

## Appraisal of Contaminated Property in the United States

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### Abstract

In the United States, contaminated property may be appraised for several reasons other than traditional property tax assessment: litigation (both tort and criminal), brownfield redevelopment, preservation/conservation easements, or financing. The Uniform Standards of Professional Appraisal Practice, adopted for use throughout the United States, outline the minimum standards in a section titled Advisory Opinion 9. This article outlines the methodology dictated by those standards and how it has evolved over the years from both academic and applied perspectives, focusing specifically on its application to contaminated property. Appropriate methodology within those standards has evolved over the years in the academic and practitioner literature.

### Introduction

Gamble and Downing (1982)<sup>1</sup> were among the first to examine the impact of contamination on residential real estate, analyzing the effects of the March, 1979, nuclear accident at Three Mile Island on nearby home values. They compared 583 residences within 25 miles of the plant with homes in a control neighborhood 75 miles away, both before and after the accident occurred using a hedonic model to isolate the pricing impacts of the event<sup>2</sup>.

The appraisal profession in the U.S. began recognizing the negative impact of environmental contamination on property value shortly thereafter, and soon thereafter the literature was replete with guidance to aid appraisers tasked with quantifying these price effects<sup>3</sup>. For example, the American Institute of Real Estate Appraisers<sup>4</sup>, in a 1988 official guidance to appraisers, noted that "...leaking underground storage tanks (LUSTS) and spills and overfills from tank systems can cause severe contamination of subject properties and surrounding parcels and seriously affect the value of those

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<sup>1</sup> Gamble, H.B., and R.H. Downing, "Effects of Nuclear Power Plants on Residential Property Values," Journal of Regional Science, 1982, 457-478.

<sup>2</sup> A hedonic model is a multiple regression equation used for disaggregating the price paid for multidimensional commodities into their component parts.

<sup>3</sup> Kinnard, William N. and Elaine M. Worzala, "How North American Appraisers Value Contaminated Property and Associated Stigma," The Appraisal Journal, July, 1999, 269-279.

<sup>4</sup> The American Institute was one of the two predecessor organizations to the present-day Appraisal Institute. The other predecessor organization was the Society of Real Estate Appraisers.

properties.”<sup>5</sup> Patchin (1988), noted that leaking underground storage tanks have a negative effect on real estate and that even “...mildly contaminated [sites] can be expected to suffer reduced marketability.”<sup>6</sup> A subsequent study conducted by Gamble and Downing (1984), revealed evidence that the prices of building lots were lower near landfills and that the values for residential properties located on the main access road serving the landfills were lower than other properties in the area<sup>7</sup>.

Since that time, appraisal methodology has evolved rapidly, and by the late 1980’s, American appraisers universally recognized several truths about contaminated property:

1. A property may be affected by either on-site contamination or proximate (that is, nearby) contamination.
2. The methodology which had evolved for Eminent Domain appraisal analysis proved to be the most useful for evaluating contaminated properties.
3. The cost of remediation is not, by itself, a sufficient proxy for the diminution in market value, since at equilibrium contaminated properties sell for less than the difference between unimpaired value and the cost of remediation. This difference is called “stigma.”
4. The market explicitly recognizes that remediation is often not a full cure, and hence post-remediation properties continue to suffer from a degree of stigma.

Subsequent advances in appraisal standards and methodology have helped give definition to these axioms and in 2003 the Appraisal Standards Board (ASB) incorporated this into Advisory Opinion 9 of the Uniform Standards of Professional Appraisal Practice (USPAP). In this Advisory Opinion, the ASB clearly delineates that appraisers must take contamination into account, as required under USPAP Rules 1-1(a), 1-2(e), 1-2(g), 1-3(b), and 1-4. Further, the *Ethics Rule* would prohibit an appraiser from knowingly issuing an opinion that misleads the reader into believing that a property is not impacted by on-site or proximate contamination. Further, federal guidelines for appraisal of property for financing purposes obligates the reporting of any known contamination and including the impact of such in the value opinion<sup>8</sup>. The standard Uniform Residential Appraisal Report requires appraisers to note any adverse environmental conditions (either on-site or proximate) and, by implication, report on the impact on value<sup>9</sup>. As of this writing, 29 states have various mandatory disclosure laws pertaining to contamination and similar circumstances, and many state courts have rules as to obligations regarding contamination and other negative situations<sup>10</sup>.

As such, the norm for appraisal in the U.S. today is the *impaired* condition. *Unimpaired* values are usually determined only as base-lines for court cases (i.e. – calculating damages in tort situations) or in retrospective circumstances for determination of some value prior to the contamination. Financing

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<sup>5</sup> American Institute of Real Estate Appraisers; Research Department, Underground Storage Tanks: Basic Information For Appraisers (Illinois: National Association of Realtors, 1988), 3.

<sup>6</sup> Patchin, Peter J., “Valuation of Contaminated Properties,” *The Appraisal Journal* (January 1988), 10.

<sup>7</sup> Hays B. Gamble, Hayes, B. and Roger H. Downing, Effects of Sanitary Landfills on Property Values and Residential Development (University Park, PA: Institute for Research on Land and Water Resources 1984), 7.

<sup>8</sup> See, for example, Fannie Mae Selling Guide VII, 303 and 405.02, or its predecessor, OTS 1989 Bulletin TB-16.

<sup>9</sup> Fannie-Mae Form 1004, Freddie Mac Form 70.

<sup>10</sup> See, for example, *Fausett & Co v. Bullard*, 229 S.W.2d 490 (Ark. 1950), *Clark v. Olson*, 726 S.W.2d 718 (Mo. banc 1987), *Lynn v. Taylor*, 642 P.2d 131 (Kan.App. 1982), *McRae v. Bolstad*, 646 P.2d 771 (Wash. 1982), *Fauerke v. Rozga*, 332 N.W.2d 804 (Wis. 1983), *Reed v. King*, 145 Cal.App.3d 261, 193 (Cal.Rptr.130 1983)

decisions, litigation, tax assessment, and other normal appraisal situations all require that the *impaired* condition be appraised.

### **Contaminated Property – Fundamental Issues**

Patchin's (1988) early work on the subject of contaminated property focused on defining a framework which included clean-up costs; the availability of indemnities; the premium demanded by investors on yield or cap rates; and the impact on the cost of financing. He recommended that the appropriate analytical framework was the income approach to value using the Ellwood method to determine cap rates. Inputs to the Ellwood Method include prevailing cap rates on unimpaired property, available mortgage terms, and anticipated future improvement or decline in value. He noted, however, that there is "...virtually no chance of obtaining mortgage financing for a seriously contaminated property."<sup>11</sup>

Patchin (1991) was also the first to show that the decline in value is often greater than the cost-to-cure suggests.<sup>12</sup> Mundy (1992a) identifies this phenomenon as "stigma," a term which has continued in the lexicon to this day.<sup>13</sup> In his definition, Mundy (1992a) was also the first in the valuation literature to list specific criteria for stigma,<sup>14</sup> which are:

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|--------------------|-------------------|
| - Disruption       | - Prognosis       |
| - Concealability   | - Degree of Peril |
| - Aesthetic Effect | - Level of Fear   |
| - Responsibility   |                   |

These seven criteria, collectively, represent the necessary and sufficient conditions for stigma.

Mundy established the prevailing paradigm for valuation of contaminated property, which follows the methodology that had been well-established in the eminent domain appraisal literature:

$$\begin{array}{r} \text{Value Unimpaired} \\ \text{Minus} \\ \text{Value Impaired} \\ \text{Equals} \\ \text{Diminution in Value} \end{array}$$

Mundy (1992b) later showed that the diminution in market value can be attributed to two different factors: a *marketability effect* and an *income effect*. He attributed the former to the increased marketing period for the asset; even in the absence of a decrease in selling price, value is diminished due to the increased time necessary to realize liquidity as well as an increase in the discount rate to account for higher risks of holding a relatively illiquid asset.<sup>15</sup>

Mundy (1992c) attributed the latter effect to decreases in rent or occupancy, or an increase in operating expenses; since the value of a given property is defined as the fully discounted stream of anticipated

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<sup>11</sup> Patchin, P.J., op. cit.

<sup>12</sup> Patchin, P.J., "Contaminated Properties – Stigma Revisited," The Appraisal Journal, 1991, 167-172.

<sup>13</sup> Mundy, Bill, "Stigma and Value", The Appraisal Journal, 1992a, 7-13.

<sup>14</sup> While Mundy (1992a) was the first in the valuation literature to present these, he correctly cites the authorship of this from the sociology literature: Edelstein, Michael, Contaminated Communities: The Social and Psychological Impacts of Residential Toxic Exposure (Boulder, Colorado: Westview Press, 1988), 6.

<sup>15</sup> Mundy, Bill, "The Impact of Hazardous Materials on Property Value," The Appraisal Journal, 1992b, 155-162.

benefits and costs, stigma factors in directly. Building on this, he then focused on the determination of the appropriate risk-adjusted discount rate.<sup>16</sup> Here, he found that the appropriate measure of the increased risk associated with holding contaminated property is a potential increase in the cost of capital, both equity and debt. While Mundy (1992c) and Patchin (1991) agree that impairment impacts the way income is capitalized or discounted, Mundy (1992c) prefers the use of varying discount rates to account for varying levels of risk in different time periods, while Patchin (1991) uses the Ellwood method to determine a cap rate. Kilpatrick, Brown, and Rogers (1999) take Mundy (1992c) one step further by showing that the impacts of an impairment can be partitioned among the risk impact (the increase in the discount rate) and the cash-flow impact (the decrease in cash flows).<sup>17</sup>

The question of residual post-remediation stigma has been dealt with by Patchin (1991), Mundy (1992b), and Chalmers and Jackson (1996).<sup>18</sup> Patchin (1991) was the first to suggest that stigma may diminish over time “once a cure is in place;” however he noted that this would be different for residences as opposed to commercial properties. Mundy (1992b) argues that this is a function of ongoing market perceptions of risk and developed a graphical representation of how such perceptions may change over time and hence value may be restored eventually. Bell (1998) adopted Mundy’s (1992b) methodology and expanded it to illustrate how property values may change over time under varying circumstances.<sup>19</sup> Chalmers and Jackson (1996) systematize this into what they call the “contamination lifecycle”, in which the effects of contamination vary according to the status in time: before cleanup; during and after cleanup; and after remediation is completed. A recent analysis by urban economist Daniel McMillan (2003) involving an Asarco plant in Tacoma, Washington – a remediation that Bill Mundy was directly involved in – bears this out.

Jackson (1997) summarizes the literature on contaminated property, and lists seven fundamental factors which appraisers must consider: the cost and timing of remediation; the existence and quality of any indemnification; the degree to which the problem has been characterized; the potential for business interruption; the approval of a remediation plan; the regulatory framework; and the likelihood of 3<sup>rd</sup> party lawsuits.<sup>20</sup>

## **Valuation Methodology**

Real estate appraisal in the United States adheres to the paradigm of three traditional approaches to value: the cost-less-depreciation approach; the sales comparison approach; and the income capitalization approach.

Within these broad approaches, there are numerous acceptable methodologies. For example, an income approach may take the form of a direct capitalization, a discounted cash flow, or even a gross rent multiplier, to name just a few. Other more arcane approaches to value, such as options pricing, are used

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<sup>16</sup> Mundy, Bill, “The Impact of Hazardous Materials on Property Value: Revisited,” The Appraisal Journal, 1992c, 463-471.

<sup>17</sup> Kilpatrick, John A., Doug Brown, and Ronald C. Rogers, “Exterior Insulation Finish Systems and Property Values,” The Appraisal Journal, 1999, 83-88.

<sup>18</sup> Chalmers, James, and Thomas Jackson, “Risk Factors in the Appraisal of Contaminated Property,” The Appraisal Journal, 1996, 44-58.

<sup>19</sup> Bell, Randy, “The Impact of Detrimental Conditions on Property Values,” The Appraisal Journal, 1998, 380-391.

<sup>20</sup> Jackson, Thomas, “Investing in Contaminated Real Estate,” Real Estate Review, 1997, 38-43.

primarily in academic forums. But generally alternative methodologies are consistent with the fundamentals of one of the three traditional approaches.

Further, Advisory Opinion 9 to the Uniform Standards of Professional Appraisal Practice (USPAP) incorporates the Mundy (1992a) three-step paradigm as the recommended outline for all contaminated property appraisal work-plans (Standard Rule 1 analysis) and reports (Standard Rule 2 reporting) for valuation assignments:

1. Mundy (1992a) and USPAP recommend the development of an *unimpaired* value under the hypothetical condition that the property is “free of any contamination.”<sup>21</sup> Note that under USPAP, a hypothetical condition, which must be explicitly disclosed in a manner which is not misleading to the user of the report, requires the appraiser assume “that which is contrary to what exists but is supposed for the purpose of analysis.”<sup>22</sup> Advisory Opinion 9 further cautions the appraiser to explicitly advise the client, in advance, as to the impact of the use of this hypothetical condition and to take care to adhere to the *Ethics* provisions of USPAP.

Interestingly enough, there is no requirement under USPAP that the property also be appraised in the *impaired* condition, so long as the nature of the hypothetical condition is fully disclosed. This allows for a significantly broad use of unimpaired appraisals. For example, many appraisers specialize in certain kinds of property (e.g.: residential) but do not have the expertise to determine *impaired* value. Thus, they would be unqualified under the *Competency* requirements of USPAP to render such an *impaired* value. However, their expertise in rendering an *unimpaired* value allows them to be of substantial assistance and value to the appraisal process by following this paradigm.

2. Mundy and Advisory Opinion 9 then recommend that the property be appraised without this hypothetical condition, thus rendering an opinion of *impaired* value.

USPAP Advisory Opinion 9 recognizes that appraisers are often entering unknown waters with step 2. For example, determining the nature and extent of the contamination requires that the appraiser rely on professional judgments of other experts, such as engineers, whom the appraiser deems reliable. The *Competency* rule of USPAP prohibits the appraiser from rendering opinions in areas outside of the demonstrated expertise of the appraiser. Indeed, if, in the course of completing an appraisal assignment, and appraiser improperly renders, for example, an engineering opinion – for which he or she is not competent – then it is not the engineering standards which have been violated but rather the appraisal standards.

USPAP Advisory Opinion 9 also cautions appraisers regarding the use of extraordinary assumptions. Specifically, this is an “...assumption, directly related to a specific assignment, which, if found to be false could alter the appraiser’s opinions or conclusions.” For example, an appraiser may be asked to render the *impaired* value under the assumption that the property has been remediated. This requires both that the appraiser make certain extraordinary assumptions about the quality, degree, timing, and prognosis of the remediation but also requires that the appraiser make estimates about post-remediation stigma for a property which is not yet remediated. Thus, it is quite possible that several extraordinary assumptions be made. These must be fully and explicitly disclosed, and caution is again recommended regarding adherence to the *Ethics* and *Competency* provisions.

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<sup>21</sup> USPAP 2003, 146.

<sup>22</sup> *Ibid*, 3.

3. Finally, the difference between #1 and #2 above is the degree of value impairment.

The term *as-is* value is often mistakenly applied by appraisers. Within the context of Advisory Opinion 9, it is clear that *as-is* refers specifically to the *impaired* value, with the hypothetical condition relaxed and no extraordinary assumptions applied. However, when appraising properties within a neighborhood that have been impacted by either on-site or proximate contamination, many appraisers mistakenly use transactions within that neighborhood as indicators of comparable value. However, this clearly runs afoul of Advisory Opinion 9, since the use of these comparables would require that the appraiser invoke a hypothetical condition that these properties are not affected by the contamination.

With that, it is apparent that both the *unimpaired* and the *impaired* values – the 1<sup>st</sup> and 2<sup>nd</sup> points of the Mundy (1992a) and USPAP three-step valuation paradigm – require very serious consideration of the quality and availability of the sort of data on which appraisers typically rely and the methods which appraiser typically use. For example:

1. If a contamination impacts properties throughout a neighborhood, then the supposedly comparable properties within the neighborhood may or may not be impacted by either on-site or proximate contamination themselves. Thus, as discussed in the foregoing, a sales comparison approach value using such comps may be irretrievably tainted with indiscernable and inextractable value impacts.
2. The salient definition of value (in the United States, most commonly this is *Market Value*) creates a set of explicit assumptions about comparables which may or may not be satisfied by transaction data.
3. Comparable *impaired* properties often do not trade, or do not trade at equilibrium prices, typically due to two reasons: the difficulty marketing contaminated real estate and because few transactions are truly comparable as a result of many diverse attributes and different types of contamination (e.g.: type of contamination, degree of contamination, location of contamination, length of time, remediation prospects). As a result, data that could normally be extracted from market comparable sales (e.g. – market cap rates, sales adjustments, depreciation, land prices) is inextractable.

The need for alternative valuation techniques is widely recognized in the appraisal literature. Chalmers and Beatty (1994)<sup>23</sup> discuss the requirement for “full information” dictated by the traditional United States definition of market value. However, as Simons (2002) clearly notes, the transactions data available in the market will often not reflect market values at equilibrium under the assumptions inherent in the definition of value. Thus, as shown by Simons (2002), Allen and Austin (2001)<sup>24</sup>, McLean and Mundy (1999<sup>25</sup>, 1998<sup>26</sup>), Simons, Bowen, and Sementelli (1997<sup>27</sup>, 1999<sup>28</sup>), and others in the valuation

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<sup>23</sup> Chalmers, James A. and Jeffrey Beatty, “Environmental Hazards Devastate Property Values,” Real Estate Valuation Spring, 1994, pg 22-28,

<sup>24</sup> Allen, Marcus and Grant Austin, “The Role of Formal Survey Research Methods in the Appraisal Body of Knowledge,” The Appraisal Journal, October, 2001, 394-399.

<sup>25</sup> McLean, David, and Bill Mundy, “Addition of Contingent Valuation and Conjoint Analysis to the Required Body of Knowledge for the Estimation of Environmental Damages to Real Property,” Journal of Real Estate Practice and Education, 1999, 1-19.

<sup>26</sup> Mundy, Bill, and David McLean, “Using the Contingent Valuation Approach for Natural Resource and Environmental Damage Applications,” The Appraisal Journal, July, 1998, 290-297.

literature, alternative techniques and methods are appropriate and for use when efficient transactions data is not available.

In the specific case of the Sales Comparison Approach – generally the most widely used approach in the U.S. for residential properties – Chalmers and Jackson (1996)<sup>29</sup> note, “[t]he use of the sales comparison approach requires extraordinary care if useful market evidence is to be extracted.” No less an authority than the late Dr. William Kinnard, Jr. (the Appraisal Institute’s annual award for excellence in education is named in his honor) also concluded that the sales comparison approach and the matched-pairs method is left wanting in his article, Kinnard (1992).<sup>30</sup> To quote Professor Kinnard, “[u]nfortunately, the market frequently does not cooperate. The net effect, therefore, is that these ideal measures tend to remain precisely that – ideal. The appraiser generally has to look elsewhere to identify the market effects of contamination on property values.” Prof. Kinnard’s observations on the shortcomings of the traditional approaches when valuing contaminated property are supported by Patchin (1988)<sup>31</sup>, Wilson (1994, 1996), Roddewig (1996),<sup>32</sup> and Weber (1997).<sup>33</sup>

Weber (1997) is one of the first to recommend an alternative methodology, suggesting instead that a monte carlo simulation is an applicable tool in such situations. Lentz and Tse (1995) had also suggested the use of an alternative methodology, in their case options pricing as an alternative to the discounted cash flow model.<sup>34</sup> Jackson (1998) returns to a somewhat more traditional approach, showing that a mortgage-equity type model can be useful in quantifying the effects of stigma.<sup>35</sup> In the face of a broad array of methodologies used by appraisers to assess the stigma damages stemming from contamination, Kinnard and Worzola (1999) surveyed and summarized the key methodologies currently in use.<sup>36</sup> While their study focused primarily on income producing property, they noted that the somewhat more traditional methods most widely used by practitioners were at odds with the more advanced techniques recommended in the academic and practitioner literature.

Over the years, a variety of acceptable methodologies have emerged and proven useful for dealing with the special circumstances faced in a contaminated property situation. These are:

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<sup>27</sup> Simons, Robert, William Bowen, and Arthur Sementelli, “The Effects of Leaking Underground Storage Tanks on Residential Sales Price,” Journal of Real Estate Research, 1997, 29-43.

<sup>28</sup> Simons, Robert, William Bowen, and Arthur Sementelli, “The Price and Liquidity Effects of UST Leaks from Gas Stations on Adjacent Contaminated Property,” The Appraisal Journal April, 1999, 186-194.

<sup>29</sup>Chalmers, James A. and Thomas O. Jackson, “Risk Factors in the Appraisal of Contaminated Property,” Appraisal Journal January, 1996, pgs 44-58,

<sup>30</sup> Kinnard, William, “Measuring the Effects of Contamination on Property Values,” Environmental Watch (published by the Appraisal Institute), Winter, 1992, pgs 1-4.

<sup>31</sup> Patchin, Peter, “Valuation of Contaminated Properties,” The Appraisal Journal, 1988, 7-16.

<sup>32</sup> Roddewig, Richard, “Stigma, Environmental Risk, and Property Values: 10 Critical Inquiries,” The Appraisal Journal, 1996, 375-387

<sup>33</sup> Weber, B.R., “The Valuation of Contaminated Land,” Journal of Real Estate Research, 1997, 379-398.

<sup>34</sup> Lentz, George, and K.S.M. Tse, “An Options Pricing Approach to the Valuation of Real Estate Contaminated by Hazardous Materials,” Journal of Real Estate Finance and Economics, 1995, 121-144.

<sup>35</sup> Jackson, Thomas, “Mortgage Equity Analysis in Contaminated Property Valuation,” The Appraisal Journal, 1998, 46-55.

<sup>36</sup> Kinnard, William, and Elaine Worzola, “How North American Appraisers Value Contaminated Property and Associated Stigma,” The Appraisal Journal, 1999, 269-278.

***Use of a Control Area*** Appraisers use macrostatistics (e.g.: neighborhood income, housing stock, and other economic statistics) to develop a “control area” which is similar in nature to the neighborhood which contains the contamination. Then, properties from the control area are used as comparables, insuring that the comparable data is not impacted by proximate contamination as a negative externality.

***Case Studies, Academic Studies, and National Comparables*** Appraisers who specialize in contaminated property maintain data bases of similar situations, both individual properties (sortable in electronic form by property type, locational characteristics, or other salient keys) and wide-area studies (neighborhoods impacted) and are able to develop comparable data which can then be used as inputs to the traditional approaches. The use of such studies and their application to the appraisal problem was illustrated by Kilpatrick (2001).<sup>37</sup>

***Survey Research*** Market research methodology has been shown to be extremely useful in determining appropriate discounts from otherwise unimpaired value. Mundy and McLean (1998a, 1998b) outline the role contingent valuation and conjoint analysis can play in determining these adjustments.<sup>38,39</sup>

***Hedonic Modeling*** is widely recognized by academics as a powerful tool for extracting marginal prices of contamination, particularly from among complex data. However, it is extremely fragile to model specification as well as other econometric considerations. Boyle and Kiel (2001) survey its use among environmental analysts and appraisers.<sup>40</sup>

***Depreciation Analysis*** can be used in specific situations where an impairment has caused incurable physical depreciation to the structure which has shortened its economic life. Kilpatrick (2003) outlines the suggested methodology, which requires the use of structural engineers working together with appraisers.<sup>41</sup>

## **Summary and Conclusions**

In the late 1980’s appraisers in the United States realized the need to develop methodologies to properly determine the impact on the value of real estate as a result of environmental contamination. What emerged was a rigorous and well tested set of tools and techniques consistent with the well-accepted approaches to value and the Uniform Standards.

Subsequent studies of real estate values have confirmed the usefulness of these methods. Boyle and Kiel (2001)<sup>42</sup> summarize empirical studies of the impact of contamination on residential values, while Jackson

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<sup>37</sup> Kilpatrick, John A., “Concentrated Animal Feeding Operations and Proximate Property Values,” *The Appraisal Journal*, 2001, 301-306.

<sup>38</sup> Mundy, Bill, and Dave McLean, “Using the Contingent Value Approach for Natural Resource and Environmental Damage Applications,” *The Appraisal Journal* 1998a, 290-297.

<sup>39</sup> Mundy, Bill, and Dave McLean, “The Addition of Contingent Valuation and Conjoint Analysis to the Required Body of Knowledge for the Estimation of Environmental Damages to Real Property,” *Journal of Real Estate Practice and Education*, 1998b, 1-19.

<sup>40</sup> Boyle, Melissa and Katherine Kiel, “A Survey of House Price Hedonic Studies of the Impact of Environmental Externalities,” *Journal of Real Estate Literature* 2001, 117-144.

<sup>41</sup> Kilpatrick, John A., “Construction Defects and Stigma,” forthcoming in *Mealey’s Construction Defects*.

<sup>42</sup> Boyle, Melissa, and Katherine Kiel, op. cit.

(2001)<sup>43</sup> summarizes impacts on non-residential properties. Both of these studies confirm the usefulness of the methods which have evolved over the past 20 years.

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<sup>43</sup> Jackson, Thomas, "The Effects of Environmental Contamination on Real Estate: A Literature Review," Journal of Real Estate Literature, 2001, 91-116.