

Methods and Techniques for Contaminated Property Valuation

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As noted in the previous edition of “Environment and the Appraiser,”¹ assignments involving contaminated properties, or properties that may be impacted by environmental contamination, often require specialized valuation methods and techniques. The Appraisal Standards Board provides guidance on this issue in Advisory Opinion 9 (AO-9), “The Appraisal of Real Property That May Be Impacted by Environmental Contamination,”² which states that *[e]stimating the effects of environmental contamination on real property value usually involves the application of one or more specialized valuation methods* (AO-9, Lines 182–184). Like all methods for valuing real property, these methods and techniques must be derived from or based upon one or more of the three approaches to value: sales comparison approach, income capitalization approach, and cost approach.

Over time, appraisers who specialize in analyzing the impacts of environmental contamination on real property interests have developed specialized methods and techniques that adapt standard appraisal approaches to these assignments. These methods are discussed in the peer-reviewed literature in the field and elsewhere. Since many assignments involving contaminated properties are for litigation, it is important to utilize methods and techniques that have gained general acceptance in the appraisal profession, or at least in that segment of the profession that specializes in contaminated property valuation. The purpose of this article is to provide an overview of professionally accepted methods and techniques for valuing contaminated properties or estimating the effects of environmental contamination on the market value of real property. These

methods and techniques can generally be described as follows:

- analysis of environmental case studies
- paired sales analysis of potentially impacted properties
- multiple regression analysis of potentially impacted neighborhood areas or properties in proximity to a contamination source
- use of market interviews to collect data and information used in other approaches or to support and supplement the results of other analyses
- adjustment of income and yield capitalization rates to reflect environmental risk premiums in an income capitalization analysis

Other methods may emerge over time, but as yet have not achieved general acceptance in the appraisal profession or do not have the required linkage to one of the three traditional approaches to value.

Appraisal Standards Requirements and Guidance

Prior to undertaking assignments requiring specialized methods and techniques for the valuation of contaminated properties, the *Uniform Standards of Professional Appraisal Practice* (USPAP) admonishes appraisers to *be aware of, understand, and correctly employ those recognized methods and techniques that are necessary to produce a credible appraisal* (USPAP, Standards Rule 1-1(a), Lines 511–512). Further, an appraiser must have competence in the required methods and techniques and their application in the field of contaminated property valuation. Advisory Opinion 9 states that *an appraiser must have the req-*

1. Thomas O. Jackson, “Appraisal Standards and Contaminated Property Valuation,” *The Appraisal Journal* (April 2003): 127–133.

2. Appraisal Standards Board, Advisory Opinion 9, “The Appraisal of Real Property That May Be Impacted by Environmental Contamination,” 2003, Lines 1–191.

uisite knowledge about appropriate methods (AO-9, Line 57) and that [a]n appraiser who lacks knowledge and experience in analyzing the impact of environmental contamination on the value of real property must take steps necessary to complete the assignment competently (AO-9, Lines 58–60). The Competency Rule of USPAP³ sets forth three steps that appraisers must take in such situations: (1) disclose the lack of knowledge and/or experience to the client before accepting the assignment; (2) take all steps necessary or appropriate to complete the assignment competently; and (3) describe the lack of knowledge and/or experience and the steps taken to complete the assignment competently in the report (USPAP, Lines 364–368). Similarly, the Appraisal Institute's Guide Note 6, "Consideration of Hazardous Substances in the Appraisal Process,"⁴ notes that an appraiser who does not have the required knowledge and experience in *this special field* may accept such an assignment *provided the appraiser discloses such lack of knowledge and experience to the client prior to acceptance of the assignment, arranges to complete the assignment competently, and describes the lack of knowledge or experience and the steps taken to competently complete the assignment in the report.*

As in all valuation assignments involving contaminated properties, opinions regarding property value diminution must be based on real estate market data such as verifiable sales transactions. As stated in AO-9, [t]he analysis of the effects of increased environmental risk and uncertainty on property value (environmental stigma) **must be based on market data, rather than unsupported opinion or judgment** (AO-9, Lines 178–180. Emphasis added). This point is reinforced in the "Standard on the Valuation of Property Affected by Environmental Contamination,"⁵ of the International Association of Assessing Officers, which states:

Courts in Florida (*Finkelstein v. Dept. of Transportation*, 1995), Georgia (*Hammond v. City of Warner Robbins*, 1997), Illinois (*Techalloy Co., Inc. v. Property Tax Appeal*

Board, 1997), Iowa (*Bockeloo v. Board of Review of City of Clinton*, 1995), Massachusetts (*Reliable Electric Finishing Co. v. Board of Assessors*, 1991) and Ohio (*Volpelgesang v. CESOS International, Inc.*, 1993) have all held that **the mere allegation of unmarketability is not enough**. Loss or diminution of value **must be proven by market data** (emphasis added).

Accordingly, it is unacceptable practice to assume that environmental contamination will reduce the value of a property without adequate support derived from information in the relevant real estate market. Further, such information must be pertinent to a professionally acceptable method or technique for valuing contaminated properties.

Perspectives from the Literature

In 1991, the Appraisal Institute sponsored a symposium entitled "Measuring the Effects of Hazardous Materials Contamination on Real Estate Values: Techniques and Applications,"⁶ organized by the late William N. Kinnard, Jr. At that time, Kinnard discussed the difficulties with traditional appraisal methods such as "comparable sales analysis" and "paired sales or sales-resale analysis," which he termed "valuation by analogy," as ideals that can usually not be employed in valuing contaminated properties.⁷ Kinnard and other symposium participants pointed out the difficulties of finding sales of comparable properties with similar environmental issues as the subject property and the time and effort required to collect information on a potentially comparable property's environmental history. This perspective was echoed in the early writings of Patchin, Wilson, Mundy, and others who also participated in the 1991 symposium. Indeed, Kinnard lamented the lack of knowledge and information to quantify uncertainty "about both market and regulatory response"⁸ to a contaminated property, attributable today to perceived environmental risk or stigma.⁹ Nevertheless, Kinnard's paper for this symposium discusses the use of multiple regression analysis as a

3. The Appraisal Foundation, *Uniform Standards of Professional Appraisal Practice*, 2003, "Competency Rule," Lines 360–368.

4. Appraisal Institute, *Guide Notes to the Standards of Professional Appraisal Practice of the Appraisal Institute*, 2003, Guide Note 6, "Consideration of Hazardous Substances in the Appraisal Process," 17–24, 18.

5. International Association of Assessing Officers, "Standard on the Valuation of Property Affected by Environmental Contamination," Section 4—Specific Factors Influencing Value (Chicago: International Association of Assessing Officers, 2001): 14.

6. Appraisal Institute, *Measuring the Effects of Hazardous Materials Contamination on Real Estate Values: Techniques and Applications*, proceedings of October 1991 symposium (Chicago: Appraisal Institute, 1992).

7. William N. Kinnard, Jr., "Measuring the Effects of Contamination on Property Values: The Focus of the Symposium in the Context of Current Knowledge," in symposium proceedings, *Measuring the Effects of Hazardous Materials Contamination on Real Estate Values: Techniques and Applications* (Chicago: Appraisal Institute, 1992), 4.

8. *Ibid.*

9. See definitions in AO-9, Lines 81–82 and 90–91.

“method of measuring reduced property values.”¹⁰ This method can be used when there are “sales transaction data in large quantities,” for measuring price differences in different locations or “distance zones.” This technique would have applicability in performing a proximity analysis or an analysis comparing a potentially impacted area with an otherwise similar but unimpacted control area, as will be discussed in the next section. Kinnard also discusses “survey research techniques,” but warns that they must be carefully designed and implemented. Interestingly, Kinnard notes that “the results from survey analyses must be tempered with the knowledge that **the expectation of events is almost invariably more negative** and more sharply delineated, at least when [the events], are expected to affect oneself negatively, **than is realized when the events occur** (emphasis added).”¹¹ This observation—and warning—from this seminal thinker suggests that analysis and conclusions drawn from abstract techniques, such as contingent valuation surveys, could overstate any adverse impacts of environmental contamination on property values.

Lastly, Kinnard decries what he refers to as “the judgmental model in the abstract,” based on “a series of logical assumptions” rather than “actual, verified, bona fide market data,” such as “cost, rental or operating expense data, as well as market sales transaction data.”¹² As previously noted, AO-9 and other sources state that the analysis of the effects of contamination on market value “must be based on market data, rather than unsupported opinion or judgment” (AO-9, Lines 179–180). No matter how compelling or logical the argument, the reliable measurement of the effects of contamination on market value must be based on market data. A credible valuation opinion cannot be produced in the abstract without clear, direct market support and evidence.

Patchin¹³ was an early advocate of the use of the income capitalization approach with risk adjustments to capitalization rates as the appropriate technique for measuring the effect of contamination on market value. These environmental risk adjustments, however, were not extracted from comparable sales,

but in many cases were based on “judgment.” According to proponents of this approach, and as noted in the 1991 symposium, this was because few or no comparable sales of contaminated properties existed at that time. By 1994, Patchin had concluded that:

The market is slowly becoming accustomed to dealing with contaminated property. Properties formerly believed to be unmarketable are now beginning to sell, usually with a great deal of difficulty and with severe discounts. Proper analysis of this steadily increasing flow of market data can give appraisers another tool in the measurement of the losses in value caused by contamination.¹⁴

Patchin posits that this sales information should be analyzed through a case studies approach. In general, case studies are useful when appropriate sales cannot be located in the same local market area as the subject property, but can be found in other areas. Case studies will be discussed in the following section.

In 1999, Kinnard and Worzala published the results of a survey of North American appraisers as to how they value contaminated properties.¹⁵ Based on 86 usable survey responses (out of 192 delivered), Kinnard and Worzala found that 80% of the appraisers used the sales comparison approach when valuing contaminated properties, while 79% used the income capitalization approach. Obviously, many of the respondents used both approaches. Within the income capitalization approach, direct capitalization was preferred to discounted cash flow analysis. The most frequently mentioned adjustment within the income capitalization approach was to increase the capitalization rate to reflect the increased risk associated with the property’s environmental condition. When asked about the basis for risk adjustments for environmental stigma, most (83%) indicated “market sales data,” but a significant number (51%) still relied on “judgment.” Many also used buyer/seller/broker “opinions,” either alone or as supplements to an approach based on sales data.

In 2002, the Appraisal Institute and The Centre for Advanced Property Economics sponsored a symposium entitled “Environmental & Property

10. Kinnard, 4–5.

11. *Ibid.*, 5.

12. *Ibid.*

13. Peter J. Patchin, “Valuation of Contaminated Properties,” *The Appraisal Journal* (January 1988): 7–16.

14. Peter J. Patchin, “Contaminated Properties and the Sales Comparison Approach,” *The Appraisal Journal* (July 1994): 402–409, 402.

15. William N. Kinnard, Jr., and Elaine M. Worzala, “How North American Appraisers Value Contaminated Property and Associated Stigma,” *The Appraisal Journal* (July 1999): 269–279.

Damages: Standards, Due Diligence, Valuation and Strategy.”¹⁶ This symposium included presentations on a variety of reporting, methodological, and appraisal standards issues. The framework presented in this article is consistent with that presented at the 2002 symposium and with AO-9. This conceptual framework and related methods and techniques have a foundation in the professional literature on the topic.¹⁷

Methods and Techniques

Valuation Framework

As explained in AO-9, the effects of environmental contamination on the value of real property can be categorized as follows:

- *cost effects*, or deductions for costs to remediate a contaminated property to appropriate regulatory standards, recognizing that not all costs are recognized by the market as having an effect on value;
- *use effects*, or limitations on the highest and best use of properties that may be impacted by environmental contamination, recognizing that these effects would be meaningful only if they limited the use of the site or property that would be the highest and best use without the effect of the contamination, and would otherwise meet the four highest and best use criteria (physically possible, legally permissible, financially feasible and maximally productive); and
- *risk effects*, or the effects on value due to increased perceptions of environmental risk by relevant market participants (AO-9, Lines 170–180).

These factors influence the value of a potentially impacted site according to the following formula:

$$\begin{aligned} \text{Impaired value} &= \text{Unimpaired value} \\ &- \text{Cost effects (remediation and related costs)} \\ &- \text{Use effects (effects on site usability)} \\ &- \text{Risk effects (environmental risk/stigma)} \end{aligned}$$

Further, since property value diminution is the difference between the impaired and unimpaired values¹⁸ the following formula can be derived:

$$\begin{aligned} \text{Property value diminution} &= \text{Cost effects} \\ &\quad (\text{remediation and related costs}) \\ &+ \text{Use effects (effects on site usability)} \\ &+ \text{Risk effects (environmental risk/stigma)} \end{aligned}$$

These formulas are consistent with the guidance provided by AO-9 with respect to the application of USPAP standards to the valuation and analysis of contaminated properties.

In the first formula, the unimpaired value of a contaminated property can usually be estimated using a traditional sales comparison approach, income capitalization approach, or cost approach to value. The appraiser estimating this unimpaired value must be careful to qualify it as hypothetical and as necessary for the intended use of the assignment results. In contrast, the impaired value of a contaminated property, or property that may be impacted by environmental contamination, can rarely be estimated through one of the traditional approaches to value due to data limitations and other factors; thus, alternative methods must be utilized. However, these methods must be based on relevant market data and must be consistent with the applicable requirements of USPAP for appraisal development.

In measuring the three potential effects on value (cost, use, and risk), cost effects are derived from remediation costs, which typically are estimated by environmental specialists. Assuming the market recognizes these costs, the appraiser can usually deduct them as a lump sum from the unimpaired value in a similar manner to a capital expenditure for deferred maintenance. When a discounted cash flow analysis is used, the anticipated costs can be deducted from the projected cash flows in the periods in which they are projected to occur. Uncertainty regarding cost estimates, projection, and timing would be reflected in the environmental risk premium added to the unimpaired property or equity yield rate (risk effect). Use effects can be analyzed by estimating the highest and best use of the subject contaminated property in an impaired and unimpaired condition. If the conclusions of the two highest and best use analyses are the same, then there are no use effects on value. If they differ, then the unimpaired and im-

16. "Environmental and Property Damages: Standards, Due Diligence, Valuation & Strategy," co-sponsored by The Centre for Advanced Property Economics and the Appraisal Institute, Toronto (April 4–7, 2002).

17. Additional reviews and compilations of literature in this field can be found in Thomas O. Jackson, "The Effects of Environmental Contamination on Real Estate: A Literature Review," *Journal of Real Estate Literature* (2001) 9, no. 2: 93–116, and Richard J. Roddewig, ed., *Valuing Contaminated Properties: An Appraisal Institute Anthology* (Chicago: Appraisal Institute, 2002).

18. See Jackson, "Appraisal Standards and Contaminated Property Valuation," and AO-9.

paired values would be estimated for different uses and compared. Risk effects, on the other hand, are derived from the perceived environmental risk and uncertainty related to a property's environmental condition. Measuring this element usually requires more sophisticated and less direct techniques; these methods and techniques are discussed below.

Paired Sales Analysis

Paired sales analysis can be used to estimate the effects of contamination when there are fairly recent sales of properties in a similar environmental condition as the subject of the analysis within the market area, or the area of alleged impacts. For example, this can occur when industrial properties in an industrial district are potentially impacted by the same contamination source. In a paired sales analysis, sales of properties in the impacted area are paired with sales of otherwise similar properties located outside the impacted area in order to determine the effects, if any, of contamination on properties within the impacted area. With a sufficient number of paired sales, the impact of the adverse environmental condition on the subject property or properties can be estimated. However, the appraiser must also consider the effects of nonenvironmental differences between the paired sales properties in the analysis. Such differences might arise from locational attributes unrelated to any environmental issues, as well as physical differences in the properties.

The use of paired sales analysis (paired data analysis) is discussed in *The Appraisal of Real Estate*,¹⁹ where it is described as “a theoretically sound method,” and as “helpful and persuasive” even “when limited data are available.” However, the use of quantitative adjustments in a paired sales analysis or any other form of the sales comparison approach should not go beyond the available data. In situations where quantitative adjustments are not possible or appropriate, a relative comparison analysis may be performed. *Relative comparison analysis* is defined in *The Appraisal of Real Estate* as follows:

A qualitative technique for analyzing comparable sales; used to determine whether the characteristics of comparable property are inferior, superior, or similar to

those of the subject property. Relative comparison analysis is similar to paired data analysis, but quantitative adjustments are not derived.²⁰

When a relative comparison analysis is used in a paired sales analysis of properties with potential environmental impacts, the unimpaired comparables are given a composite ranking as inferior, superior, or similar to the impaired subject, based on individual comparisons of nonenvironmental elements such as size, age, etc. If the prices of the unimpaired comparables are consistent with or “bracket” the impaired sale, then there would be no indicated property value diminution due to the impaired property's environmental condition. On the other hand, if the impaired property's sale price falls below the unimpaired comparables that ranked inferior on the nonenvironmental elements of comparison, then the indication of the impact of contamination is otherwise. In this situation, a range of indicated diminution could be derived and possibly reconciled to a point estimate. Of course, this procedure is dependent on identifying impaired sales with the same environmental condition as the appraiser's subject, as well as identifying unimpaired comparables that are reasonably similar to the impaired sales except for their environmental condition at the time of sale. Jackson²¹ characterizes this as a two-step procedure.

Bell²² also discusses the use of paired sales analysis in analyzing the impact of environmental contamination on property value. Bell describes paired sales analysis as “one of the most useful applications of this approach (sales comparison approach),” where “the subject property, or similarly impacted properties, termed *test areas*, and unimpaired properties, termed *control areas*” are compared and “if a legitimate detrimental condition exists, there will likely be a measurable (and clearly discernable) and consistent difference between the two sets of market data; if not, there will likely be no significant difference between the two sets of data. This process involves the study of a group of sales with a detrimental condition, which are then compared with a group of otherwise similar market data without the detrimental condition.”²³

19. Appraisal Institute, *The Appraisal of Real Estate*, 12th ed. (Chicago: Appraisal Institute, 2001), 438.

20. *Ibid.*, 445.

21. Thomas O. Jackson, “The Effect of Previous Environmental Contamination on Industrial Real Estate Prices,” *The Appraisal Journal* (April 2001): 200-210.

22. Randall Bell, *Real Estate Damages: An Analysis of Detrimental Conditions* (Chicago: Appraisal Institute, 1999).

23. *Ibid.*, 19-20.

Analysis of Environmental Case Studies

The additional elements affecting the value of contaminated properties may make it difficult to identify and research sales of properties in a similar environmental condition and in the same market area as the subject property. In this situation, the appraiser may need to analyze comparable impaired sales from outside the subject property's market area. These sales and the environmental circumstances surrounding them are referred to as case studies. The environmental condition of the case study properties should be similar to the environmental condition of the subject property. Among the elements to be considered are those listed as "Relevant Property Characteristics" in AO-9. Relevant property characteristics may include, but are not limited to:

1. whether the contamination discharge was accidental or permitted;
2. the status of the property with respect to regulatory compliance requirements;
3. the remediation lifecycle stage (before, during, or after cleanup) of the property as of the date of value;
4. the contamination constituents (petroleum hydrocarbons, chlorinated solvents, etc.);
5. the contamination conveyance (air, groundwater, soil, etc.);
6. whether the property is a source, non-source, adjacent, or proximate site;
7. the cost and timing of any site remediation plans;
8. the liabilities and potential liabilities for site cleanup;
9. the potential limitations on the use of the property due to the contamination and its remediation; and
10. the potential or actual off-site impacts due to contaminant migration (for source sites) (AO-9, Lines 114–126).

Once this information has been assembled, the selected case study properties are then matched with otherwise similar but uncontaminated comparables in their market area in order to determine any adverse effects attributable to the environmental condition of the case study properties. The appraiser

then compares, analyzes, and reconciles the contamination-related impacts derived for each case study to the subject property. The appraiser should also consider differences in general market conditions, property type, and date of sale between the subject and the case studies so that effects are not incorrectly attributed to nonenvironmental influences. Jackson and Bell²⁴ present an in-depth discussion of the factors and elements that should be considered in case studies analysis.

Multiple Regression Analysis

When properly developed, a multiple regression model can be used to analyze the impact of environmental contamination on the sale prices of properties in an allegedly impacted area. Multivariate statistical models can test for the significance of any impacts, after controlling for other influences on value that are unrelated to the potentially adverse environmental condition. The results of such analyses can indicate whether there is any statistically discernable (significant) effect on sale prices that may be attributable to the environmental condition of the impaired properties relative to an otherwise similar group of properties in an unimpaired condition.

Care should be taken in making inferences from regression analyses of groups of properties to individual properties. Regression models can be used to construct estimates of average (mean) impacts for the category of properties being analyzed. However, individual property impacts may differ substantially from average impacts. In addition, in areas with multiple, adverse influences and/or diverse submarkets and property types, it may not be possible to reliably estimate the effect of a single contamination source through regression analysis. In developing or using a regression model, the appraiser should explain why the selected variables were chosen and how the model was constructed. Data used in the analysis should be retained in the appraiser's workfile, consistent with the Record Keeping section of the Ethics Rule (USPAP, Lines 325–336).

One possible and relatively simple specification of a multiple regression model for analyzing the effect of environmental contamination on sale price is as follows:

24. Thomas O. Jackson and Randall Bell, "The Analysis of Environmental Case Studies," *The Appraisal Journal* (January 2002): 86–95.

$$P = \beta_0 + \beta_1 X_1 + \dots + \beta_n X_n + \beta_{n+1} ENV_1 + \dots + \beta_{n+1+p} ENV_p + e_i$$

where:

P = the sale price of the property, adjusted for remediation costs for unremediated contaminated properties (to focus the analysis on environmental risk effects)

β_0 = a constant term

$X_1 \dots X_n$ = a vector of continuous nonenvironmental property characteristics such as building size, age, lot size, etc.

$ENV_1 \dots ENV_p$ = a vector of discrete variables indicating the environmental condition of the property at the time of sale (the base would be uncontaminated properties)

e_i = a random error term

An example of this model specification in the analysis of contaminated industrial properties is provided by Jackson.²⁵ In this model, the risk effects of the properties' environmental condition on sale price were analyzed before, during, and after remediation. Included in the sales analyzed were unimpaired comparable properties, so that the impacts on sale price due to environmental condition were relative to otherwise similar but uncontaminated properties.

In a multiple regression analysis, the model specification should include the nonenvironmental factors that influence sale price as independent, or predictor, variables in the equation. In this way, the variation in sale price explained by the nonenvironmental variables (size, age, etc.) would not be attributed incorrectly to the environmental condition variables being tested in the model (distance from contamination source, remediation status, location in contaminated neighborhood, etc.). An analysis of the statistical significance of the environmental condition variables would indicate whether there was adequate statistical evidence to conclude that there were significant environmental impacts on value.

Two other types of multiple regression analyses used to estimate the impacts of environmental contamination are *proximity analysis* and *control area*

analysis. In a proximity analysis, the regression model is usually specified so that one of the independent variables or a set (vector) of independent variables reflects the distance of each of the sale properties to the source of the environmental contamination. These variables can be specified as continuous distance from the contamination source or as discrete distance bands, or concentric bands, around the source.

Before drawing conclusions from such an analysis, the appraiser should consider the possibility of multiple adverse influences on sale price that might exist in areas with a number of contamination sources or other disamenities. In such situations, it may be difficult or impossible to sort out the relative influence of any one source as distinct from the others. Another limitation on this type of analysis involves the general tendency for residential properties that are closer to older industrial facilities and landfills to sell for less than otherwise similar properties located further away, regardless of whether the facilities have released any environmental contamination. Thus, lower sale prices closer to an industrial facility or landfill would not be due to hazardous environmental contaminants.

A multiple regression control area analysis can be used to analyze the effects of contamination on properties in a neighborhood area where it is claimed that property values have been diminished because of environmental stigma. In this type of analysis, sale prices of properties in the potentially impacted area (the subject area) are compared to prices of similar properties in a comparable neighborhood (the control area) having the same characteristics, but without the adverse environmental condition under study. In many such analyses, the locational influences of the subject and control areas are compared before and after a contamination event. Such events could be the actual release of the contamination or a public announcement of the release. Typically, such events are publicized in the media.

Issues in developing a reliable control area analysis involve potential time and area interactions and the influence of confounding nonenvironmental factors. In comparing two or more areas, even well-matched areas can be influenced by differing market and locational conditions over time,²⁶ and these

25. Jackson, "The Effect of Previous Environmental Contamination on Industrial Real Estate Prices," and Thomas O. Jackson, "Environmental Contamination and Industrial Real Estate Prices," *Journal of Real Estate Research* 23, no. 1/2 (2002): 179-199.

26. Warren Rogers, "Errors in Hedonic Modeling Regressions: Compound Indicator Variables and Omitted Variables," *The Appraisal Journal* (April 2000): 208-213.

differing influences may be incorrectly attributed to the adverse environmental condition under study. However, the subject and control areas do not need to be identical, but should be influenced by the same general market conditions over time so that changes in relative pricing can be appropriately attributed. Thus, the initial selection of the control areas is a critical step in this type of analysis. Control area selection criteria and procedures will be discussed in a future edition of this column.

Market Interviews

Market interviews are not methods or techniques for valuing contaminated properties, but are useful for collecting and understanding the data and information necessary to apply the other methods and techniques discussed herein. The results of market interviews can be used to supplement a sales-based analysis, as previously discussed, and/or to provide information useful for understanding the market's requirements for environmental risk premiums in an income capitalization analysis, as discussed below. These requirements can be expressed as required rates of return or as return premiums over unimpaired rates. However, market interviews cannot stand alone as an appropriate or credible valuation method or technique.

In planning and conducting market interviews, care should be taken not to introduce bias into the results. Important in this regard are:

- selection of market participants to be interviewed;
- development of unbiased information about the subject property and its environmental condition; and
- construction of a structured questionnaire and interview protocol that can be replicated.

Potential bias can be introduced whenever the information provided or questions asked are not objectively developed and presented. Individuals to be interviewed should be representative of typical market participants. In addition, the environmental and other information provided should be consistent with what is considered typical or normal market knowledge. Interviewees should be asked to assess

the subject property in an unimpaired condition and in its impaired, contaminated condition. Differences between the two sets of responses will then reflect the effects of the property's environmental condition. Detailed notes and/or transcripts of interviews, as well as all information provided to interviewees, should be retained in the appraiser's workfile, consistent with the Record Keeping section of the Ethics Rule (USPAP, Lines 325–336).

Market participants need not have perfect knowledge of environmental contamination to the extent expected from a qualified environmental engineer who has performed detailed testing of a contamination source. A real estate market that has become knowledgeable of environmental influences on properties in an area will either react or not react in its pricing decisions based on its perception of the risk and potential impact of the contamination. All situations of environmental contamination do not inexorably lead to a reduction in the pricing and value of real property. An appraiser must not assume that the market will react in a certain way to environmental contamination when the assumed reaction has not been clearly demonstrated in observed market transaction data. Such opinions and conclusions are nothing more than speculation and should be avoided. It is important to remember Kinnard's observation from twelve years ago that "the results from survey analyses must be tempered with the knowledge that the expectation of events is almost invariably more negative and more sharply delineated, at least when [the events] are expected to affect oneself negatively, than is realized when the events occur."²⁷

Income Capitalization Analysis

As noted, Kinnard and Worzala²⁸ surveyed appraisers and found that 79% use the income capitalization approach when valuing contaminated properties. Further, the most frequently mentioned adjustment made to account for the effects of contamination was to increase the income capitalization rate (R_o) in a direct capitalization model. Absent any effect on income, the adjusted rate (adj. R_o) would produce an estimate of property value diminution due to environmental risk effects through the following equations:

27. Kinnard, 5.

28. Kinnard and Worzala.

$$\text{Unimpaired value } (V_o) = \text{Net operating income } (I_o) \div R_o$$

$$\text{Adjusted } R_o = \text{Unimpaired overall income capitalization rate } (R_o) + \text{Environmental risk premium}$$

$$\text{Impaired value} = \text{Net operating income } (I_o) \div \text{Adjusted } R_o$$

$$\text{Property value diminution (risk effects)} = \text{Unimpaired value } (V_o) - \text{Impaired value}$$

$$\text{Property value diminution (risk effects)} = ((\text{Net operating income } (I_o) \div R_o) - (\text{Net operating income } (I_o) \div \text{Adjusted } R_o))$$

The adjustment of the income capitalization rate should be based on data that reflects the market's perception of the increased environmental risk due to the specific environmental condition of the property and/or in market under study. The appraiser should avoid making judgmental rate adjustments. One method of determining an appropriate environmental risk premium would be to extract it from paired sales data. In this method, sales of otherwise comparable, but unimpaired, income-producing property are paired with sales of impaired income-producing properties with similar environmental issues to the subject, with differences in income capitalization rates attributable to the impaired property's environmental condition. Prior to estimating the rate differential and risk premium, the sale price from which the capitalization rate is calculated should be adjusted for anticipated remediation costs to be assumed by the buyer, so as not to mix cost and risk effects in the risk premium. The environmental risk premium can also be gauged through lender and investor survey data via the market interview technique previously discussed.

Where the income capitalization analysis approach is used, a mortgage-equity analysis, band of

investment technique, or discounted cash flow analysis could be employed to adjust the mortgage and equity components of the overall income or yield capitalization rates. In addition to overall equity and mortgage risk premium adjustments, the loan-to-value ratio and other capitalization rate components might be adjusted to account for any increased environmental risk. Jackson²⁹ presents a framework for the application of mortgage-equity analysis in contaminated property valuation.

Conclusion

In selecting an appropriate method and technique for valuing a contaminated property or for estimating the effect of contamination on real property value, appraisers should consider their level of expertise and competency with a particular method or technique, the type of property under study (residential, income producing, etc.), whether the issue prompting the analysis involves a single property or an area, and the availability of appropriate sales and property data. The availability of appropriate sales and property data is frequently mentioned as a primary concern by appraisers. However daunting the data collection effort may seem, a persistent effort can usually uncover appropriate and comparable sales information to use with one or more of the methods and techniques discussed in this column. Modern real estate appraisal recognizes the importance of the sale price and transaction data as reflective of the full mix of positive and negative external influences, including environmental disamenities, potentially affecting market value.

In rare situations, there may not be any market data with which to construct a credible analysis. In such cases, the appraiser should avoid espousing unsupported opinions and conclusions that are not based upon adequate and appropriate market evidence and data. The appraiser should also avoid speculating on possible future effects that have not occurred or are not derived from clear and convincing market data and credible analyses of the types

29. Thomas O. Jackson, "Mortgage-Equity Analysis in Contaminated Property Valuation," *The Appraisal Journal* (January 1998): 46-55.

discussed. Appraisers must focus on analysis of observable market data. Reliable opinions concerning the impacts of environmental contamination on the market value of real property are dependent on the ethical behavior and unbiased analysis of competent appraisers who understand and use appropriate methods and techniques and also recognize their limitations. Future editions of "Environment and the Appraiser" will continue to explore the methods and techniques introduced here, with detailed examples of their use and application.

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