Robert A. Simons, PhD

The Effect of Pipeline Ruptures on Noncontaminated Residential Easement-Holding Property in Fairfax County

Petroleum pipelines cross the nation transporting petroleum products to refineries and end users. Unfortunately, sections of these pipelines at times have ruptured, sometimes spectacularly, releasing petroleum into the environment. Even if a property is not directly affected by petroleum contamination, the expectation that another leak may occur can reduce property values of other easement holders along the pipeline. This article uses multiple regression analysis of the housing markets in Fairfax County, Virginia, to address the effect these ruptures have on residential property values elsewhere along the pipeline right-of-way.

Petroleum pipelines crisscross the United States, transporting natural gas and crude oil with partly and fully refined petroleum products from seaports and domestic oil production areas to refineries or pipeline and marketing terminals. The goods typically are downloaded into trucks for trips to gasoline stations. According to the Federal Department of Transportation's Office of Pipeline Safety (OPS), there were about 2,000 natural gas firms and 300 companies operating petroleum distribution pipelines in 1997, with over 2 million miles of moderate-to-large (defined as having a diameter of 8 inches–40 inches) pipelines in service.[1] Unfortunately, a substantial portion of the pipelines transporting liquid products were built rapidly around World War II. As a result, some pipeline segments have experienced chronic weakness in line integrity, resulting in pipeline ruptures releasing petroleum into the environment. Sometimes abrupt leaks can be catastrophic, sending flammable petroleum products skyward in a plume, requiring evacuation, and causing long-term damage to aquatic ecosystems that may extend several miles away. Even if a property is not directly affected by petroleum contamination, the expectation that another leak might occur could potentially reduce the value of other properties encumbered by pipeline easements (e.g., holding an easement) along the pipeline right-of-way. Quantification of this property value reduction is the main focus of this article.

One of the largest pipeline companies in the United States, both in terms of product transported and length of pipeline, is the Colonial Pipeline Company. The pipeline

Robert A. Simons, PhD, is an associate professor of real estate and urban planning at the Levin College of Urban Affairs, Cleveland State University, Ohio. He received his PhD from the University of North Carolina at Chapel Hill. His consulting interests include environmental damages, brownfields redevelopment, housing policy, and inner-city retail niche markets. Contact: (216) 687-5258. roby@wolf.csuohio.edu.

runs more than 5,300 miles from the vicinity of Houston, Texas, to suburban New Jersey, right outside New York City. Colonial also has one of the highest accident rates in the hazardous liquid pipeline industry, having reported 194 accidents to the OPS between 1968 and 1997.[2] Many of these releases have been concentrated in Virginia and South Carolina. The largest rupture occurred in Simpsonville, South Carolina, in 1996, where 22,700 barrels (about 1 million gallons) were released.[3] Reston (Fairfax County), Virginia, was the site of a pipeline leak of approximately 9,700 barrels (about 430,000 gallons) in March 1993, the fifth largest Colonial pipeline rupture since 1990. There was also an earlier, smaller leak in nearby Centreville in 1987. This pipeline corridor in Fairfax County was selected for further study.

Selection of Fairfax County as the Study Area

Fairfax County was selected over other potential study areas for a number of reasons. First, there was a substantial rupture in the county. Because this rupture was not the largest one (less than half the size of the Simpsonville rupture), real estate effects generated by the event could potentially be generalized to other situations. Second, the main event occurred several years ago; any effects could be traced over time. Third, the event was known to be publicized, so the real estate markets would have knowledge of it. The Reston event was covered in *The Washington Post*—at least 20 articles were written about the rupture and subsequent cleanup within a year. Finally, the higher density of the market and professional nature of its public offices indicated a high likelihood that both data and a sufficient number of sales would be available.

Nature of the 1993 Colonial Pipeline Rupture

The rupture of the Colonial Pipeline in Reston occurred on the grounds of the Reston Hospital Center. It was a surface spill, with no evidence of ongoing groundwater contamination. The petroleum then ran down Sugarland Run Creek, away from the pipeline corridor, eventually ending up in the Potomac River several miles away. Very few properties along the pipeline right-of-way were directly contaminated by the rupture, but a number of mostly residential downstream properties along the creek were impacted as the petroleum passed by their homes, some of which had to be evacuated. After the rupture, Colonial conducted a systematic series of digs (testing excavations) along the easement. Many of these digs occurred later in 1993, but some were conducted over the next several years. Overall, an excess of 100 digs were performed.

RELEVANT LITERATURE

The literature on environmental hazards clearly indicates that a negative proximity influence on residential property may be expected where petroleum contamination has been discovered. Barton Smith considered the effect of the 1994 flood and ensuing release from the Colonial Pipeline in Harris County, Texas. He concluded that the net effect of the release was associated with a 10.2% reduction in value for the affected residential subdivision.[4] The author, along with William Bowen and Arthur Sementelli found a loss of 17% in the case of close proximity (within 300 feet) to leaking underground storage tanks (LUST) sites where the site still had tanks in place.[5] Because the same study also showed no significant negative effect for residential sales close to LUSTs associated with past events but with the USTs removed, part of this price reduction may represent market concerns about a possible recurrence at the same site. This issue is germane to the problem at hand. Smaller but substantial reductions to residential property values averaging 5%–8% within a few hundred feet of high-voltage overhead transmission lines have been documented by Peter Colwell, and William Kinnard and Sue Ann Dickey, among others.[6] This negative ef-

---

2. The U.S. Department of Transportation, Office of Pipeline Safety (OPS) 1996 Colonial Pipeline Task Force. Final Report, January 10, 1997, page i.

3. Ibid., appendix B.

4. Barton Smith, The Estimation of Property Values Losses in White Lake Area of Harris County, Texas. Report, November 1996.

5. Robert A. Simons, William Bowen, and Arthur Sementelli, "The Effect of Underground Storage Tanks on Residential Property Values in Cuyahoga County, Ohio," *Journal of Real Estate Research*, v. 14, no. 1/2 (1997): 29–42.

6. Peter Colwell, "Power Lines and Land Value," *Journal of Real Estate Research*, v. 5, no. 1 (1990): 117–127. William Kinnard and Sue Ann Dickey, "A Primer on Proximity Impact Research: Residential Property Values Near High-Voltage Transmission Lines," *Real Estate Issues*, v. 20, no. 1 (1996): 23–29.

fect is generally reduced as the property is located farther away from the line.

Proximity to both LUSTS and electrical transmission lines reflects the market's perceived knowledge of an actual hazard. In the case of houses located on the Fairfax County portion of the Colonial Pipeline corridor away from the immediate impact area, no contamination is necessarily present. Therefore, any change in value should reflect the degree to which the market capitalizes any perceived risk associated with a repeat of a similar incident, and its potential danger and disruption to enjoyment of any property encumbered with a pipeline easement. However, other factors may impact value along the pipeline right-of-way. For example, discussion with local real estate market participants indicates that being located on a pipeline may actually have a positive effect on property value because of the additional open space along the pipeline right of way. Therefore, we expect that before the pipeline incidents, there may have been a premium associated with homes along the pipeline; however, after the 1993 rupture, properties along the Colonial Pipeline easement would be discounted thereafter to reflect possible future events. This discount (a reduction in sales price) could be reduced over time as the market's expectation of future negative impacts is diminished.

PROPERTY VALUES IN FAIRFAX COUNTY

The Fairfax County area has experienced substantial economic growth over the past decade, although job growth slowed after the mid-1990s. The county had a population of 900,000 in 1996. Although the county is largely a bedroom community for Washington D.C., it also has an employment base of more than 500,000 jobs. Residential property values are above average for the nation. For example, a typical four-bedroom, two-bathroom, detached home of about 2,200 square feet on ⅓ acre sold for approximately $285,000 in 1996. A typical townhouse would sell for approximately $160,000. In general, the average selling price of Fairfax County real estate has been largely flat since 1992 due in part to a slowdown in the development of new jobs and moderately vigorous home

building which drove up the supply of residential units in the county.

Data-Gathering Procedures

Our investigation began with a visit to the Fairfax County offices in September 1997 to gather data about the Colonial pipeline corridor and the local real estate markets. First, we contacted local public fire safety, geographic information system (GIS), and property assessment officials.[7] Next, we drove along accessible portions of the pipeline corridor throughout its 30-plus-mile length in Fairfax County. Sometimes the Colonial pipeline shared the right of way with a power transmission line or with another pipeline. These areas were noted. The visible width of pipeline right of way varied from 10–20 feet to more than 60 feet, with 30–40 feet being typical in residential areas.

After purchasing and installing real estate sales data from Experian (REDI) and analyzing property tax documents provided by Fairfax County, we identified 593 properties encumbered by Colonial Pipeline easements (e.g., the county tax maps showed that the pipeline ran through the property). We also identified 437 parcels that are directly adjacent to the pipeline right of way, but not on it (and hence have no pipeline easement). The vast majority of both types of property are residential in nature. Overall, 218 residential properties encumbered by pipeline easements sold between 1985 and 1997. Of these, 179 were single-family. A total of 76 single-family sales and 20 townhouse sales occurred after the 1993 Colonial pipeline rupture. Table 1 shows the breakdown of properties along the Colonial Pipeline easement in Fairfax County. It is important to note that none of these residential properties are believed to be directly contaminated by the Reston pipeline rupture.

In order to determine the effect that the news of the 1993 Colonial Pipeline rupture had on residential properties in the noncontaminated section near the pipeline, two areas were addressed. The first was the residential area two miles north of the rupture location. This study area was ideal in the sense that for nearly all units the Colonial Pipeline did not share its right of way with overhead power lines or other pipelines. Also, the types of homes in this area

Being located on a pipeline may positively affect property value because of the additional space along the pipeline right-of-way.

TABLE 1   Number of Properties Along the Colonial Pipeline, Fairfax County

Countywide Inventory of Properties	
On the pipeline:	593
Adjacent to the pipeline:	437
With shared transmission lines:	143
With shared pipelines:	10

Countywide Inventory of Sold Residential Properties Only			
Description/Use	Single-family	Townhouse	Total
Pipeline sales, 1985–1997	179	39	218
Pipeline sales after 1993*	76	20	96
Adjacent sales, 1985–1997	115	124	239
Adjacent sales after 1993	63	69	132
Power line in row**	26	39	65

*   Countywide inventory of property sales on the pipeline after the pipeline rupture.

** Count of properties on the pipeline with shared transmission line easements.

were relatively similar. The second study area included the balance of the Colonial Pipeline corridor in Fairfax County.

To illustrate the situation, a map of several subdivisions along the pipeline right of way is shown in figure 1. It is fairly typical of the corridor because the pipeline can be seen in proximity to a major roadway, as it cuts through a higher-density townhouse development and a single-family detached project.

DATA ANALYSIS

North Fairfax Study Area: Sugarland Run Creek

The North Fairfax study area contains 19 single-family homes encumbered by Colonial Pipeline easements (the case group) that sold between 1990 and 1997. None of these homes were believed to be contaminated directly by the spill resulting from the pipeline rupture. A control group comprised of other single-family homes in the same subdivisions as the homes along the pipeline right of way was created. Any sales from this group for which key data were missing (square feet, bedrooms, other rooms) were deleted. There were a total of 768 sales not on the pipeline that sold during the same period. A total of 787 sales were available for statistical analysis. Because there was an insufficient number of condominium or townhouse sales along this section of the pipeline, we were unable to perform any analysis for these markets in the North Fairfax study area. All sales were believed to be on municipal water systems.
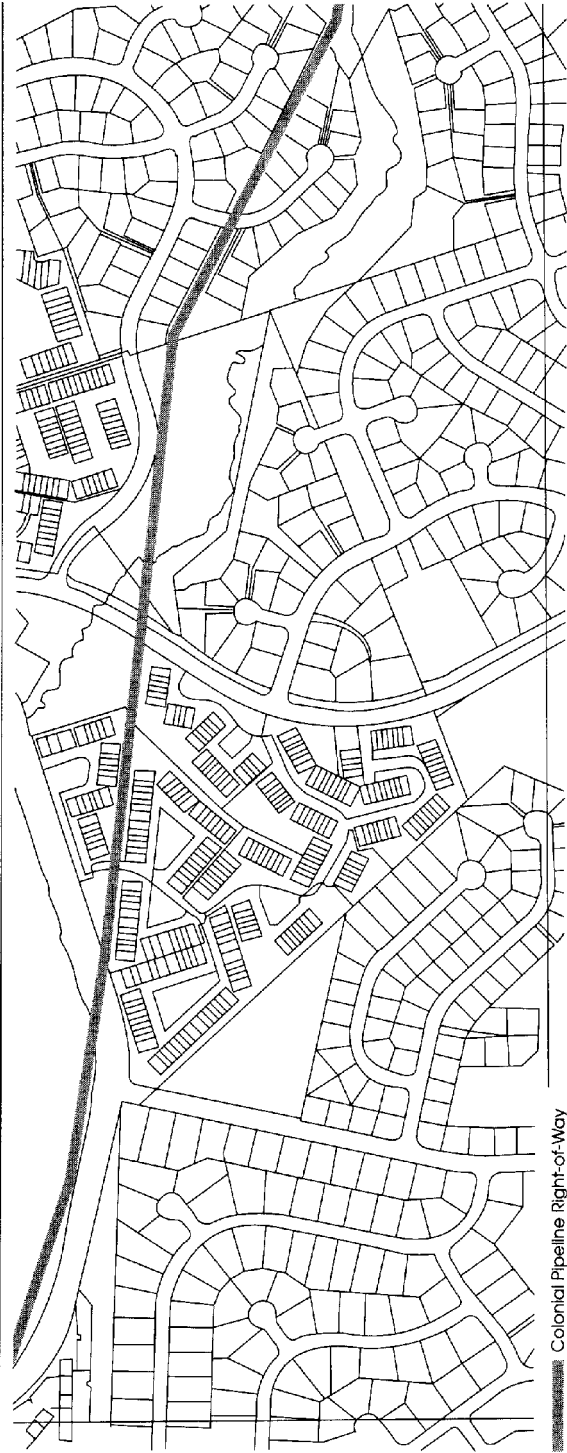
For single-family homes in the North Fairfax study area, we employed a multivari-ate hedonic regression model, using a pooled cross section of sales over the 1990–1997 period. This form of regression analysis uses ordinary least squares (OLS), and is able to isolate the effects of each independent variable on sales price, while holding all other variables in the model constant. After experimenting with different functional forms for price, we determined that for this purpose the dependent variable should be the natural log of the sales price. This form is convenient because the parameter estimates for the dummy variables in this model can be interpreted as the percentage effect on market value.

Independent (explanatory) variables include physical characteristics such as square feet of living area, lot size, covered parking, number of rooms, bathrooms, fireplaces, and basements. We also included year of construction, month of sale, the selling year, and a dummy (0 or 1) variable for each of the census tracts in the area that had pipeline sales.

To determine the effect of the pipeline on sales price, we added dummy variables. The first indicates that the sale is located on the Colonial pipeline regardless of sale year. The second variable (shown at the bottom of table 2) indicates that the sale occurred after the March 1993 Colonial Pipeline rupture. This variable reflects the effect of the rupture on residential market value, holding the other variables in the model constant. Ten pipeline sales occurred before the rupture, with nine after the rupture. Because the dependent variable is presented in log form, the interpretation of the variable reflects a percentage change in price if the sale was both on the pipeline and occurred after the 1993 rupture.

FIGURE 1 Segment of the Colonial Pipeline

Colonial Pipeline Right-of-Way

TABLE 2   Regression Results for Single-Family Homes: North Fairfax Area

Variable	Parameter Estimate	Standard Error	t-statistic
Intercept	-1.727	5.312	-0.33
Square footage of living area	0.000	0.000	18.54***
Total land area	0.000	7.085E-7	3.67***
Basement (0-no, 1-yes)	-0.040	0.011	-3.71***
Number of fireplaces	0.059	0.011	5.43***
Number of bathrooms	0.054	0.010	5.53***
Number of covered parking spaces	0.000	0.000	7.47***
Number of total rooms	0.010	0.004	2.21**
Sales (years)	0.007	0.003	2.75***
Year of construction	-0.001	0.000	-9.28***
Census tract 4805	0.061	0.013	4.73***
Census tract 4920	0.196	0.012	16.31***
Census tract 4821	-0.044	0.022	-2.05**
Property sold in January	-0.002	0.019	-0.12
Property sold in February	-0.031	0.021	-1.47
Property sold in March	-0.008	0.016	-0.49
Property sold in April	0.035	0.017	2.02**
Property sold in May	0.020	0.018	1.12
Property sold in June	0.008	0.014	0.56
Property sold in July	0.009	0.015	0.61
Property sold in August	-0.020	0.014	-1.40
Property sold in September	-0.017	0.017	-0.97
Property sold in October	0.017	0.017	1.00
Property sold in November	0.006	0.017	0.37
Home on pipeline corridor (0-no, 1-yes)	0.064	0.023	2.75***
Sale on pipeline post-1993 rupture (0-no, 1-yes)	-0.055	0.033	-1.68*

For probability > *(t)*

*   Significant at 10%

** Significant at 5%

*** Significant at 1%

Dependent variable: log of sales price

Model adjusted R^2 = 0.759

Based on 787 sales

Hedonic Model Results: The North Fairfax Study Area

The results of the North Fairfax study area are reported in table 2. The overall model has an adjusted R^2 of 0.76, and an F-statistic significant at a 99% level of confidence. Regression problems including multicolinearity and heteroscedasticity are within acceptable levels. The other real estate variables (e.g., living area, year built), generally performed as expected, with the signs predicted by theory. For example, lot area, parking spaces, rooms, and living area square footage were all positive and statistically significant. Each additional fireplace and bathroom added about 5% to the sales price.

Considering the effect of the 1993 pipeline rupture on the sales prices of uncontaminated single-family houses on the easement,

the interaction variable *sale on pipeline post-1993 rupture* has a negative sign of 0.055, statistically significant at a confidence level of 90%. This indicates a 5.5% reduction in the sales price, holding all other variables in the model constant.

Predictive Regression Analysis for the North Fairfax Study Area

To supplement the above analysis, we also prepared a model for the same single-family sales in the north study area, omitting the sales on the pipeline. This model also had an adjusted R^2 of 0.76 and was satisfactorily specified. However, because the predictive model included sales both before and after the pipeline rupture and was applied only to pipeline sales after 1993, the fit may be less than optimum. The purpose was to predict

the price for each pipeline sale that occurred after the 1993 rupture, then compare the predicted price to the actual sales price. The difference between the two prices, if negative, would be an indication of the loss attributable to being on the pipeline.

Table 3 contains the comparison of the predicted and actual selling prices, and their differences. Seven of the nine pipeline properties sold below their predicted selling prices, and two sold for more. Including the two properties that sold for above their predicted amounts, the weighted average loss attributable to being on the pipeline is 3.3%. This figure is slightly lower than the 5.5% reduction derived above. Due in part to the relatively small sample size, these results do not independently indicate a reduction in value. However, in the context of other evidence, this finding does support the notion of a price reduction. As for the sales that appeared to sell for above their predicted price, sometimes activities outside the model (e.g., kitchen rehabs) occurred, affecting price without being detected.

LARGER FAIRFAX COUNTY PIPELINE CORRIDOR ANALYSIS

The modeling procedures for the larger corridor study area are similar to those of the North Fairfax area study, except that townhouse sales are also available. Two separate hedonic analyses were undertaken—one for single-family homes and one for corridor-long townhouses.

Single-Family Homes
Our analysis of single-family sales along the pipeline was very difficult. Because of the variety of homes that sold, we could not construct a representative control group of sales off the pipeline. Therefore, we considered four separate residential subdivisions in the county. All four were along the pipeline corridor, and each subdivision had at least ten pipeline sales. We constructed similar statistical models to that of the North Fairfax area, and modeled the same variable (on the pipeline and sold after the 1993 event). The results were that in all four subdivisions, the post-1993 pipeline variable was slightly negative. (The results varied from -0.3% to -1.4%.) However, none of these results were statistically significant.

Townhouse Hedonic Model Results: The Fairfax Pipeline Corridor
The townhouse market was also analyzed using a hedonic price model for the entire pipeline in Fairfax County. This is possible because characteristics of townhouses are more homogeneous than single-family detached houses; therefore, their distribution approximates normality. For townhouses, we used a pooled cross section of sales over the 1986–1997 period. A total of 39 townhouses sold on the pipeline during this time period. Of these, 20 sales occurred after the 1993 Colonial Pipeline rupture. The townhouse market was analyzed using a hedonic price model for the entire pipeline in Fairfax County. The dependent variable is the natural log of the real sales prices in 1996 dollars. Because the dependent variable is presented in log form, the interpretation of the variable reflects a percentage change in sales price if the sale was on the pipeline and occurred after the 1993 rupture variable (*TH* sale on pipeline post-1993 rupture).

Independent variables include physical characteristics such as square feet of living area, lot size, covered parking, number of bedrooms, bathrooms, total rooms, fire-

Seven of the nine pipeline properties sold below their predicted selling prices, and two sold for more.

TABLE 3   Colonial Pipeline North Fairfax Area Sales

Property	Actual Price	Predicted Price	Difference	Percent Gain (Loss)
1	$244,000	$264,625	-$20,625	-7.79%
2	$265,000	$325,055	-$60,055	-18.48%
3	$269,950	$270,376	-$426	-0.16%
4	$317,000	$321,509	-$4,509	-1.40%
5	$320,000	$287,822	$32,178	11.18%
6	$335,000	$363,353	-$28,353	-7.80%
7	$340,000	$342,878	-$2,878	-0.84%
8	$345,000	$372,368	-$27,368	-7.35%
9	$348,000	$330,754	$17,246	5.21%
Total:	**$2,783,950**	**$2,878,740**	**-$94,790**	
			Weighted average loss:	**-3.29%**

places, and basements. We also included the construction year, season of sale, a date code dummy if the sale took place after the 1993 rupture, and other dummy variables for each of the census tracts in the area that had pipeline sales. The results are shown in table 4. The model has an adjusted R^2 of 0.89, and an F-statistic significant at a 99% level of confidence. Again, the other real estate variables

(living area, year built), generally performed as expected with the signs predicted by theory.

Considering the effect of the 1993 pipeline rupture on the sales prices of uncontaminated townhouses on the easement, the interaction variable *TH sale on pipeline post-1993 rupture* has a negative sign of 0.026, statistically significant at a confidence level of 95%

TABLE 4 Regression Results for Townhouses: Entire Fairfax County Corridor

Variable	Parameter Estimate	Standard Error	t-statistic
Intercept	-17.775	1.716	-10.36***
Property sold in 1986	0.118	0.010	11.82***
Property sold in 1987	0.090	0.006	14.11***
Property sold in 1988	0.065	0.005	12.7***
Property sold in 1989	0.031	0.005	6.32***
Property sold in 1990	0.043	0.005	8.14***
Property sold in 1991	-0.012	0.005	-2.42**
Property sold in 1992	-0.020	0.005	-4.08***
Property sold in 1993	-0.061	0.004	-14.67***
Property sold in 1994	-0.054	0.006	-9.55***
Property sold in 1995	-0.058	0.006	-9.81***
Property sold in 1996	-0.072	0.006	-11.67***
Square footage of living area	0.000	0.000	48.07***
Basement (0-no, 1-yes)	-0.101	0.002	-41.16***
Number of bedrooms	0.006	0.004	1.59
Number of fireplaces	0.030	0.003	10.97***
Number of bathrooms	0.019	0.002	7.66***
Number of covered parking spaces	0.000	0.000	11.25***
Number of total rooms	0.004	0.002	2.17**
Total land area	0.000	0.000	7.92***
Year of construction	0.015	0.001	16.82***
Census tract 4302	0.097	0.007	13.01***
Census tract 4805	0.085	0.004	20.87***
Census tract 4825	0.050	0.006	7.67***
Census tract 4826	0.045	0.004	10.86***
Census tract 4905	0.060	0.010	6.19***
Census tract 4913	-0.060	0.005	-12.35***
Census tract 4914	-0.059	0.003	-18.02***
Census tract 4917	-0.193	0.014	13.74***
Porch (0-no, 1-yes)	-0.009	0.001	-6.47***
Property sold in fall	0.002	0.002	0.84
Property sold in winter	-0.007	0.002	-3.11***
Property sold in spring	0.005	0.002	2.29**
TH on pipeline corridor (0-no, 1-yes)	0.017	0.007	2.41**
TH sale post-1993 rupture (0-no, 1-yes)	0.005	0.004	1.39
TH sale on pipeline post-1993 rupture (0-no, 1-yes)	-0.026	0.010	-2.59**

For probability > *(t)*

* Significant at 10%

** Significant at 5%

*** Significant at 1%

Dependent variable: real log of sales price

Model adjusted R^2 = 0.891

Based on 2,529 sales

Table 5 Summary of Findings

Study Area	Distance from Pipeline Rupture	Technique of Analysis	Type of Unit Studied	Total Sales/ Pipeline Sales	Reduction in Value
Sugarland Run Creek	Within 2 miles	Hedonic multiple regression	Single-family detached	787/19	-5.5%*
Sugarland Run Creek	Within 2 miles	Predictive regression	Single-family detached	NA/9	-3.3%
Balance of Fairfax County	Within county	Hedonic multiple regression	Single-family subdivisions	4 subdivisions	-0.3% to -1.4%
Balance of Fairfax County	Within county (average 10–15 miles)	Hedonic multiple regression	Townhomes	2,629/39	-2.6%**

* Statistically significant at 90% level of confidence.

** Statistically significant at 95% level of confidence.

The single-family homes and townhouses with pipeline easements within 10 miles of a well-publicized substantial rupture experienced a 1%–2% loss in property value.

or higher. This indicates a 2.6% reduction in the sales prices, holding all other variables in the model constant.[8]

CONCLUSIONS

Table 5 summarizes the results for this analysis. For the North Fairfax (Sugarland Run Creek) study area, combining the results of the two studies of single-family home sales on the pipeline for the two miles area north of the 1993 rupture (with losses of 5.5 and 3.3% respectively), the conclusion is that single-family homes with easements along the Colonial Pipeline right of way located within two miles of a well-publicized, substantial pipeline rupture experience a loss in value of 4%–5% after the rupture, relative to comparable noncontaminated properties not on the pipeline.

For the entire Fairfax pipeline corridor, based on the two studies along the Colonial Pipeline corridor, the conclusion is that same-county single-family homes (with losses of 0.3%–1.4%) and townhouses (loss of 2.6%) with pipeline easements within 10 miles of a well-publicized, substantial pipeline rupture experience a loss in value of 1%–2% after the rupture, relative to comparable noncontaminated properties away from the pipeline right of way.

This article implies that appraisers and county property tax assessors in Fairfax County and potentially in other areas should consider reducing the value of easement-holding residential properties along large oil pipeline rights of way with a relatively high incidence of publicized pipeline ruptures. This discount may be applied even though these residential properties are not known to be contaminated. This loss can be attributed to the market's valuing the possibility of a future occurrence, based on a well-publicized and substandard-operating record with respect to pipeline ruptures. These reductions in value would be larger in close proximity to the rupture event. The following rules of thumb may apply to residential property with pipeline easements, holding all else constant:

1. Properties located within two miles may experience losses of up to 4%–5%.

2. Residential properties farther away, but on the pipeline corridor within the same market area would be expected to have a 1%–2% discount. (With respect to the passage of time, these figures represent an average loss within four years of a major pipeline rupture.)

3. Substantially improving operation of the pipeline, including upgrade of pipe and maintenance, could potentially partially reverse these effects.

8. Another model also had the shared transmission line variable. Its inclusion did not change the statistical significance or reduce the magnitude of the sale on pipeline post-1993 rupture variable. The same model also controlled for properties adjacent to the pipeline, which also showed a modest reduction in and statistically significant sales price. The net effect between sales of properties adjacent to and along the pipeline sales after the 1993 event was a reduction in price of 2.3%.