeline construction company also is not required to disclose if a residence is located within a PIR. The landowner is placed in the position to negotiate an easement without pertinent information that may impact the value of the property.

Real estate valuation for partial takings in a condemnation court setting requires appraised values for the remaining property to allow for the condemn or to provide “just compensation” to the party that owns the potentially encumbered property. In this setting, proximity to a natural gas transmission line and its respective PIR may not be disclosed to a landowner. A landowner would have to request this information. Additionally, those who do not have the pipeline cross their respective properties have no legal standing in court. The adjoining and nearby owners of property of easement granting landowners do not have the legal
standing required to be a party to the litigation. Nonetheless, the adjacent and other nearby landowners may have residences located within a PIR. These adjacent and other nearby landowners have no ability to negotiate for compensation in exchange for the potential decrease in value that a new pipeline installation might cause. The location of a residence within a PIR could impose a hardship on the nearby landowner without compensation for a loss in value.

This research is designed to evaluate the impact of notice to a potential land purchaser of the proximity of a residence to a natural gas transmission line. The research is based on a hypothetical situation where a legislative change places an additional requirement on the seller to provide notice to a buyer that a home offered for sale is located within 500 feet of a natural gas pipeline. Also, this research is designed to evaluate the impact of notice to a potential land purchaser if a residence is located within a PIR of a natural gas transmission line. It also is designed to examine a hypothetical situation where a legislative change places an additional requirement on the seller to provide notice to a buyer that a home offered for sale is located within a PIR. This impact was tested using an experimental design, virtual-tour, and contingent valuation survey to measure the fair value a potential land purchaser would offer once notice of the condition was provided.

**Purpose of the Study**

The Potential Impact Radius (PIR) around a natural gas transmission line is information that a land purchaser could be provided prior to the purchase of a home. At present, a residential disclosure of this information is not required prior to a real estate transfer. This study is intended to address the question, “How would a purchase price be impacted if a seller provided buyers a notice that the residential property that has been listed for sale is located within a Potential Impact Radius (PIR) of a natural gas transmission line?” Does the notice of the location affect
the purchase value a buyer is willing to offer for a residential property? Does the perceived risk associated with PIR affect the amount a potential buyer would offer? At the time of this study, academic literature does not address the impact notice of a PIR on property values. This study is intended to expand the understanding of how the disclosure of information affects the willingness of a purchaser to pay for a property within a PIR.

**Research Question and Units of Analysis**

**RQ1: Did awareness that a home was located within a Potential Impact Radius affect the perceived value of the home?**

Residential property purchasers with children under the age of 18 who were interested in buying a home within the next two years and were residents of southwest Ohio were the test subjects of this study. An experimental approach was used to simulate purchasing behavior. The affect was a measurement of the change in property value as a result of the disclosure of information. A parent respondent served as the unit of measure for this experiment. This experiment analyzed the responses of those surveyed to determine if a change in perceived value results from the disclosure of information. To measure impact, a survey of property owners in the area was performed to check if the control of no disclosure and the two separate treatments that included disclosures showed a statistically significant difference. Contingent valuation methods associated with an experimental design as found in Lane, Seiler and Seiler (2013) and Seiler (2014a; 2014c; 2018) were leveraged for this analysis.

The statistical analysis of data collected by the survey was descriptive, inferential, and predictive. A descriptive analysis measured the percentage change in the fair price assessment that was translated into a dollar value range based in mean and/or median value responses. Inferential statistics were conducted through a series of t-tests on the three hypotheses. A
predictive statistical analysis was performed using discriminant statistics and linear regressions. The unit of measure was the dollar value change in the stated fair price.

**Practical Contribution**

This study has policy implications. It examines a potential outcome should appropriate governing bodies require disclosure of PIRs to potential real estate purchasers. This study might aid in developing an understanding of the perceived risks of purchasers and landowners concerning PIRs. This perceived risk, which statistical significance has shown, could be considered in future easement and condemnation actions for natural gas transmission pipelines. Pipeline construction companies, landowners, judicial, and quasi-judicial bodies that determine the compensation value required in consideration for a natural gas transmission pipeline easement might consider the impact of a PIR. This research may bolster the potential standing for landowners who own a home located within a PIR, which may allow unencumbered (i.e. the pipeline does not pass over their respective properties) landowners, who are located in a PIR, to bring an action for damages that may result from the construction of a natural gas transmission line.

For a list of concepts and definitions used in this study, see Appendix G.
CHAPTER TWO:

LITERATURE REVIEW

The Property Value Impact of Natural Gas Transmission Lines

The available literature that measures the property value impacts of natural gas transmission lines is not limited to academic journals. As the establishment of property value impacts are required in practice for environmental impact statements and as court certified experts are required to provide testimony to determine “just compensation” in eminent domain proceedings, the courts and administrative agencies seek input from a variety of sources.

The Position of The U.S. Federal Energy Regulatory Commission (FERC)

The Federal Energy Regulatory Commission (FERC), Office of Energy Projects, performs a literature review as part of the due diligence process in the approval or rejection of a proposed natural gas transmission project that crosses state lines. In 2014, FERC performed a literature review on a pipeline named the “Constitution Pipeline” that has been the source document for all subsequent FERC rulings on the potential property value impact of a natural gas transmission line (FERC, 2014). From a practitioner’s standpoint, this FERC literature review is the starting point for any property valuation analysis concerning natural gas transmission lines. The literature review contained in the Final Environmental Impact Statement, FERC/FEIS-2700F, on the subject NEXUS Gas Transmission Project (Docket Number: CP16-22-000, issued November 30, 2016, is a statement of the official position of the federal government (FERC, 2016).
In the 2016 Final Environmental Impact Statement of the subject NEXUS pipeline, the FERC/FEIS-2700F analysis provided the following statement as to impact of natural gas transmission lines on property value:

The effect that a pipeline easement may have on property value is a damage-related issue that would be negotiated between the parties during the easement acquisition process, which is designed to provide fair compensation to the landowner for the right to use the property for pipeline construction and operation. Appraisal methods used to value land are typically based on objective characteristics of the property and any improvements. The impact a pipeline could have on a property’s value would depend on many factors including the size of the tract, the values of adjacent properties, the presence of other utilities, the current value of the land, and the current land use. Subjective valuation is generally not considered in appraisals. A potential purchaser of property may decide to purchase land based on his or her planned use. An industrial user might find the pipeline (i.e., a potential source of energy for an industrial plant) preferable; a farmer looking for land for grazing or cropland may or may not find it objectionable. If the presence of a pipeline renders a planned use infeasible, it is possible that a potential purchaser would decide not to purchase the property; however, each potential purchaser has different criteria and differing capabilities to purchase land. (FERC, 2016, p. 4-191)

The 2016 Final Environmental Impact Statement, FERC/FEIS-2700F, included a literature review. FERC based its analysis on the following published research to conclude that a natural gas transmission pipeline does not impact the property value of real estate significantly.

Allen, Williford and Seale, Inc. (2001) prepared a study for the Interstate Natural Gas Association of America Foundation, Inc. to determine the impact of natural gas pipelines on real estate. Four separate geographically diverse areas were selected for the case study. The results of the study revealed no significant impacts on property sale prices located along natural gas pipelines and the pipeline size or the product carried did not impact sales price. The study also revealed no significant impacts on demand for
properties within the geographically diverse areas and the presence of a pipeline did not impede development of the surrounding properties (FERC, 2016, p. 4-192).

More recent studies also evaluated potential effects of natural gas pipelines on real estate in other regions of the United States and reached similar conclusions as Allen, Williford and Seale, Inc.

PGP Valuation Inc. (2008) conducted a study for Palomar Gas Transmission, Inc. for an Oregon LNG Project to evaluate the potential effect on property values of a natural gas pipeline. That pipeline was constructed in 2003/2004 in northwestern Oregon and along the western edge of the Portland metropolitan area. The PGP study found no measurable long-term impact on property values resulting from natural gas pipelines for the particular pipeline project studied. Interviews with buyers and brokers indicated no measurable impact on value, and there was no trend in the data to suggest an extension of marketing periods for properties with gas pipeline easements (FERC, 2016, p. 4-192).

The Ecowest (Fruits, 2008) studied the same pipeline as PGP Valuation Inc. (2008). The study found the pipeline did not have a statistically significant or economically significant impact on residential properties, and there was no relationship between proximity to the pipeline and sale price (FERC, 2016, p. 4-192).

Diskin, Friedman, Peppas, and Peppas (2011) studied the effects of natural gas transmission pipelines on residential values in Arizona, which was the study of the replacement of existing natural gas transmission lines in three areas around Phoenix, Arizona. This study concluded no identifiable systematic relationship between proximity to a pipeline and residential sale price or value (FERC, 2016, p. 4-192).
Hansen et al. (2006) analyzed property sales near a pipeline accident that occurred in Washington and considered the property’s proximity and persistence over time. While this study revealed a decline in property values after the accident, it noted the effect was localized and declined as the distance from the affected pipeline increased. The effect also diminished over time in the years following the incident (FERC, 2016, p. 4-192).

In addition, FERC, the lead federal agency on the construction of pipelines, researched the effect of pipelines on property values and reported the results in an Environmental Impact Statement issued in October 2014 (FERC Docket No. CP13-499-000) (FERC, 2014). FERC concluded that there was no evidence that pipelines in Pennsylvania and New York resulted in a decrease in property value. (FERC, 2016, p. 4-192).

In the conclusion of the 2016 Final Environmental Impact Statement, FERC/FEIS-2700F, FERC stated, “Based on the FERC literature review, which is supported by actual property sales data, there is no prevailing evidence supporting the claim that proximity to natural gas pipelines has a long-term detrimental effect on property value” (FERC, 2016, p. 4-193).

In Table 3 is a summary of the 2016 Final Environmental Impact Statement, FERC/FEIS-2700F.

Table 3. A summary of the 2016 Final Environmental Impact Statement

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Study Area</th>
<th>Findings</th>
</tr>
</thead>
</table>
Table 3 (Continued)

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Study Area</th>
<th>Findings</th>
</tr>
</thead>
</table>
| PGP Valuation Inc. (2008) | Property along a natural gas pipeline constructed in 2003 located in Northwestern Oregon along the Western Edge of the Portland Metropolitan area | 1. No measurable long-term impact on property values resulting from natural gas pipelines  
A. Interviews with buyers and brokers indicated no measurable impact on value  
B. No trend in the sales data to suggest an extension of marketing periods for properties with gas pipeline easements |
| Fruits (2008) | Property along a natural gas pipeline constructed in 2003 located in Northwestern Oregon along the Western Edge of the Portland Metropolitan area | 1. The natural gas pipeline had no statistically significant or economically significant impact on residential properties  
2. No relationship between proximity to the natural gas pipeline and sale price was found |
| Diskin, Friedman, Peppas, and Peppas (2011) | Residential Property Values in Arizona: Replacement of existing natural gas transmission lines in three areas in the Phoenix, Arizona area | 1. No identifiable systematic relationship between proximity to a pipeline and the residential sales price or value |
| Hansen, Benson, and Hagen, (2006) | Bellingham, Washington near a 1999 Gasoline Pipeline Rupture and explosion | Decline in property values after the accident, the effect was localized  
1. 4.6% decline in value for properties within 50 feet of the explosion  
2. 2.3% decline for properties within 100 feet after the gasoline pipeline rupture, but the effect declined as distance from the affected pipeline increased  
The negative impact on price diminished with the passage of time after the incident |
| FERC (2014) | Properties along pipelines in New York and Pennsylvania | 1. No evidence that the construction and installation of pipelines resulted in a decrease in property value. |

Research in Support of the Conclusion that Proximity to Natural Gas Transmission Pipelines has Minimal to No Impact on Property Valuations

Additional studies reached a similar conclusion as FERC (2016). This set of research studied how the proximity of a natural gas transmission pipeline impacted home values. The supporting research was performed on natural gas transmission lines and found that natural gas transmission lines have minimal to no impact on property valuations.

Kinnard (1993) studied the effect of the proximity of natural gas pipelines on nearby houses. This study focused on the value of houses in nine towns in Connecticut located near a natural gas transmission line. The study also examined the effect of a natural gas transmission
pipeline on the value of housing in a master planned residential community in Las Vegas, Nevada. Both studies found no pattern of measurable and significant negative impacts on the sales price of housing close to an existing or proposed natural gas transmission pipeline and no systematic pattern of variation in the sales prices of homes (Kinnard, 1993).

Kinnard, Dickey, and Geckler (1994b) attempted to repeat the procedure in Kinnard (1993). This study used 2,190 home sales in Las Vegas. The home sales were classified into five distance zones. The authors concluded there was no pattern of measurable and significant negative impacts on the sales prices of housing close to an existing or proposed natural gas transmission pipeline, and there was no systematic pattern of variation in the sales prices of homes near a natural gas pipeline (Kinnard, Dickey, & Geckler, 1994b).

Wilde, Loos, and Williamson (2012) conducted a literature review that supported the conclusion that no systematic evidence exists, based on actual sales data, that proximity of residential houses to pipelines reduces property values (Wilde, Loos, & Williamson, 2012).

In their study, Wilde, Williamson, and Loos (2014) studied proximity and notice. A natural gas transmission line was installed in 1992 in Clark County, Nevada. In 2007, notices of increase in pressure of the gas transmission was sent to surrounding residents. This study was based on data accumulated over a 20-year period beginning in 1991 through 2012. The authors found no effects associated with the proximity of residential properties to the natural gas transmission line at any point in time studied (Wilde, Williamson, & Loos, 2014).

The Interstate Natural Gas Association of America (INGAA) is a trade organization that published Allen, Williford, and Seale, Inc. (2001). Allen, Williford, and Seale, Inc. (2001) concluded that no evidence exists that pipelines affected sales prices. Fourteen years later, INGAA sponsored a subsequent study to address properties in the Midwest, Northeast, Mid-
Atlantic and Southeast, where there was concern over pipeline projects and their impact on property values. This study was performed by Integra Realty Resources. Integra Realty Resources (2016) had the following conclusions, which were consistent with Allen, Williford, and Seale, Inc. (2001):

1. There is no measurable impact on the sales price of properties located along or in proximity to a natural gas pipeline versus properties not located along or in proximity to the same pipeline.

2. Neither the size nor the age of a natural gas pipeline affects a property’s sale price.

3. There is no impact on demand for properties located along natural gas pipeline easements nor is development in areas with natural gas pipelines hindered.

4. Natural gas pipelines do not affect the property value of any particular type of residence any more or less than another type of residence.

5. The sales frequency of homes “on” a pipeline is consistent with those “off” a pipeline, indicating the presence of a pipeline does not inhibit sales (Allen, Williford, & Seale, Inc., 2001).

Integra Realty Resources (2016) expanded the scope of the examination beyond Allen, Williford, and Seale, Inc. (2001). Integra Realty Resources (2016) addressed the impact of the presence of a natural gas transmission line on lending and insurability of transferred properties. The study concluded that the presence of a natural gas transmission pipeline had no effect on a buyer’s ability to obtain a mortgage. Integra Realty Resources (2016) also concluded, based on qualitative interviews with insurance companies and their respective agents, the presence of a natural gas transmission line had no impact on either the ability to acquire property insurance or the premium paid for property insurance policies (Integra Realty Resources, 2016).
McElveen, Brown, and Gibbons (2017) studied a single-family residential housing development near Tampa, Florida, established in the 1990s. The housing development was built around an existing gas transmission line installed in 1959. The authors concluded that, in general, proximity to natural gas pipeline is not factored by homebuyers. The authors attributed this finding to the lack of physical cues. As stated, natural gas transmission lines lack visibility, noise, and odor (McElveen, Brown and Gibbons, 2017).

Herrnstadt and Sweeney (2018) studied the values of properties in the area of a fatal gas line explosion. The properties were in San Bruno, California, which experienced a natural gas pipeline explosion in 2010. The study found that the San Bruno disaster showed no meaningful shift in hedonic price gradients following the increased awareness (Herrnstadt & Sweeney, 2018).

Table 4 provides a summary of the above-stated additional studies in support of the conclusion of FERC (2016). These additional studies have found that natural gas transmission lines have a minimal to no impact on property valuations.

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Study Area</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinnard, Dickey and Geckler (1994b)</td>
<td>Proposed High Pressure Natural Gas Pipelines 1. 2,190 Single Family Homes near Las Vegas 2. The home sales classified into five distance zones. Re-examination of Kinnard (1993)</td>
<td>1. No pattern of measurable significant negative impacts on sales prices 2. No systematic pattern of variation in sales prices observed or should be expected</td>
</tr>
<tr>
<td>Wilde, Loos, and Williamson (2012)</td>
<td>Literature review of the effect of the proximity of residential property to a natural gas pipeline.</td>
<td>There was no systematic evidence that the proximity to a natural gas pipelines negatively impacts real estate values</td>
</tr>
</tbody>
</table>
### Table 4 (Continued)

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Study Area</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wilde, Williamson, and Loos (2014)</td>
<td>Clark County, Nevada</td>
<td>The proximity to natural gas pipelines with the notice of an increase in pipeline pressure did not impact the residential property values. The authors found no effects associated with the proximity of residential properties to the natural gas transmission line at any point in time studied</td>
</tr>
<tr>
<td></td>
<td>1. In 1992 a natural gas transmission pipeline was installed.</td>
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<td></td>
<td>2. In 2007, notices of increase in the gas pressure sent to residents.</td>
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<td></td>
<td>3. Data was collected over a 20-year period beginning in 1991 through 2012.</td>
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<td></td>
<td>4. The natural gas pipelines were in the same general market as the study of Kinnard, Dickey and Geckler (1994).</td>
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</tr>
<tr>
<td>Integra Realty Resources (2016)</td>
<td>Allen, Williford &amp; Seale, Inc. (2001) re-examined INGAA sponsored a subsequent study 14 years after Allen, Williford &amp; Seale, Inc. (2001) to address properties in the Midwest, Northeast, Mid-Atlantic and Southeast, where there was concern over pipeline projects and their impact on property values.</td>
<td>1. There is no measurable impact on the sales price of properties located along or in proximity to a natural gas pipeline versus properties which are not located along or in proximity to the same pipeline.</td>
</tr>
<tr>
<td></td>
<td>2. Neither the size nor the age of a natural gas pipeline affects a property’s sale price.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. There is no impact on demand for properties located along natural gas pipeline easements nor is development in areas with natural gas pipelines hindered.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Natural gas pipelines do not affect the property value of any residence any more or less than another type of residence.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. The sales frequency of homes “on” a pipeline is consistent with those “off” a pipeline indicating that the presence of a pipeline does not inhibit sales.</td>
<td></td>
</tr>
<tr>
<td>McElveen, Brown and Gibbons (2017)</td>
<td>Near Tampa, Florida</td>
<td>1. The authors concluded that, in general, proximity to natural gas pipeline is not factored by homebuyer.</td>
</tr>
<tr>
<td></td>
<td>2. The authors attributed this finding to the lack of physical cues because natural gas transmission lines lack of visibility, noise, and odor.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. A natural gas transmission line was built in 1959.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. The housing development built around the natural gas transmission line in the 1990s</td>
<td></td>
</tr>
<tr>
<td>Herrnstadt and Sweeney (2018).</td>
<td>San Bruno, California</td>
<td>1. No significant shift in the hedonic price gradient following the event</td>
</tr>
<tr>
<td></td>
<td>2. Unable to determine if true ambivalence on behalf of the purchaser or a there was a lack of salience and awareness</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Site of a fatal natural gas explosion in 2010</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Tested the “willingness to pay” by landowners to avoid a natural gas pipeline risk.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. The San Bruno area was tested along with surrounding areas.</td>
<td></td>
</tr>
</tbody>
</table>

**Research in Support of the Conclusion that Proximity to Natural Gas Transmission Pipelines Impacts Property Valuations**

Some studies have reached conclusions that contradict FERC (2016). This set of research studied how the proximity to pipelines and other disamenities impacted home values. The pipelines were not limited to natural gas transmission lines. Prior literature in support of this position falls into two categories. One was the use of property valuations based in areas where
an incident, leak, or spill occurred. The second area in support of the position that proximity to natural gas transmission lines impacts property valuations has been associated with the concept of *perceived risk*. This set of studies found that natural gas transmission lines impact residential property valuations.

**Support for a Real Estate Valuation Impact Based on Prior Incidents, Leaks, or Spills**

Boxall, Chan and McMillan (2005) conducted a study of residential properties in rural Alberta, Canada. This study examined “sour wells,” which are oil wells that contain hydrogen sulfide and pose a potential health risk. Residential properties in the areas found within “emergency plan response zones” of sour gas wells and natural gas pipelines experienced an average loss in value of 3.8% (Boxall, Chan and McMillan, 2005).

Simons, Thomas, and Townley (2017) studied the City of Green, Ohio, and the projected financial impact of the NEXUS pipeline, which crosses City of Green, Ohio. This research was a case study based on prior peer-reviewed research concerning housing prices and their respective proximities to oil and gas pipelines. This area of research was founded primarily on property sales prices after an oil or gas pipeline rupture or leak (Simons, Thomas, & Townley, 2017).

Prior literature cited in support of the Simons, Thomas, and Townley (2017) case study included:

Simons (1999a) found that a 1993 oil pipeline rupture in Reston, Virginia, affected non-contaminated, easement-burdened residential property in a separate, remote location in Fairfax County Maryland, which resulted in a decline in value of 5.5% on single-family homes and a 2.6% decline in townhomes (Simons, 1999a).
Simons (1999b) looked at the effect of a long-term petroleum pipeline leak and contaminated groundwater in a rural area on a residential neighborhood in Summit County, Ohio. The residential property values fell in excess of 25% on resale. It should be noted that this study was in Franklin Township (now the City of New Franklin), which adjoins the City of Green (Simons, 1999b).

Simons, Winson-Geideman, and Mikelbank (2001) studied the effects of a petroleum spill into the Patuxent River in Maryland. Properties as far as 10 miles downstream and on both banks experienced a decline in value of approximately 10% on resale (Simons, Winson-Geideman, & Mikelbank, 2001). This finding was later refuted by Roddewig, Brigden, and Baxendale (2018), who found no significant impact in price over time for this same area along the Patuxent River (Roddewig, Brigden and Baxendale, 2018).

Hansen et al (2006) conducted a study on the effect of proximity to a major fuel pipeline on housing prices before and after a high-profile explosion in Bellingham, Washington. This study also stated there was a 4.6% decline in value for properties within 50 feet of the explosion and a decline of 2.3% for properties within 100 feet after the gasoline pipeline rupture. It also should be noted that the FERC Final Environmental Impact Statement cited earlier in this literature view cited Hansen et al. (2006) in stating the effect of a pipeline explosion diminishes over time for a given proximity (Hansen et al., 2006).

Simons, Thomas, and Townley (2017) concluded that prior studies showed a 5% loss for properties encumbered by a natural transmission line easement having a house located within 500 feet of the pipeline. Properties encumbered by a natural gas transmission line easement having a house located in excess of 500 feet of the pipeline experienced a loss in value of 2%. Adjacent properties, i.e. properties near a pipeline not encumbered by the pipeline, experienced a
2% loss in value for houses located within 100 to 250 feet of a natural gas transmission line easement. The authors concluded that a similar result would apply to the value of residential properties in the City of Greene, Ohio, along the NEXUS natural gas transmission line (Simons, Thomas, & Townley, 2017).

Table 5 includes a summary of the above-stated additional studies that find proximity to natural gas transmission pipelines impacts property valuations.

**Table 5. Summary of findings that proximity to natural gas transmission pipelines affects property values**

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Study Area</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boxall, Chan and McMillan (2005)</td>
<td>Rural Residential Property in Alberta Canada Study of the proximity of houses to sour wells (oil wells that contain hydrogen sulfide and pose a potential health risk) on property values</td>
<td>Sour wells did impact the value of residential properties values, decreasing the value 3.8%</td>
</tr>
<tr>
<td>Simons (1999a)</td>
<td>Near Reston, Virginia, site of a 1993 oil pipeline rupture Study area was the nearby, but separate and remote location of Fairfax County, Maryland Study of the impact of the oil pipeline on the values of a non-affected and non-contaminated, easement burdened residential property</td>
<td>Decline in property value found 1. 5.5% decline on the value of single-family homes 2. 2.6% decline on the value of townhomes</td>
</tr>
<tr>
<td>Simons (1999b)</td>
<td>Summit County, Ohio Property along a pipeline that experienced a long-term oil leak and contaminated groundwater</td>
<td>The residential property values fell in excess of 25% on resale.</td>
</tr>
<tr>
<td>Simons, Winson-Geideman and Mikelbank (2001)</td>
<td>Prince Georges Co, MD, Patuxent River Oil pipeline rupture</td>
<td>Properties as far as 10 miles downstream and on both banks experienced a decline in value of approximately 10% on resale.</td>
</tr>
<tr>
<td>Hansen, Benson, and Hagen (2006)</td>
<td>Bellingham, Washington near a 1999 Gasoline Pipeline Rupture and explosion</td>
<td>Decline in property values after the accident, the effect was localized 1. 4.6% decline in value for properties within 50 feet of the explosion 2. 2.3% decline for properties within 100 feet after the gasoline pipeline rupture, but the effect declined as distance from the affected pipeline increased The negative impact on price diminished with the passage of time after the incident</td>
</tr>
<tr>
<td>Simons, Thomas and Townley (2017)</td>
<td>City of Green, Ohio 1. Case Study analysis based on prior studies 2. Projection of the impact of the NEXUS natural gas transmission pipeline on property values 3. Study performed prior to the installation of the pipeline</td>
<td>Projected losses in the subject property value where the pipeline easement is granted 1. 5% on property within 500 feet of the pipeline 2. 2% loss on areas in excess of 500 feet. 3. Properties unencumbered but adjacent to the pipeline easement but within 250 feet of the easement or within 100 feet of a lot line were projected to lose 2% in value</td>
</tr>
</tbody>
</table>
Support for a Real Estate Valuation Impact Based on Perceived Risk of Natural Gas Transmission Pipelines

Freybote and Fruits (2015) studied the South Mist Pipeline Extension in Oregon. This natural gas transmission line was placed in operation in 2004. The authors noted the lack of visibility, odor, and sound cues of natural gas transmission lines limited the awareness and risk perception of residential landowners and potential purchasers along the pipeline. This study explored the effect that media coverage of fatal pipeline accidents that occurred elsewhere had on the purchase price of properties along the pipeline. The authors concluded that media reports of incidents elsewhere during the construction phase of the pipeline resulted in price discounts. There was a stratification of the impact based on proximity to the pipeline. The author noted the construction phase is a time when the landowners and potential purchasers can see the installation of the pipeline. The passage of time without sensory cues and media reinforcement resulted in no significant impact on the price of residential property in the area.

A series of economic impact studies of proposed pipeline projects were performed based on a similar literature review and analysis. Phillips, Battorff, and Wang (2016a) addressed the Atlantic Coast Pipeline, a natural gas transmission line in Western and Central Virginia; Phillips, Wang, and Battorff (2016b) addressed the Mountain Valley Pipeline, a gas transmission line in Virginia and West Virginia; Phillips, Wang, and Battorff (2017a) addressed the PennEast Pipeline, a natural gas transmission pipeline in Pennsylvania and New Jersey; and Phillips, Wang, and Alkire (2017b) addressed the Eastern System Upgrade, a pipeline expansion in New York State. These studies concluded that perceived risk associated with the installation of a natural gas transmission line negatively impacts residential housing prices.

Phillips, Wang, and Battorff (2016a; 2016b; 2017a) and Phillips, Wang, and Alkire (2017b) noted Boxall, Chan, and McMillan (2005) and the unpublished work of Kurt Kielisch
(n.d., unpublished), an appraiser who operates as the Forensic Appraisal Group and provides property appraisals as well as expert testimony for pipeline and other condemnation proceedings where “just compensation” valuations are required for a taking. His studies were based on surveys of realtors, appraisers, and landowners connected to five separate pipeline projects in Ohio and Wisconsin. The respondents were asked how the presence of a 36” natural gas transmission pipeline would affect the residential property value. Kielisch found the presence of a natural gas transmission pipeline crossing a residential property negatively impacts the amount that a potential purchaser would offer.

Table 6 provides a summary of studies in support of a negative real estate valuation impact based on perceived risk of natural gas transmission pipelines

Table 6: Summary of Studies support of a negative real estate valuation impact based on perceived risk of natural gas transmission pipelines

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Study Area</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freybote and Fruits (2015)</td>
<td>South Mist Pipeline Extension in Oregon Intrastate natural gas transmission line Notice submitted to residents in 1999 Pipeline in operation in 2004 Study of the impact of media coverage of fatal pipeline accidents which occurred elsewhere had on the purchase price of properties along the pipeline.</td>
<td>1. Media reports of incidents elsewhere during the construction phase of the pipeline resulted in price discounts 2. There was a stratification of the impact based on proximity to the pipeline. The author noted that the construction phase is a time when the landowners and potential purchasers can see the installation of the pipeline 3. The passage of time without sensory cues and media reinforcement resulted in no significant impact on the price of residential property in the area</td>
</tr>
<tr>
<td>Phillips, Wang, and Battorff (2016a)</td>
<td>Atlantic Coast Pipeline, a natural gas transmission line in Western and Central Virginia</td>
<td>Advocacy paper Natural gas transmission pipelines impact the property value in excess of the damages incurred during the construction and installation phase</td>
</tr>
<tr>
<td>Phillips, Wang, and Battorff (2016b)</td>
<td>Mountain Valley Pipeline, a gas transmission line in Virginia and West Virginia;</td>
<td>Advocacy paper Natural gas transmission pipelines impact the property value in excess of the damages incurred during the construction and installation phase</td>
</tr>
<tr>
<td>Phillips, Wang, and Battorff (2017a)</td>
<td>PennEast Pipeline, a natural gas transmission pipeline in Pennsylvania and New Jersey</td>
<td>Advocacy paper Natural gas transmission pipelines impact the property value in excess of the damages incurred during the construction and installation phase</td>
</tr>
<tr>
<td>Author (Year)</td>
<td>Study Area</td>
<td>Findings</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Phillips, Wang, and Alkire (2017b)</td>
<td>Eastern System Upgrade, a pipeline expansion in New York State</td>
<td>Advocacy paper Natural gas transmission pipelines impact the property value in excess of the damages incurred during the construction and installation phase</td>
</tr>
<tr>
<td>Kielisch (n.d., Unpublished)</td>
<td>5 locations in Ohio and Wisconsin Each location in the acquisition phase for natural gas transmission lines Survey of realtors, appraisers and potential purchasers Respondents were local to the area of the 5 locations</td>
<td>1. 68% of realtors anticipated a decrease in residential property value 2. Of these realtors, 56% believe that the loss would be between 5-10% 3. 70% of these realtors believed that a pipeline would cause an increase in the time required to sell a home 4. Over 75% of realtors viewed the pipelines as a safety risk 5. A survey of buyers with the choice of buying a house encumbered by a 36-inch diameter pipeline showed that 62% would not be interested at any price 6. Of the remaining 38% buyers approximately one-half of this group stated that the potential offering price would be reduced by 21% on average; the other half of this group stated that the pipeline would have no effect on the offer prices 7. Considering only those buyers who are still willing to purchase the property, the expected loss in market value would be 10.5%</td>
</tr>
</tbody>
</table>

**Conclusion of Present Literature: The Property Value Impact of Natural Gas Transmission Lines**

The literature supports the position stated in the 2016 Final Environmental Impact Statement, FERC/FEIS-2700F. In general, proximity to natural gas transmission pipelines alone has minimal to no impact on property valuations. This conclusion may be because potential purchasers do not receive notice of the existence of a natural gas transmission line prior to making a purchase offer. Natural gas transmission lines lack odor, sound, and visibility. The literature does not address how buyers would react with notice of the existence of a natural gas transmission pipeline. There is no requirement that a seller disclose the existence of a natural gas transmission pipeline to a buyer. There is no indication that potential purchasers were
informed of the existence of a natural gas transmission pipeline prior to making an offer for purchase.

The literature allows for the possibility that perceived risk may alter the amount a purchaser is willing to offer. A potential residential property purchaser who receives notice of the existence of a natural gas transmission pipeline may believe that living near this pipeline is dangerous. The application of the concept of perceived risk and its impact on the fair offer value for residential property located within a Potential Impact Radius (PIR) is a gap in the existent literature.

**Perceived Risk – Discussion and Literature Review**

In the United States, deaths caused by natural gas transmission line failures is low. The Pipeline and Hazardous Materials Safety Administration (PHMSA) maintains a record of natural gas transmission line significant incidents. The PHMSA records the number of incidents (pipeline failures), the number of fatalities, the number of injuries, and the damage costs in present day dollars. The chart is attached below (Table 7).


<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Number</th>
<th>Fatalities</th>
<th>Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>37</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>2000</td>
<td>54</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>2001</td>
<td>50</td>
<td>2</td>
<td>5</td>
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<tr>
<td>2002</td>
<td>56</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2003</td>
<td>70</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>2004</td>
<td>63</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>2005</td>
<td>111</td>
<td>0</td>
<td>5</td>
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<tr>
<td>2006</td>
<td>78</td>
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<td>3</td>
</tr>
<tr>
<td>2007</td>
<td>75</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>2008</td>
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<tr>
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<tr>
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<tr>
<td>2011</td>
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<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2012</td>
<td>62</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>2013</td>
<td>71</td>
<td>0</td>
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<tr>
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<tr>
<td>2015</td>
<td>79</td>
<td>6</td>
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</table>
Table 7 (Continued)

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Number</th>
<th>Fatalities</th>
<th>Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>56</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2017</td>
<td>65</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2018</td>
<td>58</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1371</td>
<td>50</td>
<td>175</td>
</tr>
</tbody>
</table>

The total number of deaths in the United States resulting from natural gas transmission line failures between 1999 and 2018 was 50, which is an average of 2.5 deaths per year. The total number of injuries in the United States resulting from natural gas transmission line failures between 1999 and 2018 was 175, which is an average of approximately 88 injuries per year.

A comparison to other causes of death in the United States offers perspective on how rare the fatalities can be attributed to natural gas transmission line failures. The National Center for Health Statistics—Mortality Data for 2017 contains data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. In the year 2017, several other causes of death were more common than deaths associated with the failure of a natural gas transmission line (Table 8).

Table 8. Mortality data for 2017 as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program (National Center for Health Statistics at [https://www.cdc.gov/nchs/nvss/deaths.htm on April 29, 2019](https://www.cdc.gov/nchs/nvss/deaths.htm))

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>Number of Deaths in 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall on same level from slipping, tripping, and stumbling, W01</td>
<td>744</td>
</tr>
<tr>
<td>Fall on and from stairs and steps, W10</td>
<td>2,493</td>
</tr>
<tr>
<td>Fireworks discharge, W39</td>
<td>8</td>
</tr>
<tr>
<td>Bitten or struck by dog, W54</td>
<td>36</td>
</tr>
<tr>
<td>Drowning and submersion while in or falling into bathtub, W65-W66</td>
<td>513</td>
</tr>
<tr>
<td>Contact with hornets, wasps and bees, X23</td>
<td>89</td>
</tr>
<tr>
<td>Lightning, X33</td>
<td>19</td>
</tr>
<tr>
<td>Earthquake and other earth movements, X34-X36</td>
<td>13</td>
</tr>
<tr>
<td>Flood, X38</td>
<td>27</td>
</tr>
</tbody>
</table>

As demonstrated, the actual risk associated with living near a natural gas transmission pipeline is low. Therefore, this research focuses on the concept of *perceived risk*. The risk
perception of laypersons, such as homebuyers, is based primarily on emotions or intuition rather than a sophisticated analysis of actual risks as conducted by experts (Slovic, 1987).

The issue of perceived risk of a Potential Impact Radius (PIR) of a natural gas transmission pipeline was described in a Letter to the Editor written by H. Kirby Albright in the International Right of Way Agent’s trade journal Right of Way (2011) (See Appendix A). This letter was a response to an article written in a prior issue of the same magazine that used a paired sales analysis of studies on 36-inch diameter pipelines for natural gas transmissions in three areas near Phoenix, Arizona (Diskin et al., 2011). The paired-sales studies near Phoenix, Arizona, found no systemic relationship between home valuations and proximity to the pipeline. Albright takes issue with the paired-sales Diskin study and the affirmative statement that the presence of natural gas transmission pipelines does not substantially impact property values; Albright contends that the Diskin study fails to account for the level of awareness of a natural gas pipeline by a potential purchaser. According to Albright, once a potential purchaser is made aware of the presence of natural gas transmission pipelines, that purchaser’s perceived risk results in lower offer prices if not total risk aversion (i.e., no offer is made). Albright made a special note regarding properties located in a Potential Impact Radius (PIR). Albright asserted that once this information has been presented to a potential purchaser, that purchaser’s willingness to pay the price consistent with the value prior to the introduction of the natural gas transmission pipeline decreases. Albright further asserts that once this information has been made available, the potential purchasers may no longer have interest in the property.

Studies have shown the closer a single-family home is to an environmental hazard (i.e., the higher the perceived risk), the lower is the sales price. This result has been observed at hazardous waste sites in Texas (McCluskey & Rausser, 2001); near high voltage electricity wires
People make intuitive risk judgments when purchasing a home. Lay people often lack information about hazards present in the purchase of a property, and experts are needed to adequately communicate risk assessments (Slovic, 1987). People may use a set of mental strategies, or heuristics, to make sense out of an uncertain world (Kahneman, Slovic, & Tversky 1982). The availability heuristic is the mental shortcut where one uses immediate examples that come to a given person’s mind when making a value judgment. This heuristic may allow someone to make an efficient decision, but the foundation of that decision may be biased based on recent or dramatic events, based on their salience, familiarity, or other factors (Tversky & Kahneman, 1974). Then, these judgments are related to judgments about other properties, such as (i) the hazard’s status on characteristics that have been hypothesized to account for risk perceptions and attitudes (for example, voluntariness, dread, knowledge, controllability), (ii) the benefits that each hazard provides to society, (iii) the number of deaths caused by the hazard in an average year, and (iv) the number of deaths caused by the hazard in a disastrous year (Starr, 1969, p.1237).

These perceptions may not be rational or accurate (Slovic, Layman, Kraus, Flynn, Chalmers & Gessell, 1991). Real estate brokers and inexperienced appraisers tend to find a more negative effect on property values (Jaconetty 2001).
Once fear becomes embedded in the public mind, it does not matter if scientific proof of a causal connection exists (Jaconetty, 2001); examples are studies of residents near oil and gas wells that have shown a higher perceived risk for those who depend on well or groundwater for their drinking water (Muehlenbachs, Spiller, & Timmins, 2012; Gopalakrishnan & Klaiber, 2013). The perception of fear of a potential hazard to health may provide just cause for damages due to diminished price, an increase in marketing time of a property for sale, and a decrease in the sales volume due to less potential buyers (Kinnard & Dickey, 1995). This fear need not be reasonable to be admissible in a court proceeding to assess damages (Kinnard & Dickey, 1995).

Media reports shape one’s perceived risk of potentially hazardous situations. Experience with hazards tends to come from the news media, which rather thoroughly document mishaps and threats occurring throughout the world (Slovic, 1987). The study of a gasoline line explosion showed the media effect of coverage after the event affected buyers who were uniformed prior to the event (Hansen, Benson, & Hagen, 2006). Media shapes risk perception and often amplifies risk, particularly in rare and dramatic events (Watson, et al, 2013). Local media and movies such as “Gasland” raised concerns for methane leaking into water table, significantly impacting the values of properties reliant on well water (Gopalakrishnan & Klaiber, 2013). Media coverage of unrelated gas pipeline explosions moderates the relationship of perceived risk due to pipeline proximity and residential sales prices, particularly during the construction phase (Freybote & Fruits, 2015). Without reinforcement through a dramatic event or media coverage, these perceived risks tend to dissipate over time (McCluskey & Rausser, 2001; Hansen, Benson, & Hagen, 2006; Freybote & Fruits, 2015; Herrnstadt & Sweeney, 2018).

Based on the available literature on perceived risk, one may conclude that it is possible for perceived risk of a natural gas transmission pipeline to impact property value. The literature
also shows the impact of perceived risk dissipates over time when reinforcement is not present. The research question behind this study examines the idea of informing or reinforcing information concerning a natural gas transmission pipeline. The study focuses on how a hypothetical policy change may extend the period in which a potential home purchaser experiences a perceived risk. A property disclosure form requirement would provide notice to a potential purchaser that a residential home is located within the Potential Impact Radius (PIR) of a natural gas pipeline. The notice that a home located within a Potential Impact Radius (PIR) is a perceived risk may impact the amount a purchaser would be willing to offer as a purchase price for a property.

Motivation: The NEXUS Pipeline and the City of Green, Ohio

The NEXUS pipeline is a 255-mile natural gas transmission line that carries natural gas across Northern Ohio, through Southeast Michigan, and into Ontario, Canada. The route received its final Federal Energy Regulatory Commission (FERC) approval on August 25, 2017 (160 FERC ¶61,022). This route includes a section that passes through Green, Ohio.

The City of Green, located in Southern Summit County, lies between Akron and Canton, Ohio. Incorporated in 1992 with a population of 19,179, the area has grown to a population of 25,175 as of 2017 (U.S. Census Bureau, 2019A). According to the U.S. Census Bureau, 74% of the residential properties are owner-occupied, the mean number of persons per household is 2.53, and the median value of an owner-occupied property is $173,600 (U.S. Census Bureau, 2019A). The area incorporates approximately 32 square miles with a population density of 801.7 per square mile (U.S. Census Bureau, 2019A).

The NEXUS pipeline route was proposed in 2012. The United States Federal Energy Regulatory Commission (FERC) granted authorization to build the interstate natural gas
transmission line to NEXUS in November of 2015 (160 FERC ¶61,022). The proposed route through the City of Green was an 8-mile section that wound through the southern end of the city (See Figure 3) The location of the pipeline in the City of Green was in an area primarily used for single-family residential homes. According to the City of Green, 34 buildings in Green are within 50 feet of the NEXUS pipeline and 660 houses within 1,100 feet on either side of that pipeline (Sangiacomo, 2016). This area was a Class 3 High Consequence Area (HCA) in that it contained 46 or more units intended for human occupancy.

Figure 3. Map of the NEXUS pipeline across the City of Green (Image courtesy of Google Earth)

Several residents in the city were concerned about the routing of this natural gas transmission line. The City of Green, on behalf of its citizens and in representation of publicly owned land, introduced a counterproposal that would have rerouted the pipeline approximately 20 miles to the south in a less densely populated area. The City of Green was active in litigation in the United States District Court for condemnation proceedings (NEXUS Gas Transmission, LLC v. City of Green, No. 18-3113, 2018 WL 2072606 (6th Cir. Apr. 3, 2018) and NEXUS Gas Transmission, LLC v. City of Green, No. 18-3325, 2018 WL 6437431 (6th Cir. Dec 7, 2018)). Also, the City of Green was represented during the hearings on the Environmental Impact Statement (EIS) before the United States Federal Energy Regulatory Commission (FERC).
FERC did not find the argument for the proposed route change to be persuasive. The final EIS was approved and included the initial pipeline route on August 25, 2017 (FERC, 2016). On December 28, 2017, the U.S. District Court found in favor of NEXUS in the eminent domain proceeding against the City of Green and other property owners.

NEXUS was placed in a superior property right position along the pipeline route. The City of Green was able to appeal the U.S. District Court decision, but ultimately decided to resolve this dispute. The City of Green reached a settlement with NEXUS in February of 2018. In accordance with the settlement, the City of Green had the right to inspect construction activities, NEXUS acquired and donated 20 acres of land to be added to the local park system, and $7.5 million was granted to the City of Green to promote safety in the parks and public places, by allowing the city to replace athletic facilities that would soon become “uncomfortably close to the pipeline” (See Appendix “B” for a statement from the mayor of the City of Green dated February 9, 2018).

An interesting part of the media coverage prior to the litigation between the City of Green and NEXUS was the use of the term “blast zone,” which is an area of destruction due to an explosive impact that often can be attributed to the detonation of explosives or the eruption of volcanos. By nature, the term is incendiary.

The use of incendiary language during litigation may raise the perception of danger, elicit emotion from those involved, and press a position of concern. Public discourse during the pendency of the litigation often referred to home plate on one of the local little league fields as being directly within the blast zone of the proposed pipeline route. The blast zone calculation cited was the same as the U.S. Department of Transportation’s Pipeline and Hazardous Materials Safety Administration (PHMSA) calculation for the Potential Impact Radius (PIR).
The pipeline section scheduled to travel through the City of Green had a 36-inch diameter and maximum allowable operational pressure of 1,440 pounds per square inch. Revisiting the PIR formula as stated earlier, the PIR for this area is calculated as follows:

\[ 943 = 0.69 \sqrt{1440(36)^2} \]

Based on this PIR calculation, residences situated within 943 feet of a 36-inch diameter pipeline are within the PIR. This 943-foot radius was used in this experiment.

Google Earth images of properties with a calculation of distance provided by the ruler function in that program show examples of properties in the City of Green that fall within the PIR on the NEXUS pipeline. These images are located in Appendix C.

**Ohio Residential Property Disclosures**

**Requirement of the Ohio Residential Property Disclosure Form**

Residential real estate transactions in Ohio require two property disclosure forms (Ohio Realtors, n.d.). The first is a federal disclosure for lead-based paint. The Environmental Protection Agency (EPA) and the Department of Housing and Urban Development (HUD) mandate that prospective residential property purchasers receive a Lead Paint Disclosure Form to mitigate lead poisoning risks in homes that may contain lead-based paint hazards. This law requires that a seller convey to the buyer known information on lead-based paint and lead-based paint hazards during sales and rentals of housing built before 1978. This form does not apply to any other conditions or defects related to residential property.

The Ohio Revised Code §5302.30, entitled “Property disclosure form required for all residential real property transfers,” is the second required disclosure. This law requires the owner of a 1 to 4 family residential home to inform a potential buyer of the condition of a property and of other matters concerning the property known by the owner (ORC §5302.30). According to
Ohio Revised Code §5302.30I, every person who intends to transfer any residential real property by sale, land installment contract, lease with option to purchase, exchange, or lease for a term of 99 years and renewable forever shall complete all applicable items in a property disclosure form (ORC §5302.30I).

The Ohio Revised Code §5302.30(D) places the responsibility of creating the requirements for disclosure and the Residential Property Disclosure Form on the Ohio Director of Commerce. The statute requires the disclosure of material matters relating to the physical condition of the property to be transferred, including, but not limited to, the source of water supply to the property; the nature of the sewer system serving the property; the condition of the structure of the property, including the roof, foundation, walls, and floors; the presence of hazardous materials or substances, including lead-based paint, asbestos, urea-formaldehyde foam insulation, and radon gas; and any material defects in the property within the actual knowledge of the transferor. The Director of Commerce, through the Ohio Department of Commerce and its internal office, the Ohio Division of Real Estate and Professional Licensing, established the first Residential Property Disclosure Form effective July 1, 1993 (ORC §5302.30(D)).

The Director of Commerce can amend the Residential Property Disclosure Form. These amendments can be directed by the Ohio legislature. Ohio Revised Code §5302.30(D)(2) was an example of an amendment. This section requires the disclosure form to include a statement that information on the operation and maintenance of the type of sewage treatment system serving the property is available at the local department of health or the board of health of the health district in which the property is located (ORC §5302.30(D)(2)). The amendments also can be placed on the form at the discretion of the Director of Commerce within the constraints of Ohio Administrative Procedures Act, Chapter 119 of the Ohio Revised Code, which allows the
Department of Commerce to perform quasi-legislative procedures that include proposals, notices, hearings, and agency actions that would include amendments to the Residential Property Disclosure Form.

The Ohio Department of Commerce has amended the Ohio Residential Property Disclosure Form. The most recent version of form has been in effect in Ohio since January 1, 2013 (See Appendix D). One of the amendments to the form can be found at paragraph I, “Underground Storage Tanks/Wells.” This amendment requires residential property sellers to inform buyers of “Any oil, gas or mineral right leases on the property and a statement that the buyer should exercise due diligence regarding such rights.”

**Potential Amendment**

Paragraph I, “Underground Storage Tanks/Wells,” is an important section for the purpose of this research as it is closely related to the subject of natural gas transmission lines. The form asks a residential property owner, “Do you know of any underground storage tanks (existing or removed), oil or natural gas wells (plugged or unplugged), or abandoned water wells on the property?” The requirement is that a seller with actual knowledge discloses to a potential buyer information that is not visible and is buried below the surface of the property.

Paragraph N, “Other Known Material Defects,” also may be an area that addresses natural gas transmission lines and/or their respective Potential Impact Radii (PIRs), which is a catch-all provision for matters not addressed in the prior paragraphs in the disclosure form. “Material defects” are defined within the form to include “. . . any non-observable physical condition existing on the property that could be dangerous to anyone occupying the property or any non-observable physical condition that could inhibit a person’s use of the property.” A seller with actual knowledge of a material defect is required to disclose to a potential buyer additional
information. A seller is required to disclose information not addressed in the other paragraphs of the disclosure form or not observable, but may be dangerous or otherwise limit the ability of a buyer to use the property.

Could this form be expanded to include natural gas transmission lines that encumber a property and/or the situation of a residential home lying within a Potential Impact Radius of a natural gas transmission line? Paragraph I of the disclosure form addresses the buried oil and natural gas storage and production facilities. This paragraph also queries the knowledge of the seller regarding oil, gas, and mineral leases on the subject property. A future amendment to this section could include natural gas transmission pipelines that encumber the subject property. An ambitious attorney could expand the use of the disclosure form through litigation. A case can be made under Paragraph N. One could argue that a natural gas transmission line is a non-observable physical condition existing on the property that encumbers a property and/or the situation of a residential home within a Potential Impact Radius of a natural gas transmission and “is” dangerous to anyone occupying the property.

**Limitations to the Ohio Residential Property Disclosure Form**

There are limitations to the Ohio Residential Property Disclosure Form. These limitations are viewed from the perspective a potential home purchaser. The disclosure form can be expanded to include natural gas transmission lines that encumber a property or the situation of a residential home lying within a Potential Impact Radius of a natural gas transmission line, but this form may not provide adequate information to a potential home purchaser.

The primary limitation is the requirement that the seller of a residential property have “actual knowledge” of the condition or material defect. Ohio Revised Code §5801.03 expands actual knowledge to include “constructive knowledge,” which is the inference that the seller has
received notice or notification of the condition or material defect, or based on all the facts and circumstances known to the person at the time of the disclosure, the person has reason to know the fact. This standard requires a seller to know or have reason to know of a natural gas transmission line that encumbers a property or that the location of the home is within a Potential Impact Radius of a natural gas transmission line. The issue of actual knowledge of a seller who was present during the time of pipeline construction can be shown through the easement granting process of record in the local municipality. The proof of actual knowledge of a seller who purchased the property after construction would be difficult since that seller did not grant the original easement. Imputing knowledge to a person who was not present at the time the easement was granted would be a difficult burden for an aggrieved buyer.

A second limitation for the expansion of Ohio Residential Property Disclosure Form is the measurement of an adequate recourse for failure to disclose. The burden is on the buyer to bring an action in civil court. The buyer must show the seller had actual knowledge or constructive knowledge of the condition that gives rise to the litigation and failed to disclose that information. The relief sought for failure to disclose a condition or material defect is money damages or contract rescission. Punitive damages are reserved for situations where a seller fraudulently concealed a latent condition or material defect that could not have been discovered by the buyer prior to the acquisition of the home (Grieg v. Wallick, 2012 Ohio 77).² Perhaps most important as it pertains to this research, the establishment of a value of the damages as a result of the disclosure breach is required to set the level of required compensation to satisfy the breach.

A final limitation to the notice expansion, as it relates to this research, is the condition or material defect is limited to those found on the subject residential property. The pipeline must be
buried under the subject property to require disclosure. Residential properties in proximity to a natural gas transmission line and/or houses lying within a Potential Impact Radius of a natural gas transmission line are not covered by the statute unless the pipeline is located on the property. In the situation where a residence is located in a PIR but the natural gas transmission line is located on another property, the requirement of notice would not apply.

A Potential Purchaser’s Due Diligence and the Limitation of Available Information

The doctrine of *caveat emptor* is a legal doctrine that places a burden on the purchaser to inspect goods, property, or services prior to making a purchase. The term *caveat emptor* is a Latin phrase with a literal translation of “buyer beware.” The doctrine applies to residential property. Real estate is sold “as is,” subject to the terms and warranties provided by a seller to a buyer to entice that buyer to enter a contract.

A potential purchaser of a residential property may conduct several inspections prior to the acquisition of a property. Common inspections of items that are based primarily on visible evidence available to the buyer include building inspections, termite/pest inspection, a radon inspection, a water, cistern or well inspection, sewer or septic inspection, soil samples and environmental tests, and others. These inspections are intended to satisfy concerns of a potential buyer concerning the physical condition of a property.

Physical inspections are not the only steps a potential purchaser can take. There are also tools a potential purchaser can use to find items not available for a physical inspection. Two of the due diligence procedures most likely to provide information about a natural gas transmission line are real estate surveys and real estate title examinations.
Real Estate Surveys

A potential real estate purchaser is not required to obtain a real estate survey, but it is a due diligence tool. According to Ohio Administrative Code §4733-31-01(A), surveying shall mean any professional service performed for the purpose of determining land areas, the monumenting of property boundaries, the platting and layout of lands and sub-divisions thereof, including the topography, the alignment and the preliminary grades of streets, the preparation of maps, record plats, field note records and property descriptions representing such surveys (OAC §4733-31-01(A)). The Ohio State Board of Registration for Professional Engineers and Surveyors is tasked with the licensing and regulation of parties that hold themselves out as “surveyors” in Ohio Revised Code §4733 et sec. and Ohio Administrative Code §4733 et sec. Neither the Ohio Revised Code nor the Ohio Administrative Code require that easements, which may include natural gas transmission lines, be placed on the plat of the survey. Therefore, the placement of an easement on the survey is dictated by the requirements stated by the client.

According to Professional Land Surveyors of Ohio, the types of surveys most commonly requested are:

ALTA/ACSM Surveys: These surveys usually are requested for commercial property and often required by lending institutions. The request for this survey must be in writing and accompanied by all deeds, plats, and easements affecting the subject property as well as all adjoining properties (Public Land Surveyors of Ohio, n.d.). This survey is the most expensive type and will include information about pipeline easements that cross the property. The plat of the survey generally will include a dotted line easement area showing the width of the easement in relationship to the platted property boundaries. The cost of this type of survey makes it impractical for most residential real estate purposes.
Boundary surveys: These surveys are intended to locate, describe, monument, and map exact boundaries and corners of a given parcel of land (Public Land Surveyors of Ohio, n.d.). Pipeline information may be shown on the plat of the survey, but that information is not required.

Foundation surveys: These surveys often are used for construction projects. This type of survey shows the location of a foundation on subject property to guarantee to lenders that a foundation is located on the subject property and not encroaching on easements or building lines (Public Land Surveyors of Ohio, n.d.). Pipeline information may be shown on the plat of the survey, but that information is not required.

Lot surveys: This is a survey of a lot that has been established in a recorded subdivision. These surveys are intended to depict the location of the corners of a platted lot (Public Land Surveyors of Ohio, n.d.). Pipeline information may be shown on the plat of the survey, but that information is not required.

Mortgage location surveys: Ohio Administrative Code §4733-38 provides the minimum standards for mortgage location surveys in Ohio. These surveys are intended to meet the specific needs of the lender and for title insurance underwriters. The survey plat must show required information, which includes the location of easements on a property, discovered from measurements taken at a site, and not necessarily evidenced by public record. The plat of the survey generally will include a dotted line easement area showing the width of the easement in relationship to the platted property boundaries (ORC§163.021(A)).
The use of surveys can aid in informing potential purchasers of the location and width of an easement that crosses the subject property. Information provided on the survey may include the recording information and the diameter of a pipe in a pipeline if that information is requested.

There are limitations to the information a survey provides a potential purchaser regarding the proximity to a natural gas transmission line or the location of a residence within a Potential Impact Radius of a natural gas transmission line. A survey only applies to a specified property. The survey generally does not apply to adjoining lands.

**Real Estate Title Examinations**

A real estate title examination of public records can be performed. The title examination, also referred to as a title search or a title abstract, is a search and review of documents that have been placed on record that affect a subject property. These documents include deeds, leases, wills, trusts, mortgages, easements and rights of way, court orders, covenants, declarations, conditions, restrictions, liens, and other documents that may transfer or encumber the rights that owners retain in a subject tract of land.

**Real Estate Interest Transferring Instruments**

The documents where one most commonly would discover the existence of a natural gas pipeline would be in easements and rights of way, leases, and deeds.

Easements are a grant from a landowner to another party to use a portion of land. They are commonly found for the development of natural resources, construction projects, and the placement of utility pipelines on a landowners’ land.

Rights of way often work in conjunction with easements. Rights of way are conveyances of a landowner to another party the ability to travel across or through a stated portion of a
property. Examples of rights of way are roads, highways, driveways, access roads, and other grants of authority for a party to enter a land.

Leases are evidence of an exchange of rights in land for consideration, usually money. Leases that may contain or otherwise affect natural gas transmission pipelines may include oil and gas leases, easement leases, and right of way leases.

Deeds are instruments intended to transfer an interest. They may include warranty deeds, limited warranty deeds, special warranty deeds, fiduciary deeds, quit claim deeds, and other conveyance instruments. Deeds include a description of the property to be transferred or to be granted from a grantor to a grantee along with covenants, conditions, reservations, and restrictions to be placed on the property. A deed may reference prior covenants, conditions, reservations, and restrictions of record, including easements, but this practice is not required.

Court orders also may be placed on record to transfer the rights or interests of a landowner to another party. It is a common practice for a court order to transfer an easement or right of way as a part of the condemnation process. These court actions are brought pursuant to eminent domain actions, which are brought against holdouts on a pipeline project. A court decides whether the granting of a right of way to a pipeline construction company against the intention of a landowner is necessary and that the pipeline easement promotes a public purpose.

Once a court decides a pipeline project is necessary, that granting the easement promotes a public use, and the construction company has followed the proper procedure for the granting of eminent domain, a monetary amount in exchange for the transfer must be established. A hearing allows landowners to present evidence of the qualities of their respective properties and the potential monetary damage inflicted on the property as a result of the subject easement. Based on the evidence presented at the hearing, the court determines a “just compensation” to pay the
landowner for the use of the easement or right of way. The court order is placed on record to evidence the grant of the easement or right of way to the pipeline construction company.

**Limitations of Real Estate Interest Transferring Instruments**

There is not a requirement to record information concerning a Potential Impact Radius in any of the instruments listed. Therefore, the potential purchaser of a property would not receive notice that any part of the subject property is in a Potential Impact Radius. The documents may include property plats that show where a pipeline crosses a subject property, but it is not a requirement. Deeds may contain notice of the recording information for easements or rights of way, but these exclusions are not required to be placed on the deed. A blanket statement or general exception in the deed can limit the liability of a grantor regarding prior recorded items. The general exception may state that the grantor conveys the property subject to all easements, covenants, conditions, and restrictions of record. This blanket statement is made in a deed to put the grantee on notice that other conditions may exist on the property that were not stated in the deed. Documents of record generally do not refer to easements or rights of way placed on adjoining properties.

**Geographic Information Systems (GIS)**

An additional aid to a potential purchaser is the increased access to a geographic information system (GIS). A GIS provides an overhead view of the property with spatial location and layers of information that can be used to produce 3D maps. Google Earth and ArcGIS are commonly used platforms upon which GIS layers can be added to give dimension to information. The GIS provides a satellite view of an area of land. The GIS output can allow for a researcher to see the physical conditions present on a subject property. Several county auditors
in Ohio use GIS systems for mapping and tax assessment decisions. In counties that have a GIS system, the information generally is made available to the public.

**Limitations to Geographic Information Systems (GIS)**

The limitations to a GIS is one must be able to detect a condition. In areas where there are no trees or obvious markings, an underground pipeline is not detectable by visible inspection. Additionally, GIS maps may be months to years old. The images could have been taken prior to the insertion of a pipeline. A possible limitation is that title examiners and/or attorneys who perform title examinations are not required to find conditions in a GIS map that give rise to the suspicion of a gas transmission line. Review of the GIS map to find an underground pipeline is not common practice for title examiners. Building location, property line matters, and easement questions require the use of a survey and plat from a licensed surveyor. The examination of a GIS map is an additional step that title examiners may deem unnecessary and a possible area for future liability if an incorrect statement regarding a suspected property condition is made.

**Real Estate Title Examination Reports**

The real estate title examination report states what is found in a real estate title search. The purpose of this report is to show the documents of record that affect a subject property that were placed on record within a stated time period. It is common in Ohio to perform a 40-year title examination to determine ownership of a property. Information concerning easements and rights of way of record will be provided to a potential buyer. Once that information is provided to the potential buyer, that potential buyer must determine if the easements or rights of way are substantial enough to alter the contract for purchase.
Limitations to Real Estate Title Examination Reports

A title examination is not required for the transfer of real property. The title examination can only provide information that has been placed on record. Therefore, the limitations of the Real Estate Interest Transferring Instruments above are reflected in title examinations. In addition, the filing of information concerning a Potential Impact Radius is not required by the U.S. Department of Transportation’s Pipeline and Hazardous Materials Safety Administration (PHMSA) (49 CFR §192.903 (Subpart O)). In fact, PMHSA does not require that the disclosure of PIR information be shared with the landowners who have residences located within those zones. The PIR is a measurement that establishes the required due diligence on behalf of a pipeline operator to establish an increased maintenance schedule.

A Potential Purchaser’s Due Diligence Conclusion

The methods used to inform a buyer regarding the conditions present on a residential property prior to purchase are limited. A buyer may review surveys, title research based on recorded documents, and GIS images, but remain unaware that a home is near a natural gas transmission line or that a home is located within a PIR. The lack of a formal requirement notice allows for information asymmetry at the time of purchase. This gap in information may impact the fair value a purchaser would pay for a home near a natural gas transmission line or a home located within a PIR.

Summation of Conditions Presented

The use of natural gas transmission lines is an important part of the U.S. energy mix. Advances in drilling technology have allowed for greater accessibility of natural gas reserves. The transportation of natural gas reserves may include areas near residential properties. Present
literature states the proximity of a residence to a natural gas transmission line has little to no impact on property values after the pipeline has been installed.

The actions of the City of Green and the use of the term “blast zone” to represent the Potential Impact Radius (PIR) during litigation is a demonstration of incendiary language based on a perceived risk. An important part of perceived risk is the requirement of notice. Little academic research exists concerning the impact of notice of proximity of a residence to a natural gas transmission line and real estate property values. There does not appear to be any academic research concerning the impact of notice that a residence is within a PIR of a natural gas transmission and real estate property values.
CHAPTER THREE:

METHODOLOGY

The following hypotheses have been generated to test how the perceived risk associated with the notice of the proximity of a natural gas transmission pipeline impacts property value.

Hypotheses

H1: Notice that a single-family residential home is located near natural gas transmission pipeline impacts a potential purchaser’s perceived value.

H2: Notice that a single-family residential home is located within a Potential Impact Radius of a natural gas transmission pipeline impacts a potential purchaser’s perceived value.

H3: Notice that a single-family residential home is located within a Potential Impact Radius of a natural gas transmission pipeline has a greater impact on a potential purchaser’s perceived value than notice that a single-family residential home is located near natural gas transmission pipeline.

Research Design

The difficulty in testing property values based on the introduction of information that is normally not supplied during a real estate transaction is prior valuation models have not been established to address these hypotheses.

Comparable Sales Models

For lending purposes, residential real estate appraisers use a comparable sales method for establishing a range of values for an individual property. This method is the use of past sales for a given period, often limited to within six months, within a given distance range from a subject
property with similar features as the subject property. If a new externality is presented, in this case, a natural gas transmission line, comparable sales have not been consummated and sales prices have not been set. In fact, one of the difficulties in using comparable sales for the valuation of properties near a proposed pipeline easement is that comparable sales are not able to project future values. The information can only be obtained with sales prices prior to installation and after the installation of this externality. Those who use the comparable sales model look to past sales to establish a present value. While it is possible to study a limited number of properties within a PIR on a longitudinal basis after the installation of the pipeline, none of these properties will be in a PIR prior to the installation. For this method to fit, the property must be sold twice, before and after the installation of a natural gas transmission line.

**Hedonic Regression Model**

Another model for assessing property values is the use of hedonic regressions (Wilson, 2004; Hansen et al., 2006; Fruit, 2008; Wilde, 2012; Roddewig et al., 2018). This type of modeling is used in assessing the value of properties for tax collection. This model is generated by the sales information of several houses within an area that is attributed to individual characteristics of a residential property, such as lot size, number of bedrooms, number of bathrooms, square footage, school district, and other factors, to establish a value on a subject property. Unfortunately, hedonic regression analysis may not always be possible (Simons et al., 2006). Hedonic regression modeling suffers a similar flaw as the comparable sales model. Hedonic regression does not account for the potential negative amenity until a series of sales records have been established. In this study, two treatments were offered: 1. Notice that a residence is located within 500 feet of a natural gas transmission pipeline, and 2. Notice that a residence is located with the PIR of a natural gas transmission pipeline. This notice is not a
condition that occurs in present real estate transactions. So, this condition is missing from the values established in existing hedonic regression models.

**Paired Sales Models**

These models are based on the comparison the sale of the same or similar property over a period of time. Paired sales are longitudinal studies that require time in excess of what is necessary to analyze a change in property value prior to the placing of the pipeline into the ground. This model is similar to a comparable sales model, but a much longer time period is required to have actual sales of the same or similar properties. This model is often used in combination with hedonic regression models (Diskin, et al, 2011).

**Contingent Valuation Models**

To find a model that can project a value based on a situation that is recent or to be established in the future, research often turns to surveys. In the real estate context, surveys are referred to as contingent valuation models. Prior academic work concerning real estate valuation and the introduction of an externality or negative amenity has been performed using telephone surveys that have been introduced to establish compensation.

Where a potential hazard exists, a contingent valuation study could elicit valuations that reflect the full extent of an individual’s safety concerns (Carson, 2012). Traditional appraisal techniques are designed to address valuing a parcel in its entirety, but those techniques are not well suited for valuing individual components of a property. When a new condition is presented to a property, such as the condition found in a partial taking, a different methodology is needed (Seiler, 2018).

Contingent valuations are an acceptable method when there are no comparable sales and it is difficult to establish a value because all comparable sales are valued without treatment
information (Simons et al., 2005; Seiler, 2014b). Contingent valuation models are particularly useful in confirming causes of property value diminution when a negative amenity is present (Simons et al., 2005). Contingent valuation models are especially applicable when properties suffer contamination or impairment where market failure may occur for reasons that include lack of information and knowledge (Wilde, 2012). Contingent valuation models are useful in aiding in market valuation in addition to cost, sales comparison, and income approaches (Lipscomb, 2011).

Contingent valuation models have drawbacks. The respondents are not experts and have little or no experience in assessing property values (Kinnard et al., 1994a; Kinnard, 1995, Simons et al., 2006). They tend to state a higher amount of loss due to a negative externality or stigma than a regression analysis (Kinnard et al., 1994a; Simons et al., 2006). Hypothetical surveys of actual or potential market participants may not be a good substitute for a systematic analysis of market data; they may overstate effects, if any, of proximity to negative amenities, including pipelines, on property values (Wilde, 2012).

While there are drawbacks to using a contingent valuation model, the conditions presented in this study are hypothetical. The house presented for response does not exist. The provision of notice in the two treatments also is hypothetical. Because we are dealing with a hypothetical situation, the use of prior sales data, as required for the other models stated, does not fit the experiment. As such, a contingent valuation model was selected for this study.

The methodological design for this study is a contingent valuation method associated with an experimental design, which is the use of an online third-party provider to solicit surveys based on information provided to the respondents for inquiry. Examples of this type of experimental design, called behavioral real estate, can be found at Lane, Seiler, and Seiler (2013)
and Seiler (2014, 2018). The advantage of using this type of experimental design with a contingent valuation model is that one variable can be tested, altered, or removed to show an effect in isolation (Seiler, 2014). It is also possible that a greater disclosure of information in the surveys compared to actual market contributes to the greater diminution in value (Simons et al., 2005).

While there are similar experimental design papers found in academic literature, there does not appear to be an academic paper that explores the use of this type of experimental design examining the impact of the proximity to natural gas transmission lines. A greater discussion of this research method is in the methodology section of this submission.

**Methodology and Data Collection Plan**

The study was conducted with Qualtrics software to perform an online survey. Beavercreek, Ohio, was selected to be the subject property location for the survey. Beavercreek is a suburban area located near Dayton, Ohio, that has similar population demographics, homeownership data, and property values as Green, Ohio. Beavercreek is in Greene County, Ohio. According to the U.S. Census Bureau, 71.5% of the residential properties are owner-occupied (City of Green is 74%); the mean number of persons per household is 2.44 (City of Green is 2.44); and the median value of an owner-occupied property is $178,500 (City of Green is $173,600) (U.S. Census Bureau, 2019B) (U.S. Census Bureau, 2019A).

Beavercreek, Ohio, was chosen to limit potential biases and harm since it did not have a recently installed natural gas transmission line in the area at the time of the study. Only two natural gas incidents occurred near Beavercreek within 10 years of the study. In November of 2010 in Lebanon, Ohio, an uncapped ½ inch supply pipe in an apartment laundry room was the source of an explosion and fire. The natural gas leaked into the apartment and was ignited by a
resident who attempted to light a cigarette. The explosion injured seven people and caused an estimated $1 million in property damage (Ohio Public Utilities Commission, 2012). On November 12, 2011, in Fairborn, Ohio, a house exploded when the excavation of a water line resulted in a gas line explosion. One person died and six others were injured (CBS News, 2011). These incidents appear to be isolated and accidental. Neither incident included natural gas transmission pipelines.

Beavercreek, Ohio, is in excess of 100 miles from the closest point of the NEXUS pipeline. It is a suburb of Dayton with a similar relationship to that of the City of Green, which is a suburb of Akron. Special care was used in the selection of Beavercreek as an analog for the City of Green. While both cities are in Ohio, the cities are in different media markets and separated by approximately 200 miles. For an additional bias precaution, the staged house imaged for the virtual tour was not from the City of Green or Beavercreek; the stated the address, comparable sales values, and a stated list price for the property were fictitious.

The sample population was made up of people from Greene County and 20 other counties in Southwest, Ohio. The intent was to include the surrounding counties that would have inhabitants aware of local property values and could be interested in moving to Beavercreek. The surrounding counties included in the survey were Adams, Brown, Butler, Clermont, Clinton, Fayette, Highland, Montgomery, Pickaway, Pike, Preble, Ross, Scioto, and Warren.

The collection plan was limited to parents with children under the age of 18 based on two assumptions. The first assumption was based on the demographic information of the population of the City of Green as it corresponds to the target purchaser. According to the U.S. Census Bureau, 71% of the residential properties are owner-occupied while the mean number of persons per household is 2.44. (U.S. Census Bureau, 2019B). Additionally, there was an underlying
hypothesis that was not tested in this research that a parent with children living in their home would more likely have a significant correlation with a perceived risk than a similarly situated single person.

The methodological design for this study was a contingent valuation method associated with an experimental design (for similar examples, see Lane, Seiler & Seiler, 2013; Seiler 2014a; 2018). This survey was created using Qualtrics software. Qualtrics was directed to survey a sample of 300 parents, one respondent per household, with children age 18 or under. The respondents were screened for having a likelihood of buying a home within the next two years. The likelihood screening retained respondents with a score of 5 (slightly likely) to 7 (extremely likely) on a Likert scale. Respondents with a Likert score of 4 (neither likely nor unlikely) down to 1 (extremely unlikely) were screened out of the survey. An equal distribution of male and female respondents was a requirement for each pool. The design was to have 50 male respondents and 50 female respondents in each group. The respondents were selected from a geographic area with an emphasis on Greene County, Ohio, and the surrounding counties.

Table 9 provides a breakdown of the proposed methodology and treatment of the three sample groups.

<table>
<thead>
<tr>
<th>Pools</th>
<th>Control</th>
<th>Notice of Pipeline</th>
<th>Notice within PIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of Population</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Gender of Respondents</td>
<td>50 female/50 male</td>
<td>50 female/50 male</td>
<td>50 female/50 male</td>
</tr>
<tr>
<td>Information Provided</td>
<td>Virtual Tour of Home Suggested List Price County Assessed Value Local Average Property Value</td>
<td>Virtual Tour of Home Suggested List Price County Assessed Value Local Average Property Value</td>
<td>Virtual Tour of Home Suggested List Price County Assessed Value Local Average Property Value</td>
</tr>
<tr>
<td>Treatment (Voice-over in Virtual Tour)</td>
<td>None</td>
<td>Notice that the property is located 500 feet from a natural gas transmission line</td>
<td>Notice that the property is located within the Potential Impact Radius of a natural gas transmission pipeline</td>
</tr>
<tr>
<td>Data Collection Instrument</td>
<td>Survey of Respondents</td>
<td>Survey of Respondents</td>
<td>Survey of Respondents</td>
</tr>
</tbody>
</table>
The respondents were provided an online tour of a single-family residential property located in Beavercreek, Ohio. The virtual tour was based on video images and a voice-over narration recorded using Camtasia software in an MP4 format. Three separate MP4 videos, one for the control and one for each of the two treatments, were embedded in the Qualtrics platform. The respondents were assigned randomly to three pools to test the control or either of the two treatments. Each pool was intended to be comprised of an equal number of males and females. One pool included a property with a video tour of the house and the stated price along with a stated county assessed value and a local average value of the property. A second group saw the same video tour as the first group, but the line “The residential property disclosure states that this home is located within 500 feet of a natural gas transmission line” was added to the voice-over narration. A third group saw the same video tour as the first group, but the line “The residential property disclosure states that this home is located in a potential impact radius of a natural gas transmission line” was added to the voice-over narration. The Virtual Tour Video Voice Over Script is located in Appendix E.

The survey began with screening questions and was followed by the video virtual tour. One additional screening question was asked to verify that the respondent had the speakers on and was able to hear the audio information included in the video. After the final screening question, respondents were asked to submit a potential purchase price that each respondent would be willing to offer as fair value for the purchase of the subject real estate. This question was followed by several demographic questions. For those who received either of the two treatments, there were additional questions to verify that the respondent heard the respective treatment lines during the video presentation. These questions allowed the respondent a second
chance to answer the question as to whether the treatment information altered the value of the property. The data collection instrument is found in Appendix F.

The data was compiled using the Qualtrics online platform. Qualtrics compiled the information between the dates of May 2, 2019, and concluded on June 7, 2019. The gross number of respondents who completed the survey after screening was 292. Then, the information was uploaded for statistical analysis into SPSS Statistics 25 software.

A post survey analysis found several errors submitted in responses that required attention. The answer to survey question one, the fair offer value for the property, was expected to be a 5-digit or 6-digit response. On those who entered a three-digit response less than 200, an additional three zeros were added. For example, an entry of 150 was changed to 150,000. For two-digit numbers, any number lower than 50 was excluded. For example, an entry of 95 was changed to 95,000. All responses in excess of six digits or less than two digits were excluded from the sample group. Five respondents who fell outside of this protocol were removed from the analysis.

An error occurred where a person placed a zero in the screening question of the age of the youngest child. The number 0 is less than 18 and was not removed from screening. Those with children less than 1 year old often placed an entry followed by the word “months.” A decimal allocation based on a fraction of a 12-month calendar was used as an entry for those responses. For respondents with a child, but the age appeared to be less than 1 year and a 0 was placed in the response area, 0.5 was entered. Respondents with no children who placed a 0 for the age of the youngest child were removed. Five respondents who fell outside of this protocol were removed from the analysis.
Respondents in Groups Two and Three were asked survey question 9. For Group Two, the question was, “During the virtual tour, did you hear the narrator mention that the home is located within 500 feet of a natural gas transmission line? Yes or No.” For Group Three, the question was, “During the virtual tour, did you hear the narrator mention that the home is located in a potential impact radius of a natural gas transmission line? Yes or No.” Eight respondents who answered “No” to this question were removed from the analysis. Table 10 shows the removal of respondents from analysis after quality control methods were performed.

**Table 10. The removal of respondents from analysis after quality control methods**

<table>
<thead>
<tr>
<th>Quality Control Category</th>
<th>Number of Respondents Removed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fair Offer Value Number Error</td>
<td>5</td>
</tr>
<tr>
<td>Respondent without a Child Error</td>
<td>5</td>
</tr>
<tr>
<td>Did not Hear the Notice During the Video</td>
<td>8</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

There was a syntax error in the placement of survey question 11 for Group Two and Group Three only. This question, which requested that the respondent state monetary amount of impact as the result of the respective treatment, was removed from consideration for statistical analysis.

The SPSS Statistics 25 software was used to perform statistical analysis of the responses submitted by Qualtrics. A descriptive analysis of the respondents was used to categorize the respondents. Inferential statistics were performed with series of t-tests and Pearson’s chi-square tests. A predictive analysis was performed using a discriminant analysis and a series of linear regressions.
CHAPTER FOUR:

RESULTS

Statistical Results

Sample

As stated in the methodology, the study was designed to have the three groups of 100 respondents each, 300 total respondents, and an equal 50/50 split between males and females. The survey was launched on May 2, 2019, and concluded on June 7, 2019. Though 4,307 potential respondents entered information into the survey, 919 respondents were from the selected counties in Ohio. Five hundred and fifty-eight respondents were either slightly likely, moderately likely, or extremely likely to purchase a home within the next two years; 494 respondents indicated they had a child age 18 or younger, and 309 respondents entered the correct answer to the audio test. Off these 309 respondents, 292 completed the exam and were used as a gross sample. A manipulation check was conducted to insure respondents did not simply answer quickly without regard for the question and a quality control to make sure respondents heard the treatment line in the video presentation and met the requirement of having a child 18 years or less. A total of 274 respondents were considered for this analysis.

Table 11 has a breakdown of the number of respondents used from each group.

Table 11. Breakdown of the number of respondents used from each group

<table>
<thead>
<tr>
<th>Group Designation</th>
<th>Number of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Group</td>
<td>92</td>
</tr>
<tr>
<td>Group Two (Notice of Pipeline Group)</td>
<td>88</td>
</tr>
<tr>
<td>Group Three (Notice of PIR Group)</td>
<td>94</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>274</strong></td>
</tr>
</tbody>
</table>
Table of Tables

A comprehensive table of the statistical results portion of this study has been provided (see Table 12).

Table 12. A comprehensive table of the statistical results portion of this study

<table>
<thead>
<tr>
<th>Descriptive Statistics</th>
<th>Group</th>
<th>Control v. Pipeline</th>
<th>Control v. PIR</th>
<th>Pipeline v. PIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>92</td>
<td>92</td>
<td>94</td>
<td>88</td>
</tr>
<tr>
<td>Pipeline</td>
<td>88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (40 or younger)</td>
<td>64.10%</td>
<td>92.00%</td>
<td>64.10%</td>
<td>90.40%</td>
</tr>
<tr>
<td>Gender (female)</td>
<td>54.30%</td>
<td>40.90%</td>
<td>54.30%</td>
<td>52.10%</td>
</tr>
<tr>
<td>Marital Status (married)</td>
<td>65.20%</td>
<td>72.70%</td>
<td>65.20%</td>
<td>70.20%</td>
</tr>
<tr>
<td>Ethnicity (white)</td>
<td>88.00%</td>
<td>85.20%</td>
<td>88.00%</td>
<td>87.20%</td>
</tr>
<tr>
<td>Ethnicity (Next non-white)</td>
<td>5.4% His/Lat</td>
<td>8.0% Afr Am</td>
<td>5.4% His/Lat</td>
<td>5.3% Afr Am</td>
</tr>
<tr>
<td>Number of Children (2)</td>
<td>40.20%</td>
<td>51.10%</td>
<td>40.20%</td>
<td>36.20%</td>
</tr>
<tr>
<td>Number of Children (3 or fewer)</td>
<td>89.10%</td>
<td>89.80%</td>
<td>89.10%</td>
<td>83.00%</td>
</tr>
<tr>
<td>Income (annual) (under $20k)</td>
<td>2.20%</td>
<td>3.40%</td>
<td>2.20%</td>
<td>12.80%</td>
</tr>
<tr>
<td>Income (annual) ($20k to $80k)</td>
<td>60.80%</td>
<td>65.90%</td>
<td>60.80%</td>
<td>52.10%</td>
</tr>
<tr>
<td>Income (annual) (over $80k)</td>
<td>37.00%</td>
<td>31.70%</td>
<td>37.00%</td>
<td>35.10%</td>
</tr>
<tr>
<td>Net Worth (0- $200k)</td>
<td>38.00%</td>
<td>39.80%</td>
<td>38.00%</td>
<td>40.40%</td>
</tr>
<tr>
<td>Net Worth ($200k - $400k)</td>
<td>23.90%</td>
<td>29.50%</td>
<td>23.90%</td>
<td>22.30%</td>
</tr>
<tr>
<td>Net Worth (Over $400k)</td>
<td>18.50%</td>
<td>13.60%</td>
<td>18.50%</td>
<td>14.90%</td>
</tr>
<tr>
<td>Own Home (yes)</td>
<td>63.00%</td>
<td>67.00%</td>
<td>63.00%</td>
<td>70.20%</td>
</tr>
<tr>
<td>Live Near A Pipeline (yes)</td>
<td>Not Asked</td>
<td>15.90%</td>
<td>Not Asked</td>
<td>13.80%</td>
</tr>
<tr>
<td>Granted a Prior Easement (yes)</td>
<td>10.90%</td>
<td>9.10%</td>
<td>10.90%</td>
<td>3.20%</td>
</tr>
</tbody>
</table>
Table 12 (Continued)

<table>
<thead>
<tr>
<th>Can See Self in Home (Likert 5-7)</th>
<th>77.20%</th>
<th>77.30%</th>
<th>77.20%</th>
<th>58.50%</th>
<th>77.30%</th>
<th>58.50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fair Value Mean</td>
<td>$148,163</td>
<td>$146,402</td>
<td>$148,163</td>
<td>$145,435</td>
<td>$146,402</td>
<td>$145,435</td>
</tr>
</tbody>
</table>

**Inferential Statistics**

<table>
<thead>
<tr>
<th>Group</th>
<th>Control v. Pipeline</th>
<th>Control v. PIR</th>
<th>Pipeline v. PIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-Tests</td>
<td>Control</td>
<td>Pipeline</td>
<td>Control</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>7676.56</td>
<td>9429.24</td>
<td>7676.56</td>
</tr>
<tr>
<td>Standard Error Mean</td>
<td>800.337</td>
<td>1005.16</td>
<td>800.337</td>
</tr>
<tr>
<td>t</td>
<td>1.377</td>
<td>2.115</td>
<td>0.679</td>
</tr>
<tr>
<td>df</td>
<td>178</td>
<td>184</td>
<td>180</td>
</tr>
<tr>
<td>Significance 2-Tail</td>
<td>0.17</td>
<td>0.036</td>
<td>0.498</td>
</tr>
<tr>
<td>95% Confidence Lower</td>
<td>-763.309</td>
<td>182.985</td>
<td>967.177</td>
</tr>
<tr>
<td>95% Confidence Upper</td>
<td>4284.83</td>
<td>5272.89</td>
<td>1424.773</td>
</tr>
</tbody>
</table>

**Pearson’s Chi Square**

<table>
<thead>
<tr>
<th>Condition Affect Price?</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase</td>
<td>16</td>
<td>6</td>
</tr>
<tr>
<td>Decrease</td>
<td>36</td>
<td>67</td>
</tr>
<tr>
<td>No Effect</td>
<td>36</td>
<td>21</td>
</tr>
<tr>
<td>“Pearson Chi-Square (Sig. 2-sided)”</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>“Likelihood Ratio (2-sided)”</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

**CanSee(Likert 5-7)Analysis**

<table>
<thead>
<tr>
<th>CanSee</th>
<th>71</th>
<th>68</th>
<th>71</th>
<th>55</th>
<th>68</th>
<th>55</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannot</td>
<td>21</td>
<td>20</td>
<td>21</td>
<td>39</td>
<td>20</td>
<td>39</td>
</tr>
<tr>
<td>Pearson Chi-Square (Sig. 2-sided)</td>
<td>0.987</td>
<td>0.006</td>
<td>0.006</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio (2-sided)</td>
<td>0.987</td>
<td>0.006</td>
<td>0.006</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Predictive Statistics**

<table>
<thead>
<tr>
<th>Group</th>
<th>Control v. Pipeline</th>
<th>Control v. PIR</th>
<th>Pipeline v. PIR</th>
<th>All</th>
</tr>
</thead>
</table>

**Linear Regressions**

**Offer Value**

60
Descriptive Statistics

Based on the responses provided in the Qualtrics survey, a following chart was produced to describe each group (see Table 13).

Table 13. Breakdown of the descriptive statistics

<table>
<thead>
<tr>
<th>Descriptive Statistics</th>
<th>Group One (Control)</th>
<th>Group Two (Pipeline)</th>
<th>Group Three (PIR)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Respondents</strong></td>
<td>92</td>
<td>88</td>
<td>94</td>
</tr>
<tr>
<td><strong>Age of Respondent</strong></td>
<td>64.1% - 40 or younger</td>
<td>92% - 40 or younger</td>
<td>90.4% - 40 or younger</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td>45.7% m/54.3%f</td>
<td>59.1% m/40.9%f</td>
<td>47.9% m/52.1%f</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td>65.2% married</td>
<td>72.7% married</td>
<td>70.2% married</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td>88% White/5.4% Hispanic/Latino</td>
<td>85.2% White/8.0% African American</td>
<td>87.2% White/5.3% African American</td>
</tr>
<tr>
<td><strong>Number of Children</strong></td>
<td>40.2% = 2; 89.1% = 3 or less</td>
<td>51.1% = 2; 89.8% = 3 or less</td>
<td>36.2% = 2; 83% = 3 or less</td>
</tr>
<tr>
<td><strong>Age of Youngest Child</strong></td>
<td>Even Spread</td>
<td>Even Spread</td>
<td>Even Spread</td>
</tr>
<tr>
<td><strong>Age of Oldest Child</strong></td>
<td>Even Spread</td>
<td>Even Spread</td>
<td>Even Spread</td>
</tr>
<tr>
<td><strong>Income (annual)</strong></td>
<td>2.2% less than $20k; 25% = $40-60K; 60.8% - $20,001 to 80K; 37% $80k+</td>
<td>3.4% less than $20k; 22% = $20 – 40K; 22% = $40-60K; 22% = $60-80K; 65.9% - $20,001 to 80K; 31.7% $80k+</td>
<td>12.8% less than $20k; 21.3% = 40-60K; 52.1% - $20,001 to 80K; 35.1% $80k+</td>
</tr>
<tr>
<td><strong>Net Worth</strong></td>
<td>38% - $0 – 200k; 23.9% - $200k+ to $400k; 18.5% over $400k</td>
<td>39.8% - $0 – 200k; 29.5% - $200k+ to $400k; 13.6% over $400k</td>
<td>40.4% - $0 – 200k; 22.3% - 200k to 400k; 18.5% over $400k</td>
</tr>
<tr>
<td><strong>Own Home</strong></td>
<td>63% yes</td>
<td>67% yes</td>
<td>70.2% yes</td>
</tr>
<tr>
<td><strong>Live Near a Pipeline</strong></td>
<td>Not Asked</td>
<td>15.9% yes</td>
<td>13.8% yes</td>
</tr>
<tr>
<td><strong>Granted a Prior Easement</strong></td>
<td>10.9% yes</td>
<td>9.10% yes</td>
<td>3.2% yes</td>
</tr>
<tr>
<td><strong>Can You See Yourself in this home (Likert 5-7)</strong></td>
<td>77.2% yes</td>
<td>77.3% yes</td>
<td>58.5% yes</td>
</tr>
<tr>
<td><strong>Fair Value Mean</strong></td>
<td>$148,163</td>
<td>$146,402</td>
<td>$145,435</td>
</tr>
</tbody>
</table>
Inferential Statistics

Hypothesis check (t-test)

The test of the hypotheses is a question of the differences in means when comparing Group One and Group Two, Group One and Group Three, and Group Two and Group Three. A series of t-tests were performed to find significance in the differences of the means.

H1: Notice that a single-family residential home is located near natural gas transmission pipeline impacts a potential purchaser’s perceived value.

Table 14. Graphic representation of the test results of H1: Not Supported

<table>
<thead>
<tr>
<th>DV</th>
<th>Group (IV)</th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Std. Error Mean</th>
<th>t</th>
<th>df</th>
<th>Sig. 2 tail</th>
<th>95% Conf. Lower</th>
<th>95% Conf. Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offer Value</td>
<td>Control</td>
<td>92</td>
<td>148,163</td>
<td>7676.56</td>
<td>800.337</td>
<td>1.377</td>
<td>178</td>
<td>0.170</td>
<td>-763.309</td>
<td>4284.83</td>
</tr>
<tr>
<td>Pipeline</td>
<td></td>
<td>88</td>
<td>146,402</td>
<td>9429.24</td>
<td>1005.16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

H2: Notice that a single-family residential home is located within Potential Impact Radius of a natural gas transmission pipeline impacts a potential purchaser’s perceived value.

Table 15. Graphic representation of the test results of H2: Supported

<table>
<thead>
<tr>
<th>DV</th>
<th>Group (IV)</th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Std. Error Mean</th>
<th>t</th>
<th>df</th>
<th>Sig. 2 tail</th>
<th>95% Conf. Lower</th>
<th>95% Conf. Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offer Value</td>
<td>Control</td>
<td>92</td>
<td>148,163</td>
<td>7676.56</td>
<td>800.337</td>
<td>2.115</td>
<td>184</td>
<td>0.036</td>
<td>182.985</td>
<td>5272.89</td>
</tr>
<tr>
<td>PIR</td>
<td></td>
<td>94</td>
<td>145,435</td>
<td>9767.31</td>
<td>1007.42</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

H3: Notice that a single-family residential home is located within a Potential Impact Radius of a natural gas transmission pipeline has a greater impact on a potential purchaser’s perceived value than notice that a single-family residential home is located near natural gas transmission pipeline.
Table 16. Graphic representation of the test results of H3: Not Supported

<table>
<thead>
<tr>
<th>DV</th>
<th>Group (IV)</th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Std. Error Mean</th>
<th>t</th>
<th>df</th>
<th>Sig. 2 tail</th>
<th>95% Conf. Lower</th>
<th>95% Conf. Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offer Value</td>
<td>Pipeline</td>
<td>88</td>
<td>146,402</td>
<td>9429.24</td>
<td>1005.16</td>
<td>0.679</td>
<td>180</td>
<td>0.498</td>
<td>967.177</td>
<td>1424.773</td>
</tr>
<tr>
<td></td>
<td>PIR</td>
<td>94</td>
<td>145,435</td>
<td>9767.31</td>
<td>1007.42</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Pearson’s chi-square test*

A Pearson’s chi-square test was used to test the relationship between two categorical variables.

19. How does the condition impact the fair price? (Question 10 Effects)

The dependent variable examined in the prior tests was that of the stated offer price of the respondents. An additional dependent variable was found for respondents in Group Two (pipeline respondents) and Group Three (PIR respondents). Question 10 for Group Two (pipeline respondents) asked, “How does the notice that the home is located within 500 feet of a natural gas transmission line affect the fair price of this home?” Question 10 for Group Three (PIR respondents) asked, “How does the notice that the home is located in a potential impact radius of a natural gas transmission line affect the fair price of this home?” Group One (Control Group) was not asked this question since they were not subject to either notice treatment.

For the statistical analysis, the responses to this question were placed in the three categories below:

Response 1 = Pipeline or PIR Increased Fair Value

Response 2 = Pipeline or PIR Decreased Fair Value

Response 3 = Pipeline or PIR had no effect on Fair Value
Group Two (pipeline respondents) and Group Three (PIR respondents) were compared to find a significant relationship between the Treatment (Pipeline or PIR) and the reduction in the fair value stated in Survey Question 1. In SPSS, this test was performed using the crosstabs function and adding a chi-square selection for analysis (see Tables 17 and 18 for test results).

**Table 17.** A depiction of the results of the crosstabs (Condition Impact of Fair Price)

<table>
<thead>
<tr>
<th></th>
<th>1 Increase</th>
<th>2 Decrease</th>
<th>3 No effect</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline</td>
<td>16</td>
<td>36</td>
<td>36</td>
<td>88</td>
</tr>
<tr>
<td>PIR</td>
<td>6</td>
<td>67</td>
<td>21</td>
<td>94</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>22</td>
<td>103</td>
<td>57</td>
<td>182</td>
</tr>
</tbody>
</table>

**Table 18.** A depiction of chi-square test results (Condition Impact of Fair Price)

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Df</th>
<th>Sig. 2-sided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>17.644*</td>
<td>2</td>
<td>0.000</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>17.898</td>
<td>2</td>
<td>0.000</td>
</tr>
</tbody>
</table>

* 0 cells (.0%) have an expected count less than 5. The minimum count is 10.64.

The Pearson Chi Square was 17.644; there were 2 degrees of freedom and there is a significance in that the p-value is less than .05, stated as .000.

There appears to be a significant relationship between the Treatment (Pipeline or PIR) and the reduction in the fair value stated. The pipeline respondents had 36 who responded “decrease” and 36 responded “no effect.” The PIR respondents had 67 who responded “decrease” and 21 responded “no effect.”

This test also shows independence between those who responded to the pipeline treatment and those who responded to the PIR treatment.
CanSee and cannot analysis (question 3 effects)

A second crosstabs and chi-square test was performed based on the responses to question 3. Question 3 asked, “Can you see yourself/family living in this home?” The responses were on a 7-point Likert scale where 7 was “absolutely,” 4 was “neutral,” and 1 was “definitely not.” Those who answered 5 or above were categorized as “CanSee” (Likert 5-7) while those who answered 4 or less were categorized as “Cannot” (Likert 1-4). The respondents with a neutral response of 4 were placed in the “Cannot” group under the assumption that a neutral respondent would not have been willing to make an offer on a house.

Pearson’s chi-square test is used to test the relationship between two categorical variables. In this case, the relationship between the CanSee group and the Cannot group when comparing them to the treatment group. As with the t-tests, a series of tests were performed: Group One (control respondents) against Group Two (pipeline respondents); Group One (control respondents) against Group Three (PIR respondents), and Group Two (pipeline respondents) against Group Three (PIR respondents) (see Tables 19 – 21 for test results).

**Group One (control respondents) against Group Two (pipeline respondents)**

**Table 19.** A depiction of the results of the crosstabs (CanSee/Cannot See for Group One against Group Two)

<table>
<thead>
<tr>
<th>IV</th>
<th>Cannot</th>
<th>CanSee</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>21</td>
<td>71</td>
<td>92</td>
</tr>
<tr>
<td>Pipeline</td>
<td>20</td>
<td>68</td>
<td>88</td>
</tr>
<tr>
<td>TOTAL</td>
<td>41</td>
<td>139</td>
<td>180</td>
</tr>
</tbody>
</table>

**Table 20.** A depiction of chi-square test (CanSee/Cannot See for Group One against Group Two)

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>DF</th>
<th>Sig. 2-sided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>0.000*</td>
<td>1</td>
<td>0.987</td>
</tr>
<tr>
<td>Likelihood Ration</td>
<td>0.000</td>
<td>1</td>
<td>0.987</td>
</tr>
</tbody>
</table>

* 0 cells (.0%) have and expected count less than 5. The minimum count is 20.04.
Group One (control respondents) against Group Three (PIR respondents)

Table 21. A depiction of the results of the crosstabs (CanSee/Cannot See for Group One against Group Three)

<table>
<thead>
<tr>
<th>IV</th>
<th>Cannot</th>
<th>CanSee</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>21</td>
<td>71</td>
<td>92</td>
</tr>
<tr>
<td>PIR</td>
<td>39</td>
<td>55</td>
<td>94</td>
</tr>
<tr>
<td>TOTAL</td>
<td>60</td>
<td>126</td>
<td>186</td>
</tr>
</tbody>
</table>

Table 22. A depiction of chi-square test (CanSee/Cannot See for Group One against Group Three)

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Df</th>
<th>Sig. 2-sided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>7.411*</td>
<td>1</td>
<td>0.006</td>
</tr>
<tr>
<td>Likelihood Ration</td>
<td>7.500</td>
<td>1</td>
<td>0.006</td>
</tr>
</tbody>
</table>

* 0 cells (.0%) have and expected count less than 5. The minimum count is 29.68.

The Pearson Chi Square was 7.411; there was 1 degree of freedom and there is a significance in that the p-value is less than .05, stated as 0.006.

There appears to be a significant relationship between these treatment groups and whether one can see or cannot see themselves living in the home. While 77.2% of the control group can see themselves in the house, only 58.50% of the PIR group can see themselves in the house.

This test also shows independence between those who responded in the control group and those who responded to the PIR treatment.

Group Two (pipeline respondents) against Group Three (PIR respondents)

The Pearson Chi Square was 7.303; there was 1 degree of freedom and there is a significance in that the p-value is less than .05, stated as 0.007.
There appears to be a significant relationship between these treatment groups and whether one can see or cannot see themselves in themselves. While 77.3% of the pipeline group can see themselves in the house, only 58.50% of the PIR group can see themselves in the house.

This test also shows independence between those who responded in the pipeline treatment and those who responded to the PIR treatment.

Table 23. A depiction of the results of the crosstabs (CanSee/Cannot See for Group Two against Group Three)

<table>
<thead>
<tr>
<th>IV</th>
<th>Cannot</th>
<th>CanSee</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline</td>
<td>20</td>
<td>68</td>
<td>88</td>
</tr>
<tr>
<td>PIR</td>
<td>39</td>
<td>55</td>
<td>94</td>
</tr>
<tr>
<td>TOTAL</td>
<td>59</td>
<td>123</td>
<td>182</td>
</tr>
</tbody>
</table>

Table 24. A depiction of chi-square test (CanSee/Cannot See for Group Two against Group Three)

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Df</th>
<th>Sig. 2-sided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>7.303*</td>
<td>1</td>
<td>0.007</td>
</tr>
<tr>
<td>Likelihood Ration</td>
<td>7.408</td>
<td>1</td>
<td>0.006</td>
</tr>
</tbody>
</table>

* 0 cells (.0%) have and expected count less than 5. The minimum count is 28.53.

Predictive Statistics

Another step taken with this analysis was an attempt to identify patterns within the independent variables selected for this experiment. The independent variables were the product of questions presented in the Qualtrics survey. A list of the independent variables tested were:

1. Net Worth – Based on a scale survey in eight stratified categories of the net worth of the respondent

2. Granted Easement – A yes or no question as to whether the respondent granted an easement or an oil and gas lease prior to the survey
3. Number of Children – Number of children the respondent had at the time of the survey
4. Youngest Age Group – A grouping of children, age 18 or younger, in five groups
5. Age of Oldest Child – The age of the oldest child of the respondent
6. Gender – The gender of the respondent, male or female
7. Homeowner – Did the respondent own a home at the time of the survey
8. Numeric Your Home – Likert scale 1-7 on whether one can see themselves in the home
9. Age range of the respondent – Grouping of the age of the respondent, six categories
10. Ethnicity – Ethnicity of the respondent, five stated categories and one other
11. Income Group – Annual income of the respondent, seven stratified categories
12. Live Near Line – Did the respondent live near a natural gas transmission line at the time of the survey (only applied to Group Two and Group Three)

Discriminant statistical analysis

A discriminant statistical analysis was performed on all the independent variables. The variables were placed in the SPSS model against the dependent variable Offer Value as defined by the fair value provided by the respondents in question 1 of the survey. This placement was an attempt to categorize independent variables based on their strength as a predictive factor. This analysis was performed on all respondents and a separate examination within each of the three treatment groups. None of the independent variables appeared to have significance.

Linear regression analysis

A linear regression analysis was performed on all the independent variables. The variables were placed in the SPSS model against the dependent variable Offer Value as defined by the fair value provided by the respondents in question 1 of the survey. This placement was an
attempt to categorize independent variables based on their strength as a predictive factor. This analysis was performed on all respondents and a separate examination within each of the three treatment groups.

Offer value

Offer value within all treatments

The independent variables were placed in the SPSS model against the dependent variable Offer Value to test the strength each independent variables as a predictive factor (see Tables 25 - 27 for test results).

Table 25. Model summary (all treatments)

<table>
<thead>
<tr>
<th>Model Summary</th>
<th>R Square</th>
<th>Adj R Square</th>
<th>Std. Err Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Treatments</td>
<td>0.120</td>
<td>0.052</td>
<td>9340.146</td>
</tr>
</tbody>
</table>

Table 26. The ANOVA (all treatments)

<table>
<thead>
<tr>
<th>ANOVA</th>
<th>df</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Treatments</td>
<td>13</td>
<td>1.758</td>
<td>0.540</td>
</tr>
</tbody>
</table>

Table 27. The observed coefficients with all independent variables (all treatments)

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Std. Coef Beta</th>
<th>T</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Worth Group</td>
<td>-0.190</td>
<td>-2.060</td>
<td>0.041</td>
</tr>
<tr>
<td>Live Near Line</td>
<td>-0.115</td>
<td>-1.323</td>
<td>0.188</td>
</tr>
<tr>
<td>Granted Easement</td>
<td>0.061</td>
<td>0.735</td>
<td>0.463</td>
</tr>
<tr>
<td>Number of Children</td>
<td>0.022</td>
<td>0.239</td>
<td>0.811</td>
</tr>
<tr>
<td>Youngest Age Group</td>
<td>-0.006</td>
<td>-0.055</td>
<td>0.956</td>
</tr>
<tr>
<td>Age of Oldest Child</td>
<td>-0.030</td>
<td>0.255</td>
<td>0.799</td>
</tr>
<tr>
<td>Gender</td>
<td>0.056</td>
<td>0.717</td>
<td>0.474</td>
</tr>
<tr>
<td>Home Owner</td>
<td>-0.040</td>
<td>-0.450</td>
<td>0.653</td>
</tr>
<tr>
<td>Marital Status</td>
<td>-0.050</td>
<td>-0.587</td>
<td>0.558</td>
</tr>
<tr>
<td>Age Range Respondent</td>
<td>0.238</td>
<td>2.413</td>
<td>0.017</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>-0.167</td>
<td>-2.208</td>
<td>0.029</td>
</tr>
<tr>
<td>Income Group</td>
<td>0.164</td>
<td>1.564</td>
<td>0.120</td>
</tr>
</tbody>
</table>
The linear regression of all independent variables generated an R square of 0.12. Only 12% of the variance in the Offer Value could be explained by all independent variables. The ANOVA of all treatments produced a p-value of 0.540. This significance far exceeds the target of 0.05 as required for a 95% confidence interval. This regression did not distinguish significantly predictive independent variables.

*Offer value within the control group*

The independent variables stated by the Control Group were placed in the SPSS model against the dependent variable Offer Value to test the strength each independent variable as a predictive factor (see Tables 28 - 30 for test results).

**Table 28.** The model summary for the control group

<table>
<thead>
<tr>
<th>Model Summary</th>
<th>R Square</th>
<th>Adj R Square</th>
<th>Std. Err Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Group</td>
<td>0.139</td>
<td>0.008</td>
<td>7645.081</td>
</tr>
</tbody>
</table>

**Table 29.** The ANOVA for the control group

<table>
<thead>
<tr>
<th>ANOVA</th>
<th>df</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Group</td>
<td>12.000</td>
<td>1.063</td>
<td>0.403</td>
</tr>
</tbody>
</table>

**Table 30.** The observed coefficients in the control group with all independent variables

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Std. Coef Beta</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Worth Group</td>
<td>0.188</td>
<td>1.316</td>
<td>0.192</td>
</tr>
<tr>
<td>Granted Easement</td>
<td>0.063</td>
<td>0.537</td>
<td>0.592</td>
</tr>
<tr>
<td>Number of Children</td>
<td>-0.133</td>
<td>-0.788</td>
<td>0.433</td>
</tr>
<tr>
<td>Youngest Age Group</td>
<td>-0.260</td>
<td>-1.383</td>
<td>0.171</td>
</tr>
<tr>
<td>Age of Oldest Child</td>
<td>0.068</td>
<td>0.298</td>
<td>0.766</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.060</td>
<td>-0.541</td>
<td>0.590</td>
</tr>
<tr>
<td>Home Owner</td>
<td>-0.195</td>
<td>-1.448</td>
<td>0.152</td>
</tr>
<tr>
<td>Numeric Your Home</td>
<td>0.094</td>
<td>0.802</td>
<td>0.425</td>
</tr>
<tr>
<td>Marital Status</td>
<td>-0.029</td>
<td>-0.237</td>
<td>0.813</td>
</tr>
<tr>
<td>Age Range Respondent</td>
<td>-0.100</td>
<td>-0.643</td>
<td>0.522</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>-0.001</td>
<td>-0.008</td>
<td>0.994</td>
</tr>
</tbody>
</table>
Table 30 (Continued)

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Std. Coef Beta</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income Group</td>
<td>-0.162</td>
<td>-1.148</td>
<td>0.255</td>
</tr>
</tbody>
</table>

The linear regression of all independent variables generated an R square of 0.139. Only 13.9% of the variance in the Offer Value could be explained by all independent variables in the control group. The ANOVA of the Control Group produced a p-value of 0.403. This significance far exceeds the target of 0.05 as required for a 95% confidence interval. None of the independent variables produced a p-value below 0.05. This regression does not distinguish significantly predictive independent variables.

*Offer value within the pipeline group*

The independent variables stated by the Pipeline Group were placed in the SPSS model against the dependent variable Offer Value to test the strength each independent variable as a predictive factor (see Tables 31-33 for test results).

**Table 31. The model summary for the pipeline group**

<table>
<thead>
<tr>
<th>Model Summary</th>
<th>R Square</th>
<th>Adj R Square</th>
<th>Std. Err Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline Group</td>
<td>0.318</td>
<td>0.164</td>
<td>8622.232</td>
</tr>
</tbody>
</table>

**Table 32. The ANOVA for the pipeline group**

<table>
<thead>
<tr>
<th>ANOVA</th>
<th>df</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline Group</td>
<td>16.000</td>
<td>2.065</td>
<td>0.200</td>
</tr>
</tbody>
</table>

**Table 33. The observed coefficients in the pipeline group with all independent variables**

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Std. Coef Beta</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Worth Group</td>
<td>-0.022</td>
<td>-0.182</td>
<td>0.856</td>
</tr>
<tr>
<td>Number of Children</td>
<td>-0.002</td>
<td>-0.014</td>
<td>0.989</td>
</tr>
<tr>
<td>Youngest Age Group</td>
<td>-0.231</td>
<td>-1.595</td>
<td>0.115</td>
</tr>
</tbody>
</table>
Table 33 (Continued)

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Std. Coef</th>
<th>Beta</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of Oldest Child</td>
<td>-0.069</td>
<td>-0.437</td>
<td>0.663</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-0.012</td>
<td>-0.114</td>
<td>0.909</td>
<td></td>
</tr>
<tr>
<td>Home Owner</td>
<td>-0.055</td>
<td>-0.496</td>
<td>0.621</td>
<td></td>
</tr>
<tr>
<td>Numeric Your Home</td>
<td>-0.230</td>
<td>-2.125</td>
<td>0.037</td>
<td></td>
</tr>
<tr>
<td>Marital Status</td>
<td>-0.046</td>
<td>-0.414</td>
<td>0.680</td>
<td></td>
</tr>
<tr>
<td>Age Range Respondent</td>
<td>0.326</td>
<td>2.107</td>
<td>0.038</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td>-0.021</td>
<td>-0.194</td>
<td>0.847</td>
<td></td>
</tr>
<tr>
<td>Income Group</td>
<td>0.057</td>
<td>0.408</td>
<td>0.684</td>
<td></td>
</tr>
<tr>
<td>Granted Easement</td>
<td>0.297</td>
<td>2.750</td>
<td>0.007</td>
<td></td>
</tr>
</tbody>
</table>

The linear regression of all independent variables generated an R square of 0.318. Only 31.8% of the variance in the Offer Value could be explained by all independent variables in the pipeline group. The ANOVA of the Pipeline Group produced a p-value of 0.200. This significance far exceeds the target of 0.05 as required for a 95% confidence interval. This regression does not distinguish significantly predictive independent variables.

**Offer value within the PIR group**

The independent variables stated by the PIR Group were placed in the SPSS model against the dependent variable Offer Value to test the strength each independent variable as a predictive factor (see Tables 34- 36 for test results).

**Table 34.** The model summary for the PIR group

<table>
<thead>
<tr>
<th>Model Summary</th>
<th>R Square</th>
<th>Adj R Square</th>
<th>Std. Err Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIR Group</td>
<td>0.096</td>
<td>-0.038</td>
<td>9952.305</td>
</tr>
</tbody>
</table>

**Table 35.** The ANOVA for the PIR group

<table>
<thead>
<tr>
<th>ANOVA</th>
<th>df</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIR Group</td>
<td>12.000</td>
<td>0.715</td>
<td>0.733</td>
</tr>
</tbody>
</table>
The observed coefficients in the PIR group with all independent variables

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Std. Coef</th>
<th>Beta</th>
<th>T</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Worth Group</td>
<td>-0.168</td>
<td>-1.154</td>
<td>0.252</td>
<td></td>
</tr>
<tr>
<td>Granted Easement</td>
<td>-0.034</td>
<td>-0.240</td>
<td>0.811</td>
<td></td>
</tr>
<tr>
<td>Number of Children</td>
<td>-0.105</td>
<td>-0.640</td>
<td>0.524</td>
<td></td>
</tr>
<tr>
<td>Youngest Age Group</td>
<td>-0.113</td>
<td>-0.654</td>
<td>0.515</td>
<td></td>
</tr>
<tr>
<td>Age of Oldest Child</td>
<td>-0.033</td>
<td>-0.288</td>
<td>0.774</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-0.042</td>
<td>-0.302</td>
<td>0.763</td>
<td></td>
</tr>
<tr>
<td>Home Owner</td>
<td>0.211</td>
<td>1.797</td>
<td>0.076</td>
<td></td>
</tr>
<tr>
<td>Numeric Your Home</td>
<td>-0.036</td>
<td>-0.267</td>
<td>0.790</td>
<td></td>
</tr>
<tr>
<td>Marital Status</td>
<td>0.211</td>
<td>1.561</td>
<td>0.122</td>
<td></td>
</tr>
<tr>
<td>Age Range Respondent</td>
<td>-0.081</td>
<td>-0.726</td>
<td>0.470</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td>0.164</td>
<td>1.010</td>
<td>0.315</td>
<td></td>
</tr>
<tr>
<td>Income Group</td>
<td>-0.075</td>
<td>-0.660</td>
<td>0.511</td>
<td></td>
</tr>
</tbody>
</table>

The linear regression of all independent variables generated an R square of 0.096. Only 9.6% of the variance in the Offer Value could be explained by all independent variables in the PIR group. The ANOVA of the PIR Group produced a p-value of 0.733. This significance far exceeds the target of 0.05 as required for a 95% confidence interval. This regression does not distinguish significantly predictive independent variables.

Notice within the pipeline group and the PIR group

This regression was performed by taking the responses from question 10 of the survey. Question 10 for Group Two (pipeline respondents) asked, “How does the notice that the home is located within 500 feet of a natural gas transmission line affect the fair price of this home?” Question 10 for Group Three (PIR respondents) asked, “How does the notice that the home is located in a potential impact radius of a natural gas transmission line affect the fair price of this home?” Group One (Control Group) was not asked this question as they were not subject to either notice treatment.
For the statistical analysis, the responses to this question were placed in two categories:

0 = Pipeline or PIR Increased Fair Value or had no effect on Fair Value

1 = Pipeline or PIR Decreased Fair Value

The independent variables stated by the Pipeline Group and the PIR Group were placed in the SPSS model against the dependent variable Notice to test the strength each independent variable as a predictive factor (see Tables 37-39 for test results).

Table 37. The model summary in the pipeline group and PIR group with all independent variables

<table>
<thead>
<tr>
<th>Model Summary</th>
<th>R Square</th>
<th>Adj R Square</th>
<th>Std. Err Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline and PIR Group</td>
<td>0.157</td>
<td>0.086</td>
<td>0.604</td>
</tr>
</tbody>
</table>

Table 38. The ANOVA in the pipeline group and PIR group with all independent variables

<table>
<thead>
<tr>
<th>ANOVA</th>
<th>df</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline and PIR Group</td>
<td>14.000</td>
<td>2.214</td>
<td>0.009</td>
</tr>
</tbody>
</table>

Table 39. The observed coefficients in the pipeline group and PIR group with all independent variables

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Std. Coef Beta</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Worth Group</td>
<td>-0.059</td>
<td>-0.650</td>
<td>0.516</td>
</tr>
<tr>
<td>Live Near Line</td>
<td>-0.122</td>
<td>-1.436</td>
<td>0.153</td>
</tr>
<tr>
<td>Granted Easement</td>
<td>0.297</td>
<td>3.635</td>
<td>0.000</td>
</tr>
<tr>
<td>Number of Children</td>
<td>0.019</td>
<td>0.192</td>
<td>0.848</td>
</tr>
<tr>
<td>Youngest Age Group</td>
<td>0.001</td>
<td>0.012</td>
<td>0.991</td>
</tr>
<tr>
<td>Age of Oldest Child</td>
<td>-0.148</td>
<td>-1.207</td>
<td>0.229</td>
</tr>
<tr>
<td>Gender</td>
<td>0.065</td>
<td>0.827</td>
<td>0.410</td>
</tr>
<tr>
<td>Home Owner</td>
<td>-0.005</td>
<td>-0.057</td>
<td>0.954</td>
</tr>
<tr>
<td>Numeric Your Home</td>
<td>-0.161</td>
<td>-1.077</td>
<td>0.283</td>
</tr>
<tr>
<td>Marital Status</td>
<td>0.056</td>
<td>0.668</td>
<td>0.505</td>
</tr>
<tr>
<td>Age Range Respondent</td>
<td>0.188</td>
<td>2.006</td>
<td>0.046</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>0.087</td>
<td>1.181</td>
<td>0.239</td>
</tr>
<tr>
<td>Income Group</td>
<td>0.065</td>
<td>0.636</td>
<td>0.526</td>
</tr>
<tr>
<td>Numeric Your Home</td>
<td>0.043</td>
<td>0.294</td>
<td>0.769</td>
</tr>
</tbody>
</table>
The linear regression of all independent variables generated an R square of 0.157. Only 15.7% of the variance in the dependent variable Notice could be explained by all independent variables in the pipeline and PIR group. The ANOVA of the pipeline and PIR treatments produced a p-value of 0.009. This significance is within the target of 0.05 as required for a 95% confidence interval. This regression does not distinguish significantly predictive independent variables.

**Analysis**

**Descriptive Statistics Analysis**

While the respondents are from the same area of the country, they each have a child age 18 or younger and state they have an interest in purchasing a home in the next two years; there are items that differ among the groups. Group One, the control group, is a little older than the other two groups with only 64.1% age 40 or lower. Group Two, the notice of pipeline group, has the highest male to female ratio with 59.1% male respondents. Group Three, the notice of PIR group, has the largest percentage with annual income below $20,000 per year (12.8%), the lowest percentage to have granted a lease or easement (3.2%), and the lowest percentage who could see themselves living in the subject home (58.5%). The demographics of the respondents across all groups closely represent the expected likely home purchaser in the City of Beavercreek, which has a white population of 87.8%, a median household income of $88,456, and a homeownership rate of 71.5% (U.S. Census Bureau, 2019B). The demographics are a good analog for the City of Green, which has a white population of 93.5% median household income of $70,600, and a homeownership rate of 74.3% (U.S. Census Bureau, 2019A).

The groups also state different fair value offer prices for the subject real estate. The mean value for the offer price stated by Group One respondents is $148,163. The mean value for
the offer price stated by Group Two respondents is $146,402. The mean value for the offer price stated by Group Three respondents is $145,435. The values show a slight decrease between Group One and Group Two (1.19%), between Group One and Group Three (1.84%), and between Group Two and Group Three (0.66%). This decrease appears to be in line with the hypotheses, but additional statistical analysis is required to see if these results are significant.

**Inferential Statistics Analysis**

*Hypothetical check and t-test analysis*

T-tests were used on the three hypotheses to search for a statistical difference in the means of the three groups.

**H1**: Notice that a single-family residential home is located near natural gas transmission pipeline impacts a potential purchaser’s perceived value. The t-test shows a significance of 0.170, which exceeds the 0.05 maximum requirement for a 95% confidence interval to show a difference in means. This number is too large to disprove the null hypothesis, that there is no statistically significant difference in the means of the two groups with a 95% confidence interval. H1 cannot be confirmed by this test, which is in line with the prior literature that states the proximity of a property to a natural gas transmission pipeline has minimal to no impact on the fair offer value of real estate.

**H2**: Notice that a single-family residential home is located within a Potential Impact Radius of a natural gas transmission pipeline impacts a potential purchaser’s perceived value. This hypothesis was a t-test of Group One (Control Group) and Group Three (PIR Group). The t-test shows a significance of 0.036, which is less than the 0.05 maximum requirement for a 95% confidence interval to show a difference in means. This number indicates there is less than a 3.6% chance that one could conclude there is no difference in the means of the two groups. With
a 95% confidence interval, H2 can be confirmed by this test. This new area of academic study may prove significant.

H3: Notice that a single-family residential home is located within a Potential Impact Radius of a natural gas transmission pipeline has a greater impact on a potential purchaser’s perceived value than notice that a single-family residential home is located near natural gas transmission pipeline. The t-test shows a significance of 0.498, which exceeds the 0.05 maximum requirement for a 95% confidence interval to show a difference in means. This number is too large to disprove the null hypothesis, that there is no difference in the means of the two groups with a 95% confidence interval. H3 cannot be confirmed by this test.

The series of t-tests show there is a significance in the difference between the stated fair value mean between Group One respondents, which was $148,163, and Group Three, which was $145,435. This test shows that the 1.8% decrease in mean value is statistically significant. According to the t-tests, notice that a single-family residential home is located within a Potential Impact Radius of a natural gas transmission pipeline line impacts a potential purchaser’s perceived value.

*Pearson’s chi-square test analysis*

Pearson chi-square tests were performed to test independence among the three groups. This test is used to make sure there is a legitimate independence found in the groups and the results were not simply by chance.

Upon finding significance to support H2, a Pearson chi-square test was performed to test the independence of Group Two (Pipeline Group) and Group Three (PIR Group). Question 10 was examined since it was a statement from the respondents regarding how they felt the treatment affected the value of the property. The Pearson chi-square for this test is 17.644; there
are 2 degrees of freedom and statistical significance as the p-value is less than .05 in that is was stated as .000. The chi-square test shows a significant relationship between the treatment (pipeline or PIR) and the reduction in the fair value stated. It also shows independence between the pipeline group and the PIR group.

The descriptive statistics show the pipeline respondents had 36 who responded “decrease” and 36 responded “no effect.” The PIR respondents had 67 who responded “decrease” and 21 responded “no effect.” This test supports the intuitive position that there is a difference between the two groups, which bolsters the position that the significance found in support of H2 and not in support of H1 is warranted. The two groups responded differently to their respective treatments.

Another set of crosstabs and Pearson chi-square tests was performed based on the responses to question 3, which asked, “Can you see yourself/family living in this home?” The responses were on a 7-point Likert scale where 7 was “absolutely,” 4 was “neutral,” and 1 was “definitely not.” Those who answered 5 or above were categorized as “CanSee” (Likert 5-7), and those who answered 4 or less were categorized “Cannot” (Likert 1-4). This variable is interesting to use as a dependent variable. This variable may have been a way to gauge the interest in the location, style, or price point of the property. These traits are those that may be deemed as ones found in an independent variable. However, as this question was asked after watching the respective videos, it also may show the propensity of respondents to “walk away” from an otherwise acceptable property due to the audible notice of the treatment. This response would be in keeping with the position of Albright (2011). In this series of tests, the later, dependent variable theory was followed.
The first test with CanSee and Cannot as dependent variables was conducted with Group One (control group) and Group Two (pipeline group). The Pearson chi-square for this test was 0.000; there was 1 degree of freedom, but a significance was not found as the p-value is much higher than .05, stated as 0.987. There does not appear to be a significant relationship between Group One (control group) and Group Two (pipeline group) and whether one can or cannot see themselves in the house. This test also fails to show independence between those who responded in the control group and those who responded to the pipeline treatment. This result is consistent with other findings outlined in the literature review that show proximity to a natural gas transmission pipeline does not affect property values.

The second test with CanSee and Cannot as dependent variables was conducted with Group One (control group) and Group Three (PIR group). The Pearson chi-square was 7.411; there was 1 degree of freedom and there is a significance in that the p-value is less than .05, stated as 0.006.

There appears to be a significant relationship between these treatment groups and whether one can or cannot see themselves in the house. While 77.2% of the control group can see themselves in the house, only 58.50% of the PIR group can see themselves in the house.

This test also shows independence between those who responded in the control group and those who responded to the PIR treatment. As stated earlier, this result may be a sign that the PIR respondents would “walk away” from an otherwise acceptable property upon notice that the residence is located within a PIR.

The third test with CanSee and Cannot as dependent variables was conducted with Group Two (pipeline group) and Group Three (PIR group). The Pearson chi-square was 7.303; there was 1 degree of freedom and there is a significance in that the p-value is less than .05, stated as
0.007. There appears to be a significant relationship between these treatment groups and whether one can or cannot see themselves in the house. While 77.3% of the pipeline group can see themselves in the house, only 58.50% of the PIR group can see themselves in the house.

This test also shows independence between those who responded in the pipeline treatment and those who responded to the PIR treatment. Again, this result may be a sign that the PIR respondents would “walk away” from an otherwise acceptable property upon notice that the residence is located within a PIR.

**Predictive Statistics Analysis**

*Discriminant statistical analysis*

A discriminant statistical analysis was performed on all independent variables placed in the SPSS model against the dependent variable of Offer Value, the fair value provided by the respondents in question 1 of the survey. This placement was an attempt to categorize independent variables based on their strength as a predictive factor. This analysis was performed on all respondents followed by a separate examination within each of the three treatment groups. None of the independent variables appeared to have significance on the group as a whole or within any of the three treatments.

This discriminant analysis was followed by attempts to find predictive independent variables through linear regression.

*Linear regression analysis*

Like the discriminant analysis, a linear regression analysis was performed on all the independent variables placed in the SPSS model against the dependent variable of Offer Value, the fair value provided by the respondents in question 1 of the survey. This placement was an attempt to categorize independent variables based on their strength as a predictive factor. This
analysis was performed on all respondents and a separate examination within each of the three groups.

First, a linear regression was performed on all treatments, labeled as “All Treatments” with the dependent variable of Offer Value. An additional regression analysis was not performed as all independent variables only generated an R square of 0.12. Only 12% of the variance in the Offer Value could be explained by all independent variables. The ANOVA of all treatments produced a p-value of 0.540. This significance far exceeds the target of 0.05 as required for a 95% confidence interval. This regression does not distinguish significantly predictive independent variables. No additional regression was performed on the full set of respondents, but regressions were performed on the individual groups as stated in the following paragraphs.

Second, a linear regression of the Control Group was performed with the dependent variable of Offer Value. All independent variables generated an R square of 0.139. Only 13.9% of the variance in the Offer Value could be explained by all independent variables in the control group. The ANOVA of the Control Group produced a p-value of 0.403. This significance far exceeds the target of 0.05 as required for a 95% confidence interval. None of the independent variables produced a p-value below 0.05. This regression does not distinguish significantly predictive independent variables. No additional regression was performed on this group.

Third, a linear regression of the Pipeline Group was performed with the dependent variable of Offer Value. All independent variables generated an R square of 0.318. Only 31.8% of the variance in the Offer Value could be explained by all independent variables in the pipeline group. The ANOVA of Pipeline Group produced a p-value of 0.200. This significance far exceeds the target of 0.05 as required for a 95% confidence interval. This regression does not
distinguish significantly predictive independent variables. Ethnicity appears to have significance within this group at 0.009, but with whites making up 87.2% of 94 respondents or 82 people, only 12 non-whites are included in this group, which is reflected in the standard coefficient beta of -0.312. No additional regression was performed on this group.

Fourth, a linear regression of the PIR Group was performed with the dependent variable of Offer Value. All independent variables generated an R square of 0.096. Only 9.6% of the variance in the Offer Value could be explained by all independent variables in the PIR group. The ANOVA of the PIR Group produced a p-value of 0.733. This significance far exceeds the target of 0.05 as required for a 95% confidence interval. This regression does not distinguish significantly predictive independent variables. No additional regression was performed on this group.

An additional linear regression model was performed to examine if there was a variable that could predict when a respondent would state that her respective treatment, either notice of pipeline or notice of PIR, decreased the fair offer value of the home within the Pipeline Group and the PIR Group. This binary response model was based with the Notice dependent variable. The dependent variable tested the independent variables of respondents who stated “reduced” against those who stated “increase” or “no effect.” The Control Group was not included in this test because an introduction of a natural gas transmission pipeline was not presented in the survey. All independent variables generated an R square of 0.157. Only 15.7% of the variance in the dependent variable Notice could be explained by all independent variables in the Pipeline Group and PIR Group. The ANOVA of the Pipeline Group and PIR Group produced a p-value of 0.009. This significance is within the target of 0.05 as required for a 95% confidence interval. This regression does not distinguish significantly predictive independent variables. The
“Granted Easement” variable showed significance at 0.000, but the number of people who granted easements within the Pipeline Group was 9.1% of 88 or 8 people, and within the PIR group, it was 3.2% of 94 or 3 people. That sample is too small to be a predictor within the groups.

After an analysis of the discriminant tests and linear regression tests, there does not appear to be an independent variable present in this study that has a statistically significant ability to predict the dependent value of Offer Value or the dependent variable of Notice.
CHAPTER FIVE:
CONCLUSION, LIMITATIONS, AND SUGGESTIONS FOR FUTURE WORK

Conclusion

This study intended to address the question, how would a purchase price be impacted if a seller provided buyers a notice that the residential property that has been listed for sale is located within a Potential Impact Radius (PIR) of a natural gas transmission line? Does the notice of the location affect the purchase value that a buyer is willing to offer for a residential property? Does the perceived risk associated with PIR affect the amount that a potential buyer would offer?

To address these questions, a Qualtrics survey was used that included a video tour of a residential property. Three treatments were included in the survey. A control group was presented a video tour without any residential disclosure notice. A second group was presented a video tour with an audible notice that the residence is located within 500 feet of a natural gas transmission line. A third group was presented a video tour with an audible notice that the residence is located within the potential impact radius (PIR) of a natural gas transmission line. Each respondent was asked to state a fair offer value for the residential property shown in their respective video.

As prior literature has stated, proximity to a natural gas transmission line provided minimal to no impact on the value of a residential property. This study does not contradict the prior literature.

However, there appears to be a statistical significance when a control group is compared to a treatment group providing notice that the residence is located within a PIR. The T-test,
which included these two groups, confirmed the difference in fair offer value mean of 1.8% was significant. The Pearson’s chi-square test distinguished the PIR group from the pipeline group. The Pearson’s chi-square tests also showed that the PIR group was less likely to see themselves as purchasers of the subject property. This result may be due to the type of house, location, or price point. However, this result also may be a sign that once this group was notified that a residence is located within a PIR, the respondents within that group experienced an increase in perceived risk associated with the residence and were less interested in the home.

There does not appear to be prior published academic research concerning the impact of the disclosure of a PIR to a potential residential property purchaser. This one audible line, with no other visual prompt, appears to have increased the perceived risk of the respondents in that treatment. Additional research should be performed in this area to see if this statistical significance can be duplicated, if additional cues can be added, if other models and methods can produce similar outcomes, or if a change in the types and locations of the houses affects the outcome.

**Limitations to this Research**

Several limitations can be found in this research. The self-imposed limitations screening criteria used to gain a sample with at least one child age 18 or younger, interested in purchasing a home within the next two years, residing in one of 16 counties in southwest Ohio could be removed in future research.

The use of the Qualtrics platform accounts for several limitations. Qualtrics provided respondents; therefore, the survey platform limits the sample to those who have been in contact with Qualtrics in the past. The respondents required internet access and the willingness to take a survey. A limitation discovered during the screening process for the Qualtrics survey was that
the respondents skew female. In this research, the allotment for females was filled in approximately two weeks and the allotment for males never fully filled. The respondents used indicated that they were interested in purchasing a home within the next two years, but the type of house and the location of the house may not have been like the house used in this study. The house was fictitious, only one style of house was used, one price point was used, the location of Beavercreek was random, and the values placed on the house were placed arbitrarily by the author. There is no indication as to whether this location is a “hot” or “cold” real estate market. The factors used to measure supply and demand were not tested in the study.

Limitations within this study’s methodology can be found as well. This research was limited to providing notice of a condition with one audible cue embedded within the two treatment groups. There were no visual cues within the video presentation of the treatment condition. No explanation was provided to respondents to define the term “Potential Impact Radius.” As this is a timed survey, the respondents were not able to consult with others regarding the proposed fair value of the subject property. The respondents were not screened to be real estate professionals; the assumption is they were not real estate professionals. It is also assumed that the fair value placed by the respondents was based on intuition reasoning than a scientific approach.

**Suggestions for Future Research**

Future research can build on what was found in this study. Studies could be performed using multiple properties of varying styles, locations, and price points. The choice of respondents could include those not interested in purchasing a property, from areas outside of southwest Ohio, and respondents without children. The use of a visual cue, such as a map or a written property disclosure, in a future study would be a logical next step. A study could
compare parties who were informed about what a “Potential Impact Radius” is against those who are simply told a property is located within a Potential Impact Radius. A change in methodology and model could be tried. Focus groups and real-life experiments could be performed. Last, future research could focus exclusively on Potential Impact Radii rather than include a study of a natural gas transmission pipeline proximity hypothesis.
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APPENDIX A:

LETTER

A Question of Disclosure

I am a member of AWWA Michigan Chapter 7 and have been actively involved in eminent domain matters during my 30 years of legal practice. My work in the eminent domain area has been primarily devoted to representing landowners affected by public improvement projects.

During the course of my legal practice, I have represented a number of landowners relating to projects involving gas transmission lines, as well as electrical transmission lines. With that background in mind, I read with great interest the article titled, “The Effect of Natural Gas Pipelines on Residential Value” published in the January/February 2011 edition of Right of Way Magazine. After reading it, I felt compelled to offer my comments from the perspective of landowners’ counsel.

The article indicated that, by use of a “paired-sales analysis,” the market value results were inconclusive. However, my personal experience is that the presence of natural gas pipelines does have a substantial impact on market value—specifically on properties that are on or adjacent to the line—since full and complete information about the implications of the gas transmission line are made known to the purchaser and known in the marketplace.

I bring this to your attention because I believe the authors of that article missed an absolute and fundamental point relative to measuring the impact of a gas pipeline. Namely, whether or not the purchaser (and/or the seller) truly had accurate and complete information as to the nature and extent of the gas transmission line and the potential damages associated with being in close proximity to a pipeline, including being in the area identified as the Potential Impact Radius (PIR).

According to Chapters 49 of the United States Code and under Section 49 of the Code of Federal Regulations, Section 192.903, a gas pipeline company must identify a PIR relating to gas transmission lines, and the size of the PIR is impacted by the minimum allowable operating pressure of the pipeline. In these regulations, the PIR is defined as “...the radius of the circle within which the potential failure of a pipeline could have significant impact on people or property.”

Certainly, pipeline companies are aware of the Federal Standards and Federal Regulations, but in my opinion, the general public is not aware of such items or the implications of these items. The existence of a PIR relative to a gas pipeline is rarely known to the public, unless appropriate investigation and due diligence is done by the purchaser.

A review of the right of way documentation available through public records usually reflects the nature and extent of a gas transmission line and rarely provides adequate information for a purchaser to truly appreciate the nature and extent of the gas transmission line which might be on, across or near their property. From what I have been, the documents typically include a simple language which merely assures the right to place a gas transmission line.

But even if there is no disclosure as to the size of the specific gas transmission line, the number of lines or other information, including the size and minimum pressure of the line which will allow a purchaser to engage in due diligence and discover relevant information, such as the PIR attributable to the gas line as mentioned in the regulatory codes.

I have represented a number of landowners whose owners have stated words to the effect, “I knew there was a gas pipeline easement on my property, but I never did not know that it contained a high-pressure gas line or the implications of the high-pressure gas line on my property.” In short, without disclosure and discussion, in my experience, property owners are usually advised or appreciate that any such parameters like a PIR even exists along a gas transmission route.

Even if the public records reflect the existence of a pipeline easement or a pipeline fee alignment area, true and accurate disclosure of the nature and extent of the underground activity, the implications of the pipeline, such as the PIR is not disclosed in public record documents. A prospective purchaser must fully investigate and review the information about the actual pipeline, and once information like the PIR comes to light, the purchaser’s interest in the property is substantially impacted and, often times, there is no interest at any price, once full information is known to a prospective purchaser.

The use of the paired-sales analysis makes the assumption of a knowing purchaser, but I believe this analysis is not meaningful unless it can be determined that the purchases had true, accurate and appropriate information concerning the nature and impact of the gas pipeline on, near or across their property. While I appreciate the article’s intent concerning the effects of gas pipelines, I believe that the author’s failure to confirm that the purchasers in any of the paired-sales transactions had full and complete knowledge of the details concerning the gas transmission line totally undermines the author’s work product and the conclusions set forth in the article. I do offer this point of view from the perspective of landowners’ counsel.

H. Earle Alford
Fraser Trebilcock Davis & Dunlap, P.C.
APPENDIX B:

LETTER FROM THE MAYOR

February 9, 2018

To the residents of Green,

City Council’s recent approval of the settlement negotiated with Nexus is a sad ending to a long tale of hard work, frustration and heartbreak for the City of Green. In the end, there was no re-route that we hoped for, no relief from federal energy regulators, and no support from our state environmental agencies. One by one, property owners sold their land to Nexus, until we stood behind just one property owner. Then the federal courts gave our easement rights to Nexus against our objections.

Perhaps our challenges and successes led to unrealistic expectations that our community would be spared from this menace. But our legal challenges did bear fruit and forced Nexus to desire a settlement that would put the delays behind them; to provide certainty in their construction sequence.

On January 11, the federal appeals court set an expedited date of January 31 for our oral arguments. Even then, we were focused on how to be successful in the court, and what that success would mean on this long road. We ignored a request by Nexus to continue settlement discussions that had been ordered by the federal court.

Within a week, our legal and environmental team offered this advice: now was the optimal time to see what Nexus would offer to reach a settlement. Nexus desired to have closure on the four court cases in state and federal courts; they wanted to have certainty. And for this they desired a settlement. The city needed this leverage to get what we needed to ensure the health, safety, and welfare of our community.

Our team of experts concluded that the success or failure of our challenge of the EPA’s approval would only result in a delay, and in no way would it change the route of the pipeline through the City of Green that the federal regulators had approved. Construction would begin almost immediately or it could be delayed by weeks, perhaps a couple months; but it would come.

Our City Council believes that the terms of the settlement that we negotiated would provide significant value to the community, understanding that our options to move the route have been thoroughly exhausted. Included in these benefits is our right to inspect construction activities 24/7, the right to enforce city ordinances including our Road Use Maintenance Agreements, zoning codes, and stormwater pollution protection measures; while maintaining our standing in Federal Court to ensure that all requirements of the settlement are upheld.

The settlement will give us 20 acres of land to be added onto Boettler and Southgate Parks, providing trail access from our residential neighborhoods on Thursby Road, Koons Road, and neighborhoods to the north.

And lastly, the settlement includes $7.5 million dollars to promote safety in our parks and public spaces, by allowing the city to replace athletic facilities that will soon be uncomfortably close to the pipeline.

This is not the outcome we had hoped for. I know this was not an easy decision for our council members, nor was it easy to be ordered to negotiate a settlement with Nexus on behalf of our community. However, our community will now begin the process of planning how best to use settlement funds to enhance the safety, health and welfare of our residents and make our community stronger.

Respectfully,

Gerard Neugebauer, Mayor
APPENDIX C:

NEXUS PIPELINE (Images Courtesy of Google Earth)
APPENDIX D:

STATE OF OHIO RESIDENTIAL PROPERTY DISCLOSURE FORM

STATE OF OHIO

DEPARTMENT OF COMMERCE

Purpose of Disclosure Form: This is a statement of certain conditions and information concerning the property actually known by the owner. An owner may or may not have lived at the property and unless the potential purchaser is informed in writing, the owner has no more information about the property than could be obtained by a careful inspection of the property by a potential purchaser. Unless the potential purchaser is otherwise informed, the owner has not conducted any inspection of generally inaccessible areas of the property. This form is required by Ohio Revised Code Section 5302.30.

THIS FORM IS NOT A WARRANTY OF ANY KIND BY THE OWNER OR BY ANY AGENT OR SUBAGENT REPRESENTING THE OWNER. THIS FORM IS NOT A SUBSTITUTE FOR ANY INSPECTIONS. POTENTIAL PURCHASERS ARE ENCOURAGED TO OBTAIN THEIR OWN PROFESSIONAL INSPECTION(S).

Owner’s Statement: The statements contained in this form are made by the owner and are not the statements of the owner’s agent or subagent. The statements contained in this form are provided by the owner only to potential purchasers in a transfer made by the owner. The statements are not for purchasers in any subsequent transfers. The information contained in this disclosure form does not limit the obligation of the owner to disclose an item of information that is required by any other statute or law to be disclosed in the transfer of residential real estate.

OWNER INSTRUCTIONS

Instructions to Owner: (1) Answer ALL questions. (2) Report known conditions affecting the property. (3) Attach additional pages with your signature if additional space is needed. (4) Complete this form yourself. (5) If some items do not apply to your property, write NA (not applicable). If the item to be disclosed is not within your actual knowledge, indicate Unknown.

Owner’s Initials ________ Date ________ Purchaser’s Initials ________ Date ________
Owner’s Initials ________ Date ________ Purchaser’s Initials ________ Date ________

(Page 1 of 5)
Pursuant to section 5302.30 of the Revised Code and rule 1301:5-6-10 of the Administrative Code.

TO BE COMPLETED BY OWNER (Please Print)
Property Address:

Owners Name(s):
Date: _______________________, 20_____

Owner is is not occupying the property. If owner is occupying the property, since what date: _______________________.
If owner is not occupying the property, since what date: _______________________.

THE FOLLOWING STATEMENTS OF THE OWNER ARE BASED ON OWNER'S ACTUAL KNOWLEDGE

A) WATER SUPPLY: The source of water supply to the property is (check appropriate boxes):

<table>
<thead>
<tr>
<th>Public Water Service</th>
<th>Holding Tank</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Water Service</td>
<td>Cistern</td>
<td>Other</td>
</tr>
<tr>
<td>Private Well</td>
<td>Spring</td>
<td></td>
</tr>
<tr>
<td>Shared Well</td>
<td>Pond</td>
<td></td>
</tr>
</tbody>
</table>

Do you know of any current leaks, backups or other material problems with the water supply system or quality of the water? Yes No
If “Yes”, please describe and indicate any repairs completed (but not longer than the past 5 years): ______________________.

Is the quality of water sufficient for your household use? (NOTE: water usage will vary from household to household) Yes No

B) SEWER SYSTEM: The nature of the sanitary sewer system servicing the property is (check appropriate boxes):

<table>
<thead>
<tr>
<th>Public Sewer</th>
<th>Private Sewer</th>
<th>Septic Tank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leach Field</td>
<td>Aeration Tank</td>
<td>Filtration Bed</td>
</tr>
<tr>
<td>Unknown</td>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

If not a public or private sewer, date of last inspection: ______________________ Inspected By: ______________________

Do you know of any previous or current leaks, backups or other material problems with the sewer system servicing the property? Yes No
If “Yes”, please describe and indicate any repairs completed (but not longer than the past 5 years): ______________________.

Information on the operation and maintenance of the type of sewage system serving the property is available from the department of health or the board of health of the health district in which the property is located.

C) ROOF: Do you know of any previous or current leaks or other material problems with the roof or rain gutters? Yes No
If “Yes”, please describe and indicate any repairs completed (but not longer than the past 5 years):

D) WATER INTRUSION: Do you know of any previous or current water leakage, water accumulation, excess moisture or other defects to the property, including but not limited to any area below grade, basement or crawl space? Yes No
If “Yes”, please describe and indicate any repairs completed:

Owner’s Initials ________ Date ________ Purchaser’s Initials ________ Date ________
Owner’s Initials ________ Date ________ Purchaser’s Initials ________ Date ________

(Page 2 of 5)
Property Address

Do you know of any water or moisture related damage to floors, walls or ceilings as a result of flooding; moisture seepage; moisture condensation; ice damming; sewer overflow/backup; or leaking pipes, plumbing fixtures, or appliances? Yes  No

If “Yes”, please describe and indicate any repairs completed: __________________________________________

Have you ever had the property inspected for mold by a qualified inspector? Yes  No

If “Yes”, please describe and indicate whether you have an inspection report and any remediation undertaken: ____________________________

Purchaser is advised that every home contains mold. Some people are more sensitive to mold than others. If concerned about this issue, purchaser is encouraged to have a mold inspection done by a qualified inspector.

E) STRUCTURAL COMPONENTS (FOUNDATION, BASEMENT/CRAWL SPACE, FLOORS, INTERIOR AND EXTERIOR WALLS): Do you know of any previous or current movement, shifting, deterioration, material cracks/settling (other than visible minor cracks or blemishes) or other material problems with the foundation, basement/crawl space, floors, or interior/exterior walls? Yes  No  If “Yes”, please describe and indicate any repairs, alterations or modifications to control the cause or effect of any problem identified (but not longer than the past 5 years): ____________________________

Do you know of any previous or current fire or smoke damage to the property? Yes  No

If “Yes”, please describe and indicate any repairs completed: __________________________________________

F) WOOD DESTROYING INSECTS/TERMITES: Do you know of any previous/current presence of any wood destroying insects/termites in or on the property or any existing damage to the property caused by wood destroying insects/termites? Yes  No  If “Yes”, please describe and indicate any inspection or treatment (but not longer than the past 5 years): ____________________________

G) MECHANICAL SYSTEMS: Do you know of any previous or current problems or defects with the following existing mechanical systems? If your property does not have the mechanical system, mark N/A (Not Applicable).

YES  NO  N/A  YES  NO  N/A
1) Electrical  8) Water softener
2) Plumbing (pipes)  a. Is water softener leased?
3) Central heating  9) Security System
4) Central Air conditioning  a. Is security system leased?
5) Sump pump  10) Central vacuum
6) Fireplace/chimney  11) Built in appliances
7) Lawn sprinkler  12) Other mechanical systems

If the answer to any of the above questions is “Yes”, please describe and indicate any repairs to the mechanical system (but not longer than the past 5 years):

H) PRESENCE OF HAZARDOUS MATERIALS: Do you know of the previous or current presence of any of the below identified hazardous materials on the property?

YES  NO  Unknown
1) Lead-Based Paint
2) Asbestos
3) Urea-Formaldehyde Foam Insulation
4) Radon Gas  a. If “Yes”, indicate level of gas if known __________________
5) Other toxic or hazardous substances

If the answer to any of the above questions is “Yes”, please describe and indicate any repairs, remediation or mitigation to the property: ____________________________

Owner’s Initials ________  Date ________  Purchaser’s Initials ________  Date ________

(Part of the page 3 of 5)
I) UNDERGROUND STORAGE TANKS/WELLS: Do you know of any underground storage tanks (existing or removed), oil or natural gas wells (plugged or unplugged), or abandoned water wells on the property?  Yes  No
If “Yes”, please describe:

Do you know of any oil, gas, or other mineral right leases on the property?  Yes  No

Purchaser should exercise whatever due diligence purchaser deems necessary with respect to oil, gas, and other mineral rights. Information may be obtained from records contained within the recorder’s office in the county where the property is located.

J) FLOOD PLAIN/LAKE ERIE COASTAL EROSION AREA:  Yes  No. Unknown
Is the property located in a designated floodplain?
Is the property or any portion of the property included in a Lake Erie Coastal Erosion Area?

K) DRAINAGE/EROSION:  Do you know of any previous or current flooding, drainage, settling or grading or erosion problems affecting the property?  Yes  No
If “Yes”, please describe and indicate any repairs, modifications or alterations to the property or other attempts to control any problems (but not longer than the past 5 years):

L) ZONING/CODE VIOLATIONS/ASSESSMENTS/HOMEOWNERS’ ASSOCIATION:  Do you know of any violations of building or housing codes, zoning ordinances affecting the property or any nonconforming uses of the property?  Yes  No
If “Yes”, please describe:

Is the structure on the property designated by any governmental authority as a historic building or as being located in an historic district? (NOTE: such designation may limit changes or improvements that may be made to the property).  Yes  No
If “Yes”, please describe:

Do you know of any recent or proposed assessments, fees or abatements, which could affect the property?  Yes  No
If “Yes”, please describe:

List any assessments paid in full (date/amount)
List any current assessments:  monthly fee  Length of payment (years  months)

Do you know of any recent or proposed rules or regulations of, or the payment of any fees or charges associated with this property, including but not limited to a Community Association, SID, CID, LID, etc.  Yes  No
If “Yes”, please describe (amount)

M) BOUNDARY LINES/ENCROACHMENTS/SHARED DRIVEWAY/PARTY WALLS:  Do you know of any of the following conditions affecting the property?  Yes  No  Yes  No
1) Boundary Agreement  4) Shared Driveway
2) Boundary Dispute  5) Party Walls
3) Recent Boundary Change  6) Encroachments From or on Adjacent Property
If the answer to any of the above questions is “Yes”, please describe:

N) OTHER KNOWN MATERIAL DEFECTS:  The following are other known material defects in or on the property:

For purposes of this section, material defects would include any non-observable physical condition existing on the property that could be dangerous to anyone occupying the property or any non-observable physical condition that could inhibit a person’s use of the property.

Owner’s Initials ________  Date ________  Purchaser’s Initials ________  Date ________
Owner’s Initials ________  Date ________  Purchaser’s Initials ________  Date ________

(Page 4 of 5)
CERTIFICATION OF OWNER

Owner certifies that the statements contained in this form are made in good faith and based on his/her actual knowledge as of the date signed by the Owner. Owner is advised that the information contained in this disclosure form does not limit the obligation of the owner to disclose an item of information that is required by any other statute or law or that may exist to preclude fraud, either by misrepresentation, concealment or nondisclosure in a transaction involving the transfer of residential real estate.

OWNER: ___________________________ DATE: ___________________________

OWNER: ___________________________ DATE: ___________________________

RECEIPT AND ACKNOWLEDGEMENT OF POTENTIAL PURCHASERS

Potential purchasers are advised that the owner has no obligation to update this form but may do so according to Revised Code Section 5302.30(G). Pursuant to Ohio Revised Code Section 5302.30(K), if this form is not provided to you prior to the time you enter into a purchase contract for the property, you may rescind the purchase contract by delivering a signed and dated document of rescission to Owner or Owner’s agent, provided the document of rescission is delivered prior to all three of the following dates: 1) the date of closing; 2) 30 days after the Owner accepted your offer; and 3) within 3 business days following your receipt or your agent’s receipt of this form or an amendment of this form.

Owner makes no representations with respect to any offsite conditions. Purchaser should exercise whatever due diligence purchaser deems necessary with respect to offsite issues that may affect purchaser’s decision to purchase the property.

Purchaser should exercise whatever due diligence purchaser deems necessary with respect to Ohio’s Sex Offender Registration and Notification Law (commonly referred to as “Megan’s Law”). This law requires the local Sheriff to provide written notice to neighbors if a sex offender resides or intends to reside in the area. The notice provided by the Sheriff is a public record and is open to inspection under Ohio’s Public Records Law. If concerned about this issue, purchaser assumes responsibility to obtain information from the Sheriff’s office regarding the notices they have provided pursuant to Megan’s Law.

Purchaser should exercise whatever due diligence purchaser deems necessary with respect to abandoned underground mines. If concerned about this issue, purchaser assumes responsibility to obtain information from the Ohio Department of Natural Resources. The Department maintains an online map of known abandoned underground mines on their website at www.dnr.state.oh.us.

I/WE ACKNOWLEDGE RECEIPT OF A COPY OF THIS DISCLOSURE FORM AND UNDERSTAND THAT THE STATEMENTS ARE MADE BASED ON THE OWNERS ACTUAL KNOWLEDGE AS OF THE DATE SIGNED BY THE OWNER.

My/Our Signature below does not constitute approval of any disclosed condition as represented herein by the owner.

PURCHASER: ___________________________ DATE: ___________________________

PURCHASER: ___________________________ DATE: ___________________________

(Page 5 of 5)
APPENDIX E:

VIRTUAL TOUR VOICE OVER SCRIPT

(To be played while images of the home are being shown to the participant)

Welcome to this three-bedroom, two and half bath, updated and move-in ready brick ranch in Beavercreek, Ohio.

This home has a remodeled kitchen with new white wooden cabinets, granite countertops, new stainless-steel appliances, vinyl tile floors, and a dinette with slider that opens to a convenient deck;

The large living area is highlighted by a wood-burning fieldstone fireplace;

Freshly refinished hardwood floors can be found throughout the living room, hall and bedrooms;

An updated main bath includes a tub with shower surround, newly installed vanity and a storage closet.

The master bedroom has a separate attached Daylight ½ bath;

Abundant storage space can be found in the hall and the bedroom closets;

This home also features a freshly painted full basement with an extra room including closet, perfect for a home office.

The basement also features an additional recreation room, a fully tiled bathroom with shower, and a laundry area with storage for seasonal items;

This home has central air conditioning and gas heat, a newer roof, and a recently restored chimney.
A double width concrete driveway leads to a tiled 2 car garage. This property sits on 4/10 of an acre in Beavercreek, Ohio. (INSERT THAT VARIES OVER THE THREE GROUPS)

(CONTROL = NO INSERT)

(OR TREATMENT 1)

The residential property disclosure states that this home is located within 500 feet of a natural gas transmission line.

(OR TREATMENT 2)

The residential property disclosure states that this home is located in the potential impact radius of a natural gas transmission line.

(CONTINUE FOR ALL THREE GROUPS)

Similar houses in and around Beavercreek have sold for $139,000, $145,000, $157,000 and $162,000.

The realtor has set the list price on this property at $155,000.

(FINISH)

Remember the following number. The answer to the first question is the number FOUR.
APPENDIX F:
DATA COLLECTION INSTRUMENT

We are conducting a study of the residential real estate market and would like you to participate by answering the following questions. All responses will remain ANONYMOUS and there are no right or wrong answers, but please take your time and answer each question as honestly and accurately as possible.

The survey should take between 7-10 minutes to complete.

We will begin by providing you with a brief tour of a home located in Beavercreek, Ohio. Be sure to have your computer SPEAKERS ON as you will be given a security code at some point during the video that you must enter correctly to assure proper communication of this presentation.

Please click on the link below to watch a brief home tour (up to 2 minutes and 15 seconds), and then continue through the survey.

Be sure to have your computer SPEAKERS ON as you will be given an audible security code at some point during the video. This code will be the answer to the first question so please write it down or remember it.

IF YOU DID NOT HEAR THE NUMBER PROVIDED IN THE VIDEO, CHECK YOUR SPEAKER VOLUME AND REPLAY THE VIDEO.

SCREENING QUESTIONS

1. We care about the quality of our survey data and hope to receive the most accurate measures of your opinions, so it is important to us that you thoughtfully provide your best answer to each
question in the survey.

Do you commit to providing your thoughtful and honest answers to the questions in this survey?

_ I will provide my best answers
_ I will not provide my best answers
_ I can’t promise either way

(Only the first answer will be accepted, others were sent to the “thank you” screen and their survey was ended.)

2. In which state do you currently reside?

(Pulldown of states. Only “Ohio” is acceptable as an answer. Those who answer with another state were sent to the “thank you” screen and their survey was ended.)

3. Which county in Ohio do you live in?

Pulldown includes: Adams, Brown, Butler, Clermont, Clinton, Fayette, Greene, Highland, Montgomery, Pickaway, Pike, Preble, Ross, Scioto, Warren and Other

(Those who answer “Other” were sent to the “thank you” screen and their survey was ended.)

4. How likely are you to purchase a home in the next 2 years?

<table>
<thead>
<tr>
<th>Likely home buyer</th>
<th>Extremely unlikely</th>
<th>Moderately unlikely</th>
<th>Slightly unlikely</th>
<th>Neither likely nor unlikely</th>
<th>Slightly likely</th>
<th>Moderately likely</th>
<th>Extremely likely</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

(Those who answered Extremely unlikely, Moderately unlikely and Slightly unlikely were sent to the “thank you” screen and their survey was ended.)

5. What is the age of your youngest child? (Please enter a number below)
(Those who answer with a number greater than 18 were sent to the “thank you” screen and their survey was ended.)

What is your gender?

_________ Male
_________ Female

(This question was used to allow for equal allocation of male and female respondents for each treatment. Each of the three pools were to receive 50 males and 50 females for a total of 150 of each gender and 300 total respondents.)

VIDEO PRESENTATION

Click on the video for a virtual home tour. Please turn your SPEAKERS ON with an appropriate volume to hear the description of the property. Remember the number provided in the virtual tour which will be the answer to the first question.

(Insert of the Video)

(This video is either the control or one of the two treatments.)

(The audio component is the scripted)

(The answer to the first question is presented audibly to ensure that the audio portion of the video was received by the respondent.)

(The answer to the first question is the number 4 is stated with the video audibly.)

This is an audio test. During the video tour of the house, you were provided with a number that is the answer to this first question. What was the number that you were provided?

_________ 1
_________ 2
_________ 3
_________ 4
_________ 5
(The answer to the first question was the number 4. Those who answered 1, 2, 3, or 5 were sent to the “thank you” screen and their survey was ended.)

SURVEY QUESTIONS

1. Similar houses in and around Beavercreek have sold for $139,000, $145,000, $157,000 and $162,000. The realtor has set the list price on this property at $155,000. What is a fair price for this home?
   $ ________________

2. Are you currently a homeowner? Yes or No

3. Can you see yourself/family living in this home?

<table>
<thead>
<tr>
<th>No, not at all</th>
<th>Probably Not</th>
<th>Maybe Not</th>
<th>Neutral</th>
<th>Maybe</th>
<th>Probably</th>
<th>Yes, Absolutely</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

4. Current Marital Status: Married or Single

5. What is your Age?
   ____ 21-30
   ____ 31-40
   ____ 41-50
   ____ 51-60
   ____ 61 or higher

6. How many children do you have? ______

7. What is the age of your oldest child? ______

8. Ethnicity:
For Participants that viewed Video 1:

9. What is your annual income?

[ ] Under $20,000
[ ] $20,001 – $40,000
[ ] $40,001 – $60,000
[ ] $60,001 – $80,000
[ ] $80,001 – $100,000
[ ] $100,001 – $120,000
[ ] Over $120,000

10. What is your total Net Worth? Net Worth is defined as total assets (stocks, bonds, price of your home, retirement accounts, etc.) minus total liabilities (outstanding mortgage balance, credit card debt, student loans, auto loans, etc.)

[ ] Less than -$200,001
[ ] -$200,000 to $0
[ ] $1 to $200,000
[ ] $200,001 to $400,000
[ ] $400,001 to $600,000
[ ] $600,001 to $800,000
[ ] $800,001 to $1,000,000
[ ] Over $1,000,000

11. Have you ever granted an oil and gas lease or a pipeline easement? Yes or No
Then send to “Thank You” screen and end the survey.

For Participants that viewed Video 2:

9. During the virtual tour, did you hear the narrator mention that the home is located within 500 feet of a natural gas transmission line? Yes or No

10. How does the notice that the home is located within 500 feet of a natural gas transmission line affect the fair price of this home?

___________ It increases the fair price of the home

___________ It has no effect on the fair price of the home

___________ It decreases the fair price of the home

Alternatives depending on the answer to Question 10:

If no effect on the fair price, advance directly to question 12

If it increases the fair price:

How much does the notice of that the house is located within 500 feet of natural gas transmission line increase the fair price for this home? $_

If it decreases the fair price:

11. How much does the notice of that the house is located within 500 feet of natural gas transmission line increase the fair price for this home? $_

12. What is your annual income?

___________ Under $20,000

___________ $20,001 – $40,000

___________ $40,001 – $60,000

___________ $60,001 – $80,000

___________ $80,001 – $100,000
13. What is your total Net Worth? Net Worth is defined as total assets (stocks, bonds, price of your home, retirement accounts, etc.) minus total liabilities (outstanding mortgage balance, credit card debt, student loans, auto loans, etc.)

<table>
<thead>
<tr>
<th>Net Worth Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>$100,001 - $120,000</td>
</tr>
<tr>
<td>Over $120,000</td>
</tr>
</tbody>
</table>

14. Have you or anyone you know lived near a gas transmission pipeline like described in this survey? **Yes or No**

15. Have you ever granted an oil and gas lease or a pipeline easement? **Yes or No**

*Then send to “Thank You” screen and end the survey.*

*Participants that viewed Video 3:*

9. During the virtual tour, did you hear the narrator mention that the home is located in a potential impact radius of a natural gas transmission line? **Yes or No**

10. How does the notice that the home is located in a potential impact radius of a natural gas transmission line affect the fair price of this home?

<table>
<thead>
<tr>
<th>Impact on Fair Price of the Home</th>
</tr>
</thead>
<tbody>
<tr>
<td>It increases the fair price of the home</td>
</tr>
<tr>
<td>It has no effect on the fair price of the home</td>
</tr>
</tbody>
</table>
It decreases the fair price of the home

Alternatives depending on the answer to Question 10:

If no effect on the fair price, advance directly to question 12

If it increases the fair price:

11. How much does the notice of that the house is located in a potential impact radius of a natural gas transmission line increase the fair price for this home? $___

If it decreases the fair price:

11. How much does the notice of that the house is located in a potential impact radius of a natural gas transmission line increase the fair price for this home? $___

12. What is your annual income?

________ Under $20,000
________ $20,001 – $40,000
________ $40,001 – $60,000
________ $60,001 – $80,000
________ $80,001 – $100,000
________ $100,001 – $120,000
________ Over $120,000

13. What is your total Net Worth? Net Worth is defined as total assets (stocks, bonds, price of your home, retirement accounts, etc.) minus total liabilities (outstanding mortgage balance, credit card debt, student loans, auto loans, etc.)

________ Less than -$200,001
________ -$200,000 to $0
________ $1 to $200,000
________ $200,001 to $400,000
________ $400,001 to $600,000
________ $600,001 to $800,000
$800,001 to $1,000,000
Over $1,000,000

14. Have you or anyone you know lived near a gas transmission pipeline like described in this survey? Yes or No

15. Have you ever granted an oil and gas lease or a pipeline easement? Yes or No

Then send to “Thank You” screen and end the survey.

Conclusion

For all Respondents:

The survey will end with a “Thank You for Participating Screen”
APPENDIX G:

CONCEPTS AND DEFINITIONS

Easement – Authorization granted from a landowner to another person or property to use a designated portion of a real property.

Federal Energy Regulatory Commission (FERC) – A commission within the US Department of Energy.

High Consequence Area (HCA) - Established by the PHMSA, a location that is specially defined in pipeline safety regulations as an area where pipeline releases could have greater consequences to health and safety or the environment. For natural gas pipelines, HCAs include high population areas, other population areas, commercially navigable waterways and areas unusually sensitive to environmental damage. Regulations require a pipeline operator to take specific steps to ensure the integrity of a pipeline for which a release could affect an HCA and, thereby, the protection of the HCA. (US Department of Transportation, Pipeline and Hazardous Material Safety Administration, n.d.)

Natural Gas Transmission Line - Larger pipelines ranging from 6-48 inches in diameter, that transport gas long distances at high pressures between 200-1500 pounds per square inch (psi). These lines are much larger than distribution pipelines are the network of mains and service lines that move natural gas at relatively low pressures to individual homes and businesses. (Pennsylvania Energy Infrastructure Alliance, 2017)
**Partial Taking** – A court order granted through a condemnation process that grants only a portion of a property to the condemning party with the remainder staying with the condemned landowner.

**Perceived Risk** - The risk perception of laypersons such as homebuyers is primarily based on emotions or intuition rather than a sophisticated analysis of actual risks as conducted by experts. (Slovic, 1987)

**Pipeline and Hazardous Material Safety Administration (PHMSA)** - An agency within the US Department of Transportation.

**Potential Impact Radius (PIR)** - Established by the PHMSA, as found at 49 CFR §192.903 (Subpart O) - the radius of a circle within which the potential failure of a pipeline could have significant impact on people or property. PIR is determined by the formula \( r = 0.69 \times \sqrt{p \times (d)^2} \), where \( r \) is the radius of a circular area in feet surrounding the point of failure, \( p \) is the maximum allowable operating pressure (MAOP) in the pipeline segment in pounds per square inch and \( d \) is the nominal diameter of the pipeline in inches. (49 CFR §192.903 (Subpart O))

**Proximity** – The distance from a natural gas transmission pipeline. In this case, proximity will be measured at a distance less than the Potential Impact Radius

- Regulation of natural gas transportation in interstate commerce.
- Regulation of pipeline and storage facility construction and abandonment.
- Regulation of the transportation of natural gas as authorized by the Natural Gas Policy Act and the Outer Continental Shelf Lands Act.

**Right-of-way** – An easement that allows another person or party to enter or cross a stated section of land.
Taking – The transferring of land from a private owner to another through a court sanctioned condemnation process for a public use. This condemnation, also called an eminent domain proceeding, is authorized in the Fifth Amendment to the Constitution that states "private property [shall not] be taken for public use, without just compensation.” (U. S. Constitution Amendment V)

*Defined Valuation Methods:*

Real estate valuation methods can be categorized by whether actual sales data is used to compare values or if a theoretical model is used to predict value.

**Actual Sales Data Used for Valuation**

- **Comparable Sales Method** – This is a model commonly used by real estate appraisers for property sales and financial transactions. This is the use of past sales for a given period, often limited to within 6 months, within a given distance range from a subject property, with similar features as the subject property.

- **Paired-Sales Method** – A method of valuation that compares the sale of the same or similar property over time. These are longitudinal studies that require time in excess of what is necessary to analyze a change in property value prior to the placing of the pipeline into the ground. This model is similar to a comparable sales model, but a much longer time period is required to have actual sales of the same or similar properties.

**Theoretical Model Used for Valuation**

- **Behavioral Real Estate** – Similar to the concept of utility maximization in economics. The difference is that in economics, utility is often defined as a person maximizing an expected level of wealth. While behaviorists agree that money is a strong motivator of underlying behavior, they believe additional factors should be considered. For example, if people care about
life-style, free time with family, or fitting into a social network of friends, models that attempt to explain their choices should incorporate these considerations. Any model that does not incorporate these factors is subject to specification error. (Seiler, 2014b)

**Contingent Valuation Method** – This is the use of surveys in the real estate context to understand buyer behavior.

**Hedonic Regression Method** – A method modeling that is commonly used by the government in assessing the value of properties for tax collection. This is the use of actual sales information of several houses within an area that is attributed to individual characteristics of a residential property such as lot size, number of bedrooms, number of bathrooms, square footage, school district, and other factors to establish the project a value on a subject property.
APPENDIX H:

STATUES CITED

49 CFR §192.5
49 CFR §192.903 (Subpart O)
49 CFR §192.903 (Subpart O)
49 CFR §192.903 (Subpart O)
ORC §5301.47
ORC §163.021(A)
U. S. Constitution Amendment V.
APPENDIX I:

CASES/ORDERS CITED


*Grieg v. Wallick*, 2012 Ohio 77.


Order Issuing Certificates and Granting Abandonment, *NEXUS Gas Transmission, LLC*, 160 FERC ¶61,022.