Determining Market Perceptions on Contamination of Residential Property Buyers Using Contingent Valuation Surveys

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Abstract   This study reports the results of contingent valuation (CV) studies conducted in eight states in the United States. Over 1,100 telephone interviews examined valuation effects on residential properties impacted by Leaking Underground Storage Tanks (LUST). Negative discounts for marginal bidders with affected ground water were quite consistent, varying from -25% to -33%. ANOVA established that bidding patterns from six of the seven states were statistically similar while male bidders, those over 40 years of age and those with no high school degree were more likely to bid; those with higher incomes and those bidding on certain, rather than suspected contamination, were less likely to bid. Contingent valuation results benchmark reasonably close to but higher than revealed preference outcomes for residential LUST sites in Ohio.

Introduction

When environmental contamination occurs, researchers often prefer to employ multiple regression techniques to estimate its impact on property values. Recent real estate research on contaminated property values, however, has focused on alternative methods of measurement, particularly in cases where market data are difficult or impossible to obtain. Additionally, many scholars are advocating the use of multiple approaches. A mix of revealed preferences (sales that can be used in multiple regression analysis) and stated preferences (from opinion surveys of potential buyers) are often used to rigorously test data and draw conclusions.

This study explores the use of contingent valuation analysis (CV) as a method of measurement when determining the impact of contamination on property values. Contingent valuation is a survey technique that solicits responses from people using questionnaires that provide a detailed description of a property, its current

condition, a hypothetical improvement or degradation in its condition. Contingent valuation surveys also indicate a way in which the person would pay for the improvement (such as an increase or decrease in price), or the survey solicits a bid for the contaminated property. In private markets, this is sometimes referred to as ''willingness to pay,'' although this term has a different meaning in the context of public goods. For example, land that is held in the public domain has no market price, and visitors may not be excluded from enjoying the property. Its value to direct users (and others who do not ever use it, but may like the idea of having a park in existence) is typically measured by the public's ''willingness to pay,'' which equates to taxes. This is fundamentally different from private property, where the use has value to owners, potential buyers and tenants, and uninvited parties may be considered trespassers. Despite some well-recognized limitations derived from the hypothetical nature of surveys, CV has emerged as an alternative technique for determining environmental damages to real estate in situations where sales data are not generally available or where previous sales may not have had full information available concerning the contamination.

The use of CV is important as a corroborative technique, and may be the sole technique available to determine property value losses when other local sales data are insufficient. It is common knowledge that ''real estate markets are influenced by many local factors and broad generalizations across markets are difficult, particularly with respect to environmental impacts. Intervening local market conditions significantly influence the way in which environmental contamination impacts property values.''[1] Even though CV uses a structured hypothetical situation (involving stated preferences), rather than relying upon sales data (revealed preferences), respondents are asked to put the property in the context of their own market. Thus, it can be tested if certain local market conditions affect stated bid and discount outcomes for contaminated property. This study can also be a useful tool in applying case studies from other markets to a specific situation, and may allow adjustments to valuation, if warranted, based on local (neighborhood type) and macroeconomic market conditions (the proxy variables are states in the United States).

This study begins with a discussion of contingent valuation and then discusses the effects of a particular type of petroleum contamination. Next, the research hypotheses are set forth, methodology is reviewed and the results are analyzed. The concluding paragraphs relate the results of this study to benchmarks established in previously published research. The main research hypothesis is that potential buyer behavior is consistent across markets. This is tested by an analysis of bidding and percentage discount responses over several states. In addition, demographic factors that are associated with successful bidding on contaminated properties are analyzed.

Literature Review

Continent valuation analysis (CV) has found recent application as a method of estimating the value of market goods. However, it has been more widely used as

a technique to estimate the value of non-market goods. Its importance in the valuation of environmental damages for public goods is commonly accepted. It has been used to estimate the benefits of things such as increased air and water quality, increased risk from drinking water and groundwater contaminants, outdoor recreation, and protecting wetlands, wilderness areas and endangered species (Carson, 2000). The importance of CV was emphasized in a series of papers published in 1994. Portney (1994) envisioned the role that CV would play in public policy formation, and emphasized the importance of understanding it. Recent applications for CV include real estate research, especially in the calculation of environmental damages (Clinch and Murphy, 2001). Chalmers and Roehr (1993: 37–38) recognize the use of contingent valuation for analyzing contaminated real estate in ''as is'' condition, especially when traditional approaches to value do not work. They advocate the use of formal procedures to interview market participants, including buyers, for real estate cases that involve contamination.

McLean and Mundy (1998) advocate the use of contingent valuation in real estate for two reasons. First, they suggest that buyers may be unaware of the impact of contamination on their property values, thus impacting the reliability of sales data. They also find it important to use when the availability of adequate sales data is limited, thus making traditional valuation techniques unreliable and difficult to use. In another article, Mundy and McLean (1998) evaluate the CV approach, and another survey-based methodology called conjoint analysis, in the context of federal guidelines for non-market goods and services. They discuss advantages and criticisms of CV, and then demonstrate its use in conjunction with other techniques in reference to a Tacoma, Washington case study of private property damages from a smelter.

Simons (2002a) used contingent valuation to estimate property damage from PCB contamination in a small-town market in Alabama. One hundred fifty respondents were asked if they would purchase property that was contaminated with PCBs. The actual language of the question stated ''testing by the state environmental authority shows that levels of PCBs and pesticides above those considered safe for residential use are found at several locations near the plant, including in the soils on the property you are considering buying.'' Only 4.9% of the respondents chose to bid on the scenario. The overall discount was 53% and ranged from 20%–83% of full (uncontaminated) value.

Literature regarding the impacts of petroleum contamination on property value is diverse. A study by Simons, Bowen and Sementelli (1997) found that residential property within 300 feet or on the same block as a registered leaking underground storage tank (LUST), with the tanks still present, sustained an average reduction in sales price of 17%, holding all else constant. These results were based on proximity only, and did not consider whether the properties were actually contaminated or threatened with contamination. This study used multiple regression analysis and considered residential, mostly single-family sales that took place during 1992 in Cleveland, Ohio.

Another study by Simons, Bowen and Sementelli (1999) conducted in Cuyahoga County, Ohio considered residential property contaminated by a LUST from gas stations. Moderately priced and contaminated single–family residential property that met the following criteria were studied: (1) contamination determined by environmental testing; (2) contamination suspected, but the owner refused testing; (3) adjacent to a contaminated property; and (4) down gradient (in groundwater flow terms) and within 100 feet of a defined groundwater plume. All were considered affected by the LUST. These properties showed a reduction in price of 14%–15%. Higher priced single-family residential property meeting the same criteria with actual contamination had a slightly larger price reduction.

Surveys of market participants and CV have also been used in other contexts. McClelland, Schultze and Hurd (1990) evaluated the effect of risk beliefs on residential property values by conducting a case study of a hazardous waste landfill. They performed a mail survey on residents living near the site, and questioned them on their perceptions of health risks associated with living near the landfill. Results showed respondents that were younger, female and were concerned about odors were more likely to perceive the landfill to be a greater risk. Males were not as concerned about these factors.

Jenkins-Smith, Silva, Berrens and Bohara (2002) used CV to study the effect of a smelter and refining plant on residential property values in Texas. Sellers were required to disclose the existence of contaminated soil to potential buyers. The contingent valuation analysis was administered through a telephone survey using a sample of potential homebuyers. Fifty-three percent of respondents declined to bid on the stated scenario. Among those that did bid, the average loss in willingness to pay after disclosure was $11,000, or 31% below the average house price in the area.

Three recent literature reviews address the consistency of property value discounts on similar types of environmental problems across space and time. Farber (1998) evaluates undesirable facilities and their effects on (generally) residential property values, for empirical studies. He focused on larger facilities such as sanitary landfills, hazardous waste sites, refineries, nuclear utilities, and the like, considering pre-and post announcement information, construction and facility closure. Farber found consistency in responses to pre- and post-announcement phases of construction and operations for well-publicized large facilities. The number of studies was usually quite small (2–3) for each individual type of facility, but Farber (1998:13) concluded that there was considerable agreement among the respondents across the studies for hazardous waste facilities, sanitary landfills, chemical refineries and PCB contaminated sites. All had comparable effects on property values.

Jackson (2001) addresses published contamination studies in an appraisal context, including studies of all types such as hedonic regression analysis, case studies and published accounts of real estate appraisals, on a variety of real estate types that includes both residential and commercial uses. He generally found that

contamination has an effect on prices, but the effect was temporary. He also notes the importance of intervening factors, such as market demand, on discount outcomes.

Boyle and Kiel (2001) also address the issue of consistency for value diminution for various types of contamination on residential property (usually houses but occasionally residential land) for studies using hedonic regression analysis. After normalizing results to a base year, the authors found, overall, that among air quality studies, results were not consistent. Water quality studies and undesirable land use studies generally had the correct sign on coefficients, and results were statistically significant. However, estimated effects ranged substantially for different types of contamination. Even among fairly typical uses, such as landfills, there was a spectrum of severity, information and other factors involved that markets were able to capitalize. Thus, by focusing on one methodology and property type (residential), they (like Farber) found greater consistency among results than did Jackson. This research evaluates a much narrower band of contamination types, leaking underground storage tanks from gas stations in a residential context, with few variations of information.

As a methodology, CV has its limitations. For example, some survey participants may have a stake in the outcome of a case and could give biased results in order to secure funds. Others may have issues with the polluter, and give responses based on feelings irrelevant to the issues at hand. To avoid these validity threats, the researchers did not include respondents directly involved in litigation, nor were the polluters named.

Other respondents may provide answers to try to "please" the surveyors. This issue has been addressed by having the trained surveyors stick to a prearranged script, and by not informing surveyors in advance about the details of the case. In addition, some respondents may give answers that would not mirror their actions in real life because there are no real-life consequences to providing responses to hypothetical questions (Rowe, d'Arge and Brookshire 1980; and Mathews and Desvousges, 2002). This has been associated with a discrepancy between stated and revealed preferences (Jackson in Kinnard, 2003).[2] Hypothetical bias is partially addressed by removing unreasonably low bids from the pricing calculations, focusing instead on the marginal buyer at the top of the market.

Survey Data

The data used in this study were collected over a three-year period beginning in January of 2000 and ending in January of 2003. During these three years, 1,115 useable responses were collected by telephone interviews with homeowners over an eight state area. The states were Kentucky, Pennsylvania, Ohio, Alabama, Illinois, South Carolina, West Virginia and Texas. Most but not all of the data were collected in conjunction with litigation. However, only one of the cases was directly tied to LUST (South Carolina), and this case has been settled. Typically,

the LUST scenario was used as an alternative scenario so respondents were not aware of the exact nature of the focus of the survey.

The survey methodology followed standard research protocols. The initial instrument was pre-tested for time length, clarity and other potential problems, and subsequent instruments utilized the same or very similar questions. During application of the first wave of surveys, the interviewers met regularly to discuss problems and areas where respondents experienced confusion. Some areas of concern were identified, and minor changes were implemented. A recent pretest of a very similar instrument among a random sample of the group to be surveyed showed no problems.

The population for this study was residential homeowners. In order to obtain a sample frame, a list of potential homeowners (or in one case registered voters) was purchased from a vendor.[3] The lists were organized by ZIP code or by county, and interviewers were given a quota from each geographic area to fit the needs of the case, based on a random number selection procedure. Overall, respondents from over 100 counties are represented in the sample.[4] The authors made approximately 20% of the calls. For approximately 40% of the calls, the interviewers were trained by the authors and made calls under their direct control. For the remainder of the calls, professional survey firms were retained, and the authors provided specific instructions for survey administration and procedures to follow. Interviewers were given instructions to call names at random, and continue until the required amount of interviews was completed. About 30% of the calls resulted in no answer, and another 30% yielded an answering machine. Ten percent of the numbers were no longer active. Of the remaining 30%, about 20% participated, and of these nearly all finished the interview. The remaining 10% refused to participate or were not the homeowner. If a telephone number did not yield a completed survey, the interviewer randomly selected another telephone number. If needed, numbers were called up to three times and then removed from the pool. A small percentage of completed surveys (less than 5% overall) were deemed to be as incomplete or in rare cases atypical of the target population (*e.g.*, house value $500,000 where the average value was $125,000). They were either replaced by a randomly selected respondent, or in some cases discarded. The overall response rate (useable completed survey/qualified respondents), once the interviewer spoke to a live person that was the homeowner, was over 60%. Thus, because the factors leading to non-participation (mostly no answer and answering machine, and some out-of-date numbers) were unrelated to demographics or other key respondent characteristics, the survey technique is sufficiently random to allow use of statistical analysis. The useable responses by state are listed in Exhibit 1.

The survey instrument was designed to acquire specific information from the respondents over the telephone in approximately ten minutes. This information included some preliminary questions to get the respondent comfortable with the bidding scale, the baseline value of the respondents' home, if they would bid on a home contaminated with petroleum from a LUST and the amount they would bid on the contaminated unit. Similar questions were also asked concerning other

Exhibit 1 | Responses by State

State	Number of Surveys	% of Total
Kentucky	256	23
South Carolina	192	17
Texas	187	17
Illinois	148	13
Alabama	125	11
Pennsylvania	99	9
Ohio	96	9
West Virginia	12	1
Total	1,115	100

unrelated scenarios, one of which was typically the focus of litigation. Finally, data on the respondents' demographic features were also collected.

Comparison of Sample and U.S. Homeowner Demographics

Despite the opportunistic way the data were collected, the totality of this stratified random sample is reasonably comparable to the U.S. homeowners.[5] The surveys focused on homeowners, who are generally older, better educated and have fewer minorities than the overall population that includes renters. Even though some anomalies exist within specific categories, the comparison is close enough on key demographic factors to provide a useful context for the study. For example, the median age of respondents was 49 years, compared with a 50-year median for U.S. homeowners. A total of 39% of respondents were male, compared with 49% in the U.S. [U.S. data are from AHS (2001)]. Data collection did not take into account male–female households owning property together.

Education levels of the survey respondents are roughly the same for the U.S., although the sample is slightly more educated. Eight percent of those surveyed did not finish high school compared with 16% of U.S. homeowners. Thirty-one percent of homeowners in the U.S. hold a high school diploma as their highest level of education, while 32% of the survey respondents claim that level. Twenty-six percent of those surveyed had some college education, compared to 23% across the U.S. While 28% of U.S. homeowners have at least a bachelor's degree, 34% of the survey respondents indicated that level of education (AHS, 2001).

Ninety-one percent of survey respondents were Caucasian, compared with 81% in the U.S. The number of persons per household in the U.S. is also close (with

a modal response of 2) to those surveyed. Stated housing values for the respondents were comparable to national values as respondents reported an average value of $143,000 compared with U.S. homeowners at $138,500, adjusted to 2002 dollars. Additionally, 31% of homeowners in the sample were from the Midwest, compared with 33% nationally. Overall, therefore, the sample is reasonably similar to that of U.S. homeowners. The diversity of market types (from urban Chicago, to suburban Ohio and Kentucky, all of South Carolina, to rural Texas and Alabama) also makes it possible to examine outcomes in a range of market types.

Mechanics of the Survey Instrument

In order to determine the baseline value of the respondents' current home, they were asked the following:

> *Suppose a job change required you to move to a different location. You need to find a home quickly and have been looking for some time. In looking for a home, you find one that is very similar to the one you live in now. If the neighborhood is also very similar to the one you live in now, what is the most you would be willing to offer for the home?*

Three different scenarios were then presented to the respondents. These scenarios included varying degrees of environmental problems and the respondents were asked to value the changes to their property based on the information in the scenarios.[6] Thanks to Barton Smith, Ph.D. for guiding use of this approach.

Generally, two different variations of the LUST scenario were used in this study. Individual respondents were presented with one of the two scenarios. The first, scenario, known as "LUST light" infers suspected contamination on the home site that has not been confirmed through environmental testing. The actual wording of the scenario is as follows:

> *The home is located next to a recently remodeled, operating attractive gasoline service station. The site of the station has been registered as having had leaking underground storage tanks. While the leaking tanks have been repaired, the contamination that escaped from under the station has not been removed. The home lot is located where groundwater from below the service station could flow underneath it.* **However, no environmental testing has been done to determine if gasoline, containing benzene, has migrated from the service station under the home lot.** *Except for this one factor, the rest of the neighborhood is like yours, and the home is very similar to your home. What is the most you would be willing to offer for the home?*

A second major variation of the LUST scenario is virtually identical to the LUST light scenario, with the exception of the bolded sentence that confirms the presence of petroleum. This scenario, known as "LUST heavy" was presented as follows:

> *The home is located next to a recently remodeled, operating attractive gasoline service station. The site of the station has been registered as having had leaking underground storage tanks. While the leaking tanks have been repaired, the contamination that escaped from under the station has not been removed. The home lot is located where groundwater from below the service station could flow underneath it.* ***Results of environmental testing showed that gasoline, containing benzene, has migrated from the service station under the home lot.*** *Except for this one factor, the rest of the neighborhood is like yours, and the home is very similar to your home. What is the most you would be willing to offer for the home?*

Finally, about 200 respondents in Texas were given a variation of LUST heavy, the ''LUST super-heavy'' scenario, with MTBE and undrinkable well water:

> *The home is located near an attractive operating gasoline service station. The site of the station has been registered as having had leaking underground storage tanks. While the leaking tanks have been repaired, the contamination that escaped from under the station has not been removed. The house lot is located where groundwater from below the service station could flow underneath it.* ***Results of environmental testing showed that traces of MTBE (a gasoline additive that is suspected of causing health problems) has migrated from the service station under the house lot. The home is on well water, and the water is undrinkable.*** *Except for this one factor, the rest of the neighborhood is like yours, and the home is very similar to your home.*

Of the 1,115 usable surveys that were collected, 42% were the LUST light scenario, and 58% of the responses were the LUST heavy scenario (of these 17% were for the LUST super-heavy scenario.

Changes to the questionnaire terminology were made to test for any bias associated with the wording of the scenarios. The terminology in the LUST light scenario was considered less severe than the LUST heavy scenario, and thus it was expected that discounts and bidding would be adjusted accordingly.

The final portion of the survey instrument asked the respondents a series of demographic questions. These questions were designed to determine their sex, age cohort, income level and the number of people in each household. Respondents were also asked if their neighborhood was entirely residential, primarily residential, mixed with some commercial, or rural in character. This question is the proxy for local market conditions. In addition, the respondents were also asked their race and level of education. Detailed summaries of the demographic data collected from the surveys are shown on Exhibit 2.

Research Hypotheses and Methodology

Bid percentages and percentage discounts among the states are examined using descriptive statistics, with differences statistically with confidence intervals. A

Exhibit 2 | Data Summaries for All States

Survey	TX	TX % of Total	SC	SC % of Total	IL	IL % of Total	AL	AL % of Total
Dichotomous Descriptors								
Number of bidders	11	4	104	54	23	16	13	10
Age 20–29	9	3	20	10	17	11	5	4
Age 30–39	22	8	34	18	60	41	12	10
Age 40–49	31	12	52	27	42	28	23	18
Age 50–59	52	20	31	16	16	11	35	28
Age 60–69	38	15	27	14	8	5	31	25
Age 70+	35	13	28	15	5	3	19	15
No HS Diploma	18	7	23	12	0	0	12	10
HS Grad	70	27	69	36	2	1	47	38
Some College	66	25	48	25	8	5	36	29
College Grad	20	8	44	23	65	44	27	22
Post Grad	13	5	8	4	73	49	3	2
LUST Heavy	187	100	97	51	0	0	125	100
LUST Light	0	0	95	49	148	100	0	0
Male	70	27	76	40	68	46	46	37
Female	116	45	116	60	80	54	79	63
Caucasian	175	67	155	81	140	95	110	88
Non-Caucasian	12	5	37	19	8	5	15	12
Continuous Descriptors								
No. in HH	2.62		2.65		1.90		2.37	

Exhibit 2 | (continued)

Data Summaries All States

Survey	OH	OH % of Total	PA	PA % of Total	KY	KY % of Total	WV	WV % of Total	Total N	% of Total N
Dichotomous Descriptors										
Number of bidders	21	22	13	13	72	28	3	25	260	23
Age 20–29	6	6	3	3	16	6	0	0	76	7
Age 30–39	16	17	23	23	57	22	0	0	224	20
Age 40–49	17	18	29	29	70	27	5	42	269	24
Age 50–59	24	25	18	18	55	21	6	50	237	21
Age 60–69	25	26	16	16	40	16	1	8	186	17
Age 70+	8	8	10	10	18	7	0	0	123	11
No HS Diploma	4	4	2	2	29	11	0	0	88	8
HS Grad	27	28	44	44	88	34	7	58	354	32
Some College	33	34	18	18	83	32	3	25	295	26
College Grad	28	29	26	26	39	15	2	17	251	23
Post Grad	4	4	9	9	17	7	0	0	127	11
LUST Heavy	82	85	99	100	52	20	9	75	651	58
LUST Light	14	15	0	0	204	80	3	25	464	42
Male	35	36	41	41	95	37	5	42	436	39
Female	61	64	58	59	161	63	7	58	678	61
Caucasian	80	83	98	99	246	96	12	100	1016	91
Non-Caucasian	16	17	1	1	10	4	0	0	99	9
Continuous Descriptors										
No. in HH	2.61		2.93		2.83		2.33		2.57	

Notes: Average income for respondents: TX = $38,420; SC = $49,667; IL = $136,686; AL = $39,448; OH = $53,878; PA = $57,906; KY = $38,833; WV = $33,208; all N = $56,615.

probit analysis is then used to determine the impact of demographic features and terminology changes on the bidding behavior of participants. One model has states as independent variables with respect to the probability of submitting a meaningful bid.

The research hypotheses are that likelihood of bidding is consistent across states and local markets, and that submitted bids are also consistent across states and markets. Discounts for LUST light are also expected to be smaller than for LUST heavy. This latter point is sometimes referred to as the scope effect in the CV literature.

In order to assess the impact of the LUST scenario on respondents, two factors are of key importance. First, the portion of residents not willing to bid on a scenario reflects the loss in market demand. Second, the ratio of maximum bid to baseline case reflects the potential percentage value loss on the sale. One minus this ratio reflects the discount. For example, if the person's baseline price was $100,000 and the maximum they would bid is $40,000, a 60% discount is incurred.

It is also important to note that half or less of all bidders are considered in the final results.[7] Some very low ''bottom-fisher'' bids, with discounts of up to 99%, reflect game playing rather than serious attempts to acquire property. The rational seller would not accept such a bid. Prior research on the effects of petroleum contamination does not support the use of such large discounts for the type of contamination set forth in the descriptive paragraphs.

Thus, in order to emulate the market and recognize that the top marginal bidder would be much more likely to successfully bid on the property, the number of bidders is divided in half (top half bidders) based on the discount percentage. Further, the data are partitioned again (top quarter bidders), and then analyzed using both pools of bidders.[8]

With respect to the probit analysis, both *top half bids* and *top quarter bids* are used as dependent variables in separate model estimations. The probit model is used in quantitative studies that include a dichotomous choice dependent variable. The model is specified as:

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_n x_n + u, \qquad (1)$$

where Y is the dependent dichotomous variable (top half bid or top quarter bid) and the β weights represent the coefficient values of various independent demographic variables (x) and u represents the error term. The independent variables used in this analysis include age, education, household size, gender, race, region, local market and information changes. Descriptions of the variables are included in Exhibit 3.

Exhibit 3 | Demographic Variable Descriptions for Probit Model

Variable	Description
Top Half Bid	Top half of bidders
Top Quarter Bid	Top quarter of bidders
Demographics	
Over forty	Respondent is over age 40
No HS diploma	Respondent did not graduate from high school
No. in HH	Number of persons in household
Income	Income of respondent
Non-white	Respondent is not Caucasian
Resid / mixed	Respondent's neighborhood is primarily residential or mixed
Rural	Respondent's neighborhood is primarily rural
Male	Respondent is male
Midwest	Response generated from Ohio, Illinois or Pennsylvania
Term Change	
Heavy	Response to "LUST heavy" scenario

Demographic variables such as age, education, race and region, were input into the model, and those with statistical significance were retained for future analysis.[9] The rest of the variables were retained because theory would indicate a relationship (income, gender, number in household, extent of contamination). Local market conditions were retained for analysis for top half bidders, with the entirely residential category acting as the reference.

Results

Descriptive Statistics

The descriptive results of this analysis show consistent bid discounts across the various states for the top half bidders group of respondents. Median home values ranged from a high of just over $400,000 in Illinois (all from several downtown neighborhoods in Chicago) to a low of $88,000 in South Carolina. Median bids for the LUST scenario ranged from $272,500 in Illinois to $59,300 in South Carolina. Average discounts within each state ranged from a low of 25% to a high of 33% with an average discount of 31% across all states. Light and heavy LUST bids (reflecting suspected and confirmed contamination, respectively) are pooled together. Exhibit 4, Panel A, shows the bid discounts for the top half bids group by state.[10] Exhibit 4, Panels B and C, contain a further breakdown of bids by severity of contamination scenario.

Exhibit 4, Panel A, also displays the descriptive results of the demographic variables. It shows that 32% of the respondents were over age 40. Thirty-three

Exhibit 4 | Bidding Behavior for LUST Bidders

	KY	PA	OH	AL	IL	SC	TX	Total
Panel A: Top Half Bidding Behavior for All LUST Bidders								
Bid Results								
No. of bidders	37	6	16	10	12	43	6	130
Current home value	$90,135	$134,167	$139,063	$91,550	$403,333	$88,000	$105,000	$127,188
LUST bid	$62,486	$100,000	$94,063	$67,050	$272,417	$59,302	$74,167	$87,319
LUST discount	31%	25%	32%	27%	32%	33%	29%	31%
Demographics								
Over age 40	27%	50%	38%	10%	50%	35%	17%	32%
No HS diploma	27%	0%	6%	20%	0%	26%	33%	20%
No. in HH	3.0	3.3	2.7	2.2	1.8	3.0	2.2	2.6
Income	$33,534	$57,250	$49,063	$37,060	$138,167	$38,908	$42,875	$48,678
Non-white	8%	0%	6%	30%	0%	23%	0%	13%
Male	59%	50%	38%	30%	67%	40%	17%	46%
Midwest	0%	100%	100%	0%	100%	0%	0%	26%
Term change								
LUST heavy	38%	100%	63%	100%	0%	53%	100%	53%

Exhibit 4 | (continued)

Bidding Behavior for LUST Bidders

	KY	OH	IL	SC	Total
Panel B: Top Half Bidding Behavior for LUST Light Bidders Only					
Bid Results					
No. of bidders	23	6	12	20	61
Current home value	$96,087	$136,667	$403,333	$86,650	$157,426
LUST bid	$67,261	$94,167	$272,417	$61,150	$108,262
LUST discount	30%	31%	32%	29%	31%
Demographics					
Over age 40	35%	67%	50%	45%	44%
No HS diploma	13%	0%	0%	30%	15%
No. in HH	3.12	3.2	1.8	2.75	2.8
Income	$35,685	$49,833	$138,167	$36,643	$57,551
Non-white	9%	0%	0%	25%	11%
Male	52%	0%	67%	50%	49%
Midwest	0%	100%	100%	0%	26%

Exhibit 4 | (continued)

Bidding Behavior for LUST Bidders

	KY	PA	OH	AL	SC	TX	Total
Panel C: Top Half Bidding Behavior for LUST Heavy Bidders Only							
Bid Results							
No. of bidders	14	6	10	10	23	6	69
Current home value	$73,929	$134,167	$140,500	$91,550	$89,174	$105,000	$102,341
LUST bid	$54,643	$100,000	$94,000	$67,050	$57,696	$74,167	$69,746
LUST discount	26%	25%	33%	27%	35%	29%	31%
Demographics							
Over age 40	14%	50%	20%	10%	26%	17%	23%
No HS diploma	50%	0%	10%	20%	22%	33%	25%
No. in HH	2.93	3.3	2.4	2.2	3.13	2.2	2.77
Income	$30,000	$57,250	$48,600	$37,060	$40,878	$42,875	$41,664
Non-white	7%	0%	10%	30%	22%	0%	14%
Male	71%	50%	60%	30%	30%	17%	43%
Midwest	0%	100%	100%	0%	0%	0%	25%

percent of the Texan respondents did not have a high school diploma compared to the total average among the respondents of 20%. It is interesting to note that the education levels for the top half bidders are much lower than for the overall sample. This is not reflective of sample bias, but underscores that uneducated people are more likely to bid on contaminated property.

The average number of persons per household was 2.6, with a high of 3.3 in Pennsylvania and a low of 1.8 in Illinois. Stated incomes ranged from $138,000 in Illinois to $33,500 in Kentucky. The average income was $48,700. Thirteen percent of the respondents were non-Caucasian, 46% were male and 26% came from the Midwest (Ohio, Illinois and Pennsylvania), with the rest from east, south and western U.S. Finally, 53% of the top half respondents were presented the LUST heavy scenario.

Exhibit 4, Panel B and C, contains the same data as Panel A for the top half of the market, but broken out into LUST light and LUST heavy. Panel B is the LUST light, and four states contributed a total of sixty-one bids. The average bid overall was discounted by 31% (actually 30.8%), with a state averages range from 29% to 32%. Panel C contains the sixty-nine LUST heavy bids. Their average discount was slightly higher (31.4%, rounded to 31%), with state averages ranging from 25% to 35%.

From the results above, it appears that the percentage discounts for the top half are relatively consistent across state boundaries, only varying about 20% on the downside and 6% on the upside from the overall average of 31% for all respondents. To analyze this more thoroughly, two tests were employed. The first involved construction of a confidence interval, calculated at the 95% level. For the *pooled* top half bids, the mean bid was 31.3%, with the confidence interval extending 2.6% in either direction (*e.g.*, from 28.7% to 33.8%). Five of the seven state averages were within this band, with one state at 27% and another at 25%. When the same process is repeated at the 95% level for LUST light, the mean bid was 30.8%, with the confidence interval extending 3.6% in either direction (*e.g.*, from 27.3% to 34.4%). All four states were within this band. Finally, repeating the process at the 95% level for LUST heavy, the mean bid was 31.4%, with the confidence interval extending 3.8% in either direction (*e.g.*, from 27.6% to 35.2%). Three of the six states were within this band, with three missing by one to three percentage points on the downside. Two of the three that were outside the band also had the lowest number of bidders, and their outcomes may be particularly sensitive to a small number of influential bids. Overall, this generally supports the notion that economic behavior concerning LUSTs and potentially other negative amenities is consistent among many markets in the U.S.

The other technique employed included an ANOVA analysis of the bids. The ANOVA results, shown in the Appendix, include not just the average bids for each state, but their distribution. Ohio was used as the base state against which the other state results were compared. Results for top half bids showed that six of the seven states were statistically similar, with only Alabama being statistically different from the rest, at the 90% level of confidence.

Bidding behavior was also relatively consistent across top quarter bidders. The average current home value of respondents was $141,800, with a range from $460,000 in Illinois to $83,400 in Alabama. Average LUST bids ranged from $349,000 in Illinois to a low of $68,400 in South Carolina. Sixty-five respondents were included in this sample with an average reduction in value of 19% associated with the LUST scenario.

Thirty-five percent of the respondents in the top quarter bids group were over age 40. Fifteen percent did not have a high school diploma, and the average number of persons per household was 2.5. Incomes ranged from a high of $153,600 in Illinois to a low of $35,600 in Kentucky. Non-whites made up 14% of the sample, 45% were male and 28% were from the Midwest. Twenty-eight percent of the respondents were administered the survey that included the LUST heavy scenario. The descriptive results for the top quarter bid scenario are shown in Exhibit 5. Because those with lighter contamination were more likely to bid, this group contains a higher pro-rata share of LUST light bidders.

From the results above, it appears that the percentage discounts for the top quarter are also relatively consistent across state boundaries. However, their range varies more than the top half results around the 19% average discount. Because many of the state bid totals were small, no statistical tests were run on this sample.

Five of the seven states had a fairly narrow deviation from the overall average, within four percentage points from the mean; however, Alabama and Illinois did vary substantially. An explanation could be that the Alabama respondents were in an area that had extensively well-known environmental problems, thus a LUST could be comparably less offensive. The Illinois respondents were all high-income urban dwellers, and many lived in condominiums. Hence, their behavior may be expected to be more risk averse than that of other respondents. These aside, the results support the notion that economic behavior concerning LUST events and potentially other negative amenities is consistent among several states.

ANOVA results (shown in the Appendix for top quarter bids) also showed that six of the seven states were statistically similar, with only Alabama being statistically different from the rest, at the 95% level of confidence.

Probit Analysis

The results of the probit model show the impact of the independent variables (*e.g.*, demographics) on the respondent's probability of being in the top half bid and top quarter bid groups. Exhibit 6, Panels A and B, show the probit results for the top half bidding pool of 130 respondents out of the original total of 1,115 respondents (including those from West Virginia). Panel A addresses demographic variables, a dummy variable for light and heavy contamination, and uses a regional U.S. variable for place. Panel B adds the dummy variables for local market conditions. Panel C contains the same data without the light and heavy variable and replaces the regional variable with individual states.

Exhibit 5 | Top Quarter Bidding Behavior for All LUST Bidders

	KY	PA	OH	AL	IL	SC	TX	Total
Bid Results								
No. of bidders	19	3	8	6	7	19	3	65
Current home value	$94,737	$170,000	$142,500	$83,417	$460,714	$84,947	$143,333	$141,838
LUST bid	$73,526	$140,000	$113,125	$74,250	$349,286	$68,474	$113,333	$111,592
LUST discount	22%	18%	21%	11%	24%	19%	21%	19%
Demographics								
Over age 40	37%	0%	50%	17%	57%	37%	0%	35%
No HS diploma	21%	0%	0%	17%	0%	26%	33%	15%
No. in HH	3.1	2.0	2.9	2.0	2.1	2.6	2.7	2.5
Income	$35,592	$66,917	$48,813	$36,683	$153,571	$35,739	$59,000	$52,595
Non-white	5%	0%	0%	17%	0%	37%	0%	14%
Male	63%	67%	38%	50%	71%	21%	0%	45%
Midwest	0%	100%	100%	0%	100%	0%	0%	28%
Term Change								
Heavy	37%	100%	50%	100%	0%	42%	100%	48%

Exhibit 6 | Probit Results

	β Value	Std. Error	t value	VIF
Panel A: Top Half Bidding Pool All LUST Bidders				
Intercept***	−1.3050	0.1786	−7.3073	
Over age 40*	0.2058	0.1174	1.7527	
No HS diploma***	0.7581	0.1573	4.8204	
No. in HH	0.0599	0.0437	1.3720	
Male**	0.2312	0.1028	2.2497	
Non-white	0.2030	0.1639	1.2385	
Income**	−0.0000	0.0000	−2.2291	
Midwest	0.1498	0.1370	1.0931	
Heavy**	−0.2332	0.1102	−2.1168	
Panel B: Top Half Bidding Pool All LUST Bidders with Local Market Conditions				
Intercept***	−1.3162	0.1857	−7.0869	
Over age 40*	0.2096	0.1177	1.7805	
No HS diploma***	0.7599	0.1576	4.8203	
No. in HH	0.0631	0.0437	1.4412	
Male**	0.2211	0.1031	2.1441	
Non-white	0.2103	0.1640	1.2820	
Income**	−0.0000	0.0000	−1.9976	
Midwest	0.2056	0.1434	1.4331	
Heavy**	−0.2667	0.1212	−2.3783	
Primarily residential / mixed	−0.1516	0.1354	−1.1611	
Rural neighborhood	0.1285	0.1271	1.0107	
Panel C: Top Half Bidding Pool Using Individual States				
Intercept***	−1.3578	0.1871	−7.2577	
Over age 40	0.1743	0.1220	1.4288	1.1953
No HS diploma***	0.7484	0.1626	4.6034	1.0455
No. in HH	0.0637	0.0468	1.3609	1.2093
Male**	0.2348	0.1059	2.2166	1.0194
Non-white	0.0574	0.1723	0.3332	1.0862
Income**	−0.0000	0.0000	−1.9970	2.5128
Pennsylvania	−0.2092	0.2206	−0.9482	1.2943
Ohio	0.2919	0.1895	1.5404	1.2995
Alabama	−0.2360	0.1950	−1.2104	1.3343
Illinois	0.2458	0.2833	0.8677	3.1834
South Carolina***	0.3798	0.1484	2.5600	1.5098
Texas***	−0.8338	0.2207	−3.7777	1.4260

Notes: Panel A: Null Deviance: 802.9766 on 1114 degrees of freedom; Residual Deviance: 759.2869 on 1106 degrees of freedom. Panel B: 802.9766 on 1114 degrees of freedom; 755.3461 on 1104 degrees of freedom; Panel C: Null Deviance: 802.9766 on 1114 degrees of freedom; Residual Deviance: 721.2895 on 1102 degrees of freedom.
* Significant at the .10 level.
** Significant at the .05 level.
*** Significant at the .01 level.

Because the probit model only addresses willingness to bid, no discounted price data appear in this part of the study. One of the most important demographic indicators in bidding is the education of the respondent. Referring to Panel A in Exhibit 6, those with no high school education were more likely to bid. This relationship was statistically significant at a level of confidence of .01. A positive sign on the coefficient indicates a positive relationship with the probability of bidding; however, the β coefficients do not have a percentage interpretation in their current form. In the top half bid group, the variables generally performed as expected. Respondents over age 40 were more likely to bid on the scenario than those under age 40 (significant at the .10 level). Males are more likely to bid than females, which is significant at a confidence level of .05. Income has a negative affect on bidding. As incomes increase, the probability of bidding decreases. This is significant at a level of .05.

As expected, the more severe the described scenario, the less likely respondents are to bid. The variable *heavy* (indicating the heavy LUST scenario) is significant at the level of .05. The other variables, including number of persons per household, race and a variable for Midwest respondents was not significantly different from zero.

Panel B in Exhibit 6 has the same model and variables as Panel A, but adds the two dummy variables for local market conditions. Neither primarily residential/ mixed neighborhoods nor residential areas are statistically significant. This supports the notion that a form of local market conditions, neighborhood type, is not a factor in the likelihood of bidding on contaminated LUST property.

Panel C in Exhibit 6 replaces the regional and heavy dummies with states, to determine if there are differences between the states in the probability of bidding. The heavy dummy was removed for statistical reasons (perfect collinearity). The other demographic variables remain essentially unchanged, with the exception of age (over 40), which is still positive but is no longer statistically significant. Four of the six states are not significantly different from the reference category (Kentucky). Texas is associated with significantly fewer bids. The language unique to the LUST super-heavy scenario reflecting undrinkable well water explains this. Even though South Carolina respondents were more likely to bid, these findings generally support the research hypothesis that bidding behavior is similar across markets.

The same probit analysis (without the states) was undertaken for the top of the bidding pool. The results of the probit analysis on the top quarter bid group are shown in Exhibit 7, which is based on sixty-five bidders. When the dependent variable was reduced to the top quarter of all bidders, only two variables remained significant. This is expected, however, because as the discount becomes smaller, there is less compensation for contamination. Respondents have more choice (*i.e.*, an uncontaminated site) at a similar or the same price and therefore are less likely to bid regardless of demographic features. Thus, there will be less difference between subgroups.

Exhibit 7 | Probit Results for Top Quarter Bidding Pool All LUST Bidders

	β Value	Std. Error	t value
Intercept***	−1.5565	0.2123	−7.3322
Over age 40	0.2124	0.1416	1.5004
No HS diploma***	0.5114	0.1910	2.6776
No. in HH	0.0092	0.0542	0.1698
Male	0.1494	0.1253	1.1920
Non-white	0.2391	0.1938	1.2341
Income	−0.0000	0.0000	−1.0229
Midwest	0.0554	0.1697	0.3265
Heavy**	−0.2652	0.1335	−1.9861

Notes: Null Deviance: 495.6238 on 1114 degrees of freedom; Residual Deviance: 478.9625 on 1106 degrees of freedom.
*Significant at the .10 level.
**Significant at the .05 level.
***Significant at the .01 level.

As the discounts become smaller, the results of the top quarter bid group show that lack of education remains a deciding factor in the probability of bidding (the statistical significance of this variable remains at .01). The lack of a high school education positively influences a respondent's willingness to bid on the contamination scenario.

The other variable that remains significant in the top quarter group is the terminology variable *heavy*. As expected, the more severe the contamination, the less likely respondents are willing to bid. This variable was significant at a level of confidence of .05.

Conclusion

This study analyzes several residential contingent valuation studies conducted throughout the U.S. on the effects of leaking underground storage tanks on residential property. Over the past several years, CV has been used to illustrate the potential residential buyer bid prices for contaminated property and those discounts associated with other negative amenities. Research performed in eight states concerning potential petroleum contamination from gas stations on residential property is addressed. The data set includes 1,115 telephone interviews and examines the consistency of the results for releases from LUSTs over different

markets, controlling for income, age, education, level of contamination, local market type and other factors.

The results of this study generally support the research hypothesis that economic behavior (in this case bidding discount activity) is by in large consistent across markets and state lines. The average discount for the top half of the bidding pool (assuming the marginal top bidders get the property) indicate an average discount of 31%, with state average discounts ranging from 25% to 33%, a fairly narrow band.

For all combined LUST events, the (largest *N*) average is a 31% loss, $\pm$ 2.6%, at a 95% level of confidence. Averages for five of the seven states fall into this band. ANOVA results indicate six of the seven states are statistically similar, with only Alabama bids being significantly different. Evaluating LUST heavy and LUST light responses separately generates findings that are consistent with this. The LUST light scenario shows a smaller variation than LUST heavy. For the top quarter of bidders, the average discount was 19%, with results ranging from 11% to 24%. The results were still consistent, but exhibited more variation than the top half bidders, probably due to small sample sizes.

Probability of bidding results was similar. A state dummy variable showed that five states were of a similar grouping, with one being significantly more likely to bid, and one less likely. The less likely state (Texas) can be explained based on the severity of the bidding scenario, which contained assumptions regarding undrinkable well water.

The scope effect is also fairly consistent. The LUST light discount was 30.8%, while the LUST heavy was 31.4%. For three states where both light and heavy were used, two (South Carolina with a stratified random statewide sample, and Ohio where almost all respondents were urban/suburban) had LUST heavy discounts larger than LUST light, which is consistent with theory. Results from Kentucky are reversed, but sampling in this state was from two distinct geographic regions, one of which was on the western part of the state and consisted of urban and suburban residents. The other region was a rural area located in the eastern part of the state.

The relatively narrow band of discounts found across regions is consistent with the literature on high voltage overhead transmission lines (Delaney and Timmons, 1992).[11]

Proxy variables for local market conditions, neighborhood type, were not statistically significant variables in bidding on contaminated LUST sites. This supports the notion that local market conditions may not be as important as buyer characteristics with respect to stated preferences of bidding on residential property proximate to a LUST.

Aside from the local market and state similarity issues, the probit results indicate that several factors are associated with the likelihood of bidding on a contaminated

residential LUST property. The main indicators are confirmed contamination (negative) and no high school education (positively associated with bidding). Those over age 40 and males were significantly more likely to bid (in some models), and income was negatively associated with bidding. The gender result is consistent with the findings of McClelland, Schultze and Hurd (1990), who found females were more concerned with living near a risky facility than were men. The effects of LUST contamination should mean larger discounts in more wealthy areas, which is consistent with the generally higher discounts in Illinois and Ohio.

One interesting finding is that one of the most important demographic sub-markets for bidders on contaminated property appears to be under-educated men. Thus, real estate agents faced with selling a residential property that has disclosed environmental contamination are likely to find this market segment most receptive.

Benchmarking the stated preference results with revealed preference findings, the percentage discounts, when appropriately adjusted for economic behavior, are also fairly consistent with empirical findings from peer-reviewed literature. Simons, Bowen and Sementelli (1997, 1999) found reductions in Ohio residential property values attributable to LUST events from 14% to 17% for municipal drinking water situations. The top half bidder findings for Ohio and overall were 32% and 31%, respectively, while the top quarter bidder responses were 21% and 19%, respectively. Actual loss outcomes in Ohio also ranged up to 25% when the house that had petroleum contamination used well water (Simons, 2002b). Texas bidders, when faced with a similar undrinkable well water scenario, yielded bids between 21% and 29% (top quarter and top half). Thus, the CV results correspond closely to the top quarter figures and more generally to the top half of the bidding pool. Thus, interpreting CV responses using the marginal bidder approach provides results that are much closer to market outcomes than using average loss figures (which in this survey are in excess of 50%). However, they still appear to be slightly higher than revealed outcomes. This difference is attributed to the relative lack of information concerning the contamination that was available to buyers and sellers at the time of sale for actual transactions, compared with ''full'' information for the surveys.

These results indicate a departure from using the average responses from the ''willingness to pay'' approach used in older CV studies outside real estate, which seems inappropriate in this context. Instead, a marginal bidder approach gives results closer to revealed outcomes.

It appears that the percentage discounts for LUST contamination are relatively consistent across state boundaries, only varying about 20% on the downside and 6% on the upside from the aggregate average of 31% for all respondents. Bidding discounts are generally consistent; that is behavior is consistent in five out of seven states at a 95% level of confidence, and some of the outliers can be explained. ANOVA results indicate six of the seven states surveyed are not

statistically different. Similar scope effects were also evident, and could be explained.

While certainly not perfect, survey results support the notion that economic behavior concerning residential property affected by a LUST (and potentially other negative amenities) is generally consistent among many markets across the U.S. Thus, from this study of revealed preferences, demographic factors such as education and gender, income of potential buyers and age, and factors related to knowledge of contamination, are likely to be more important than local market conditions or states (as a proxy for macroeconomic conditions). The results of this research could be useful in adjusting case study results from other parts of the U.S. to specific locales where local data are insufficient.

Appendix
ANOVA Results for CV Bids

Panel A: Top Quarter Discount

	DF	Sum of Sq.	Mean Sq.	F Value	Pr(F)
Texas	1	0.0007	0.0007	0.0498	0.8241
South Carolina	1	0.0231	0.0231	1.6708	0.2012
Illinois	1	0.0011	0.0011	0.0770	0.7823
Alabama	1	0.0790	0.0790	5.7206	0.0200
Pennsylvania	1	0.0065	0.0065	0.4741	0.4938
Kentucky	1	0.0220	0.0220	1.5917	0.2120
Residuals	59	0.8145	0.0138		

Note: Residual standard error: 0.1174933. Reference Category: Ohio bids.

Panel B: Top Half Discount

	DF	Sum of Sq.	Mean Sq.	F Value	Pr(F)
Texas	1	0.0196	0.0196	0.8660	0.3539
South Carolina	1	0.0156	0.0156	0.6916	0.4072
Illinois	1	0.0017	0.0017	0.0752	0.7844
Alabama	1	0.0684	0.0684	3.0328	0.0841
Pennsylvania	1	0.0016	0.0016	0.0730	0.7874
Kentucky	1	0.0082	0.0082	0.3622	0.5484
Residuals	124	2.7948	0.0225		

Notes: Residual standard error: 0.1501295. Reference Category: Ohio bids.

Endnotes

[1] Thanks to a JRER reviewer for these insights.

[2] At least one author in each of the three studies cited in this paragraph is currently engaged as an opposing expert witness in petroleum litigation cases involving the senior author.

[3] A list of potential home owners was provided by Intelligent Lookup Services. They are Maryland-based data vendor that provided calling lists for about half of the usable surveys. In addition to phone numbers, addresses, income categories and names, the calling lists included a potential homeowner category with a score. Those scored 7–9 were very likely to be a homeowner or a confirmed homeowner, based on survey data, location, mortgage and property tax records, U.S. census data, length of residence, address, and income, among other factors. Only these potential respondents were contacted. We believe that these potential homeowners are a reasonable representation of the population of homeowners with listed telephone numbers in the counties surveyed.

[4] Except for the state of South Carolina, the counties were not randomly selected. Typically 2–3 counties near the focal area adjacent to contamination were selected.

[5] This is provided for comparison purposes only, and does not assert that the sample, as presented, was collected in such a way as to be representative of the population of U.S. homeowners.

[6] For the sake of brevity, only the LUST scenario is included in this study. The other scenarios included PCBs, railroad tracks, a business park, a plant explosion, coal sludge, airborne chemical emissions, brownfields and a pipeline rupture with MTBE (a gasoline additive). If the other scenarios are of interest, please contact the authors.

[7] Consider a property offered for sale for $1,000,000 by the seller. Four bids are made: $950,000, $900,000, $750,000 and $400,000. The average of these bids is $750,000. If asked what the likely sales price would be, the logical answer is the top bid of $950,000, rather than the average sales price of $750,000. The average sale price of the bidding pool (willingness to pay) has little bearing on final price because the lower bids only make the market price if the other bids drop out.

[8] The marginal buyer approach is one way to deal with the hypothetical bias validity threat sometimes attributed to contingent valuation analysis. This approach recognizes unreasonably low "bottom-fisher" bids as outside the market, and removes them from the discounted price calculations. This also serves to narrow the gap often found between revealed preference studies using regression analysis and those based upon survey data.

[9] We also tried running house value independently as a variable, but the multicollinearity with income was unacceptably high.

[10] West Virginia was dropped because the number of bidders was too small to make meaningful comparisons. The data have been retained for the probit analysis.

[11] Delaney and Timmons (1992) surveyed appraisers throughout the U.S. on the effect of high voltage overhead transmission lines on residential property values. Regional discounts around an average of 10% value loss for properties proximate to a high voltage overhead transmission line were as follows: Midwest −7.8%, West Coast −9.8%, South Central −0.6%, Rocky Mountains −10.9%, Southeast −10.7%, Mid Atlantic −10.9%, Plains −12.5% and New England −15.5%.

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