features

The Analysis of Environmental Case Studies

by Thomas Jackson, PhD, MAI, and Randall Bell, MAI

abstract

In recent years, there have been a growing number of sales of environmentally impacted properties. Appraisers now have market sales data that can be used to estimate the effect of environmental contamination on real property value. This article sets forth a framework for analyzing case study data with respect to contaminated or previously contaminated properties. The central message here is that "apples to apples" comparisons must be made, and that a number of specific elements must be considered for a valid and reliable case study analysis. When properly selected and analyzed, case studies can provide useful information for analyzing environmentally impacted properties.

Determining the impacts of environmental contamination on property value requires real estate analysts to address a number of factors and elements not considered in the more typical sales comparison analysis of non-impacted or unimpaired properties. These factors may be considered or analyzed using case studies.

The first step in a case study analysis involves research into the subject property and a determination of the key factors that impact that property. Then, in an effort to determine any effect on value, case studies are developed from other properties that are similarly situated with respect to the subject property and its environmental condition. Like any valuation technique, case study analysis can be properly applied or it can be misused. In order for the analysis to be reliable and valid, the case studies must follow the simple "apples to apples" analogy. This means that the case studies being utilized must have similar property, market, *and* environmental characteristics to the subject property. Because of the complexity of topics surrounding environmental contamination, these characteristics are not always straightforward. Therefore, their applicability must be carefully examined.

Appraisal methodologies ultimately fall within one of the three traditional approaches to valuation: the cost approach, the sales comparison approach, and the income capitalization approach. Case study analysis involves situations where similar properties have been impacted by similar conditions. Thus, the analysis of case studies is an extension of the sales comparison approach. However, in addition to the typical elements of comparison such as property type and location, valid and reliable environmental case studies must consider additional elements and property characteristics. These elements are outlined in the following pages. Like any application of the sales comparison approach, it is difficult, and in some situations impossible, to find comparables that are identical in all respects to the subject property. Nonetheless, certain key characteristics should be similar for resulting inferences and conclusions to be reliable, valid, and not misleading.

Generally, case studies are utilized when there is a lack of direct market data or where analyses of direct market data need additional support. For example, if the impact of a landfill on surrounding properties were being studied, the most

pertinent approach would involve actual sales of the surrounding properties. In the event that no direct market data is available, the case studies approach utilizing market data derived of other landfill-proximate sales would become relevant. Although case studies are useful any time there is available and relevant data, they have a secondary role if there is direct market data available at the subject site. Of course, like any assignment involving appraisal practice, the *Uniform Standards of Professional Appraisal Practice* (USPAP) have an essential role to play in the analysis of case studies. A properly developed case study analysis must comply with applicable USPAP standards addressing competency, ethics, and development and reporting of assignment results.

Case Study Framework

An environmental case study must take into consideration property characteristics, contamination/discharge issues, and remediation lifecycle/detrimental condition stages if the study is to provide a meaningful comparison to the subject property. These characteristics, as well as other significant factors, are shown in Table 1 and are discussed in detail in the remainder of this article.

Like a market data grid in the sales comparison approach, a case study comparison chart organizes and compares the characteristics or elements of the case study to the subject property. As in any type of sales comparison analysis, the subject property and case studies should ideally be similar in all respects. However, in reality this does not always occur. Problems arise if a significant number of issues differ substantially from the subject property conditions, then a question may arise as to whether the case study is really comparable at all. For example, case studies involving accidental discharges are not comparable to situations where the discharge was legally permitted. Further, a source site case study may not be comparable to a non-source site subject property, except to establish an upward limit of damage. For example, if a source site case study indicates no stigma or market resistance, then it is unlikely that non-source sites would have such damage. On the other hand, using an impacted source site case study to estimate impacts for a non-source site may be misleading, since identifiable impacts derived from source site case studies usually overestimate impacts to non-source subject properties. Remediation, as explained in the following pages, should also match. After selecting an appropriate set of case studies, a relative comparison analysis can be performed, leading to a net comparison ranking for each case study relative to the subject.[1]

The example in Table 1 includes case studies that match on the permitted/accidental discharge elements of comparison. While the subject property is industrial, the case studies include both commercial and industrial properties. Residential properties would not be comparable for purposes of this environmental case study analysis. In calculating the impact on value for each of the case studies, a series of paired sales analyses could be used. In this approach, otherwise similar unimpaired comparables in the market areas of the case studies would be matched to the impaired properties and impact on sales price would be estimated. Before calculating the impact on value for each of the case studies, the sales prices of the source site contaminated comparables should be adjusted to remove the effect of future remediation costs where such costs have been reliably estimated. This can be accomplished by adding the estimated costs to be paid by the buyer from property cash flows to the nominal sales price. This would leave a price that reflects the risk-related effects of the case study property's environmental condition on its price as of its date of sale. The second step of this two step procedure is to reconcile the value impacts for each of the case studies to the subject property, based on their comparability of the elements listed in Table 1.[2] As noted, a relative comparison analysis would be appropriate for this purpose. As explained in *The Appraisal of Real Estate,* 12th ed., in this type of analysis each element could be compared and assigned a ranking of superior, inferior, or similar. An overall ranking could then be made after considering each of the individual comparisons. This overall ranking or net comparison derived from the case studies provides the basis for reconciling a range of indicated impacts on value. This is usually the final step in the case study analysis. An additional step, applicable for certain assignments, would be to deduct the subject property's estimated future remediation costs that are to be borne by property cash flows, and not by the seller or another source, such as environmental insurance. This step provides a final, adjusted estimate of the subject property's impaired value. Care should be taken, though, not to double count remediation cost effects and risk related

1. Appraisal Institute, *The Appraisal of Real Estate,* 12th ed. (Chicago: Appraisal Institute, 2001): 459–467.
2. A similar sales comparison approach is illustrated in Thomas O. Jackson, "The Effect of Previous Environmental Contamination on Industrial Real Estate Prices," *The Appraisal Journal* (April 2001): 200–210.

Table 1 Case Study Comparison Chart

	Subject Property	Case Study A	Case Study B	Case Study C	Case Study D	Case Study E	Case Study F	Case Study G
Property characteristics								
Property type*	Industrial	Industrial	Industrial	Commerical	Industrial	Commercial	Industrial	Industrial
Market conditions	Stable	Stable	Stable	Stable	Stable	Declining	Declining	Declining
Contamination/discharge issues								
Source, non-source, adjacent, proximate	Source	Source	Source	Source	Non-source	Source	Source	Source
Permitted vs. accidental discharge**	Accidental	Accidental	Accidental	Accidental	Accidental	Accidental	Accidental	Accidental
Type of contaminant	Chlorinated solvents	Hydrocarbon	Chlorinated solvents	Chlorinated solvents	Chlorinated solvents	Hydro-solvents	Hydro-solvents	Hydro-solvents
Level of contamination/discharge	Medium	Medium	Medium-high	Medium-high	Medium	Medium	Medium-high	Medium-high
Area-bioavailability/risk exposure	Low risk	Low	Low	Low-medium	Low	Low	Medium-high	Medium
Remediation lifecycle/detrimental condition stages								
Before cleanup/assessment stage	Contamination has been characterized	Characterized	Characterized	Characterized	Characterized	Characterized	Not fully	Characterized
During cleanup/repair or remediation stage	No Remedial Action Plan (RAP)	No RAP	RAP	No RAP	No RAP	RAP	No RAP	RAP
After cleanup/ongoing stage	Does not have a No Further Action (NFA) letter	No NFA	No NFA	No NFA	No NFA	NFA	No NFA	No NFA
Other/ related issues								
Costs and responsibility	Seller	Seller	Seller	Buyer	Seller	Buyer	Buyer	Buyer
Scale of project	Medium	Medium-low	Medium-high	Medium-high	Medium	Medium	Medium-high	Medium
Impacts on use and use limitations	Minimal impact	Minimal	Medium	Medium-high	Minmal	Medium	Medium-high	Medium
Third party liabilities	Low risk	Low	Low	Low	Low	Medium	Medium-high	Low
Indemnifications	Idemnified	Idemnified	No indem.	No indem.	Indemnified	No indem.	No indem.	No indem.
Insurance	Cost cap – reopener	None	None	None	Cost cap – reopener	None	None	Cost cap – reopener
Time frame and market experience	Current	Similar	Similar	Similar	Similar	Similar	Similar	Similar
Impact on value	To be determined	No impact	5% Discount	12% Discount	No impact	No impact	15% Discount	No impact

* Income–producing properties are not comparable to residential properties.

** Denotes issue that is essential for comparability.

effects, since risk effects may in part be related to uncertainties about future remediation cost estimates and requirements.

Property Characteristics

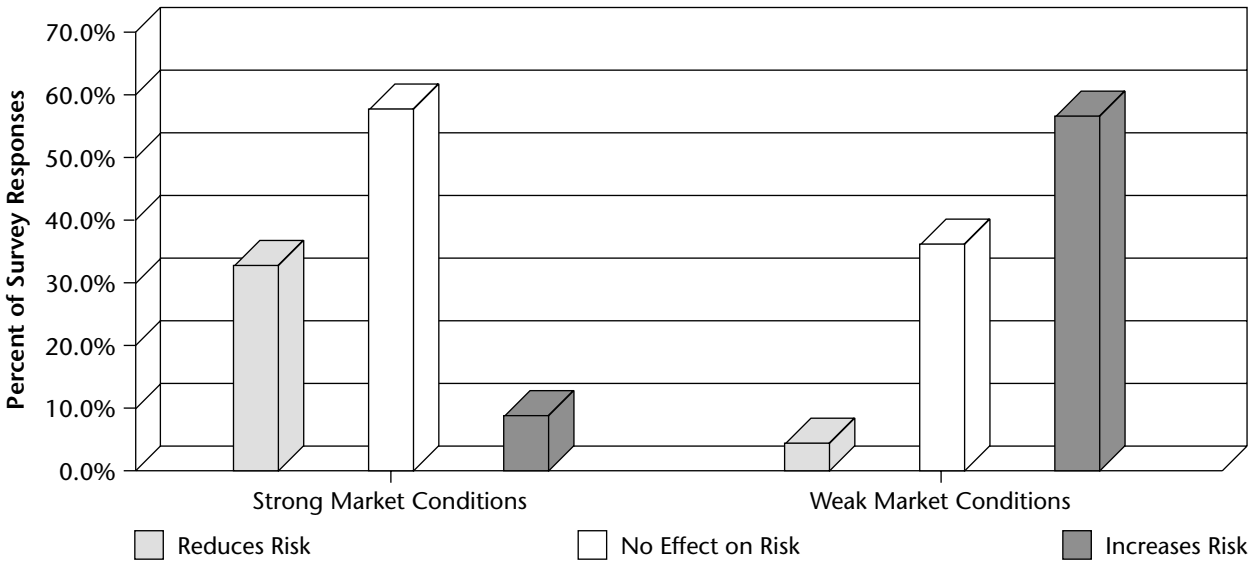
Property Type

An important similarity between the subject property and the case study is the general property type. For example, the differences between a residential property and a service station are so vast that there is simply no comparison. Perceptions, pricing criteria, and the market context of a homeowner are different from a service station owner, whose primary objective is generating income. Likewise, the value of income-producing commercial and industrial properties cannot be estimated on the basis of owner-occupied residential comparables or case studies. Not only does this make sense, it is also consistent with accepted methods for sales comparison analysis. Environmental issues will impact these property types differently. Accordingly, the subject property and case studies should be of the same general property type category. For example, these categories could include: service stations and auto repair facilities, commercial, industrial, and residential properties. At a minimum, owner-occupied residential properties should be compared to residential properties, and income-producing properties should be compared to other income-producing properties.

Market Conditions

It is a well-known attribute of the real estate market that when the market is increasing, many prospective buyers are prone to be more forgiving of certain conditions as compared to periods of market declines. Strong market conditions have a mitigating effect, while poor market conditions tend to exacerbate issues. A case study conducted in a declining market may not be as relevant where the market is now strong, or vice versa. This is consistent with formal research on the effects of environmental contamination on real estate prices, which shows that strong market conditions tend to reduce or mitigate detrimental impacts on real estate prices while weak market conditions increase or exacerbate detrimental impacts.[3] These effects are illustrated in Figure 1. This figure is based on a national survey of more than 200 lenders conducted in 1999. As depicted in Figure 2, nearly 60% of the survey respondents indicated that weak market conditions increase risk. On the other hand, more than 30% indicated that strong market conditions reduce risk. These statistically significant results confirm the general direction and effect of market conditions as intervening factors affecting environmental risk and its impact on value.

Figure 1 Effect of Market Conditions on Environmental Risk



Source: Thomas O. Jackson, "Environmental Risk Perceptions of Commercial and Industrial Real Estate Lenders," *Journal of Real Estate Research* (Nov–Dec, 2001): 271–288.

3. Thomas O. Jackson, "Environmental Risk Perceptions of Commercial and Industrial Real Estate Lenders," *Journal of Real Estate Research* (Nov–Dec, 2001); 271–288.

> "Accidental discharges may be subject to fines and sanctions and permitted discharges generally are not."

Contamination/Discharge Issues

Source/Non-Source/Adjacent/Proximate Site (SNAP)

A critical issue in evaluating environmentally contaminated property is identifying whether it is a source, non-source, adjacent, or proximate site (SNAP).[4] A "source site property" is defined as the site from which the contamination was released. An example of a source site is a service station with a leaking underground storage tank. A non-source property is contaminated, but the contamination emanated from another property (the source site)— for example, a doughnut shop next to a contaminated service station where contamination has migrated off-site and under the doughnut shop property. An adjacent property is not contaminated, but it shares a property line with a property that is. A proximate property is not contaminated and is not adjacent to any contaminated property; however, it is in the same general neighborhood of a contaminated, source site property. These distinctions are critical in evaluating contaminated properties because the risks vary considerably between the categories. Source sites have a much different set of environmental risk factors than non-source or adjacent properties. Generally, the source property owners or prior owners are responsible for the remediation of the contamination. The costs and risks of cleanup and regulatory oversight are far greater than any other category, so comparing a source case study to a non-source, adjacent, or proximate property could be misleading. Accordingly, if the subject property were the source of the contamination, then source site case studies would provide the most meaningful comparisons. Inferences drawn from source site case studies relative to a non-source site subject may be biased toward an over-estimate of environmental impacts.

Permitted vs. Accidental Discharges

A reality of the industrialized world is that there are vast quantities of contaminants produced every day. However, contaminants that are a "permitted discharge" should be distinguished from those emanating from an accidental discharge. A permitted discharge includes governmentally allowed releases such as industrial discharges into a body of water, automobile exhaust, washing machine discharges, landfills, and deep soil discharges or storage. Accidental or illegal discharges include leaking underground storage tanks, oil tanker spills, improper dumping, and so forth. There are critical distinctions between the two types of discharges. One category is permitted and legal, while the other is not. Permitted discharges do not generally involve any level of remediation, while an accidental discharge may require remediation if the quantity of contamination rises above the actionable levels set by governmental agencies. Accidental discharges may be subject to fines and sanctions and permitted discharges generally are not. These are two vastly different sets of circumstances. The release of a potentially hazardous substance that is done under a legally authorized permit with regulatory oversight has a much different set of risk characteristics than an accidental release of hazardous materials from an unplanned or accidental explosion, leak, etc. Risk perceptions of the market are related to unknown information and an accidental release has many more unknowns (cleanup costs, off-site impacts) than a planned release of materials that has been reviewed and permitted by the appropriate regulatory authority. Accordingly, a reliable case study analysis should only use case studies that are identical in this regard.

Type of Contaminant

There are literally hundreds of contaminants, and they can fall into one of several categories: hydrocarbons, including crude oil and refined petroleum; asbestos, a naturally formed rock that can be crushed and used as a building material; solvents, which may be used for dry cleaning or manufacturing; radioactive materials, including radon; metals, such as lead, chrome, or arsenic; and biologicals, such as sewage and medical waste. Research has shown that the type of contamination or hazardous substance has a significant effect on the market's perception of risk and in turn, property value diminution.[5] Ideally, the type of contaminant is the same for both the subject property and the case study. This is important because different contaminants may invoke different responses from the marketplace. A real estate analyst

4. Orell C. Anderson, "Environmental Contamination: An Analysis in the Context of the DC Matrix," *The Appraisal Journal* (July 2001): 322–332.
5. Elaine M. Worzala and William N. Kinnard, Jr., "Investor & Lender Reactions to Alternative Sources of Contamination," *Real Estate Issues* (August 1997): 42–47.

must use caution before comparing a case study that involves a contaminant that differs from the contaminant found at the subject property. It would be improper, for example, to compare a case study involving the effects of petroleum hydrocarbon contamination from a leaking underground storage tank to a subject property impacted by asbestos or radon. However, there are situations where a study is comparable, even though the contaminants differ slightly. For example, it might be worthwhile to compare a shopping center that has soil contamination from a service station's leaking underground storage tank with another shopping center that has soil contamination from dry-cleaning solvents. Careful analysis is required in this situation.

Level of Contamination

While perhaps initially startling to some, virtually all air, water, and soil are "contaminated" at some level. This is a simple reality of an industrialized society. Car emissions alone contaminate the air, water, and soil. Asbestos is a naturally occurring substance, and everyone breathes some asbestos fibers daily. Sewer pipes often leak and contaminate soils. These low-level situations are termed "background contamination." The critical factors in this regard are the standards established by the appropriate regulatory authority. Various governmental agencies set "actionable levels" providing that when some contaminants meet or exceed a certain level, there must be action on part of the responsible party to remediate the condition. Many agencies tailor the standards to the property type and risk exposure characteristics of the property and surrounding area. These are typically tied to risk-based cleanup action (RBCA) requirements that have been adopted by many states. Thus, rather than asking, "Is a property contaminated?" A more valid question is, "What level is the contamination?" While it would be virtually impossible to find case studies that have exactly the same measured quantities of contaminants as the subject property, certainly it is important that the general level of contamination be comparable.

Area Bioavailability/Risk Exposure

There are six areas of a property that may become contaminated. These are: air, water, building improvements, surface/shallow soils, ground water aquifers, and deep soils. These categories are relevant because of the concept of "bioavailability." Bioavailability is the extent to which a contaminant becomes available to humans or the biota, generally. Air pollution would be considered to have a relatively high level of bioavailability, while contaminants that are restricted to deep soils may have no bioavailability. These categories are regarded quite differently by regulatory agencies due to their differing levels of health risk exposure. Simply, where there is no exposure risk, there should be no environmental risk that reduces the value of the real property. Newer risk-based cleanup standards recognize this by treating sites at which there is limited exposure differently from sites at which the exposure is more immediate and of more serious concern. For example, hazardous materials that are trapped thousands of feet underground are different in kind from sites with hazardous materials in the shallow groundwater or in exposed soil. The risk levels, the level of market concern, and the resulting effects on property value are much different. Thus, the risk exposure for the case study properties and the subject property should be similar for a valid case study analysis.

Remediation Lifecycle/Detrimental Condition Stages

This is perhaps the most important set of factors in determining the effects of environmental contamination on real estate prices and market value.[6] Similarly this element is a critical requirement for a valid and reliable case study analysis. The case study property should be in the same stage of remediation (before, during, or after cleanup) at the time of its sale as is the subject property at its date of value. Research has shown that the risks perceived by the market change dramatically as a property moves though the remediation cycle. Before cleanup, risks and property value diminution attributable to environmental condition are greatest. These decline as remediation is underway pursuant to an approved cleanup plan. After cleanup and regulatory closure, property value impacts are minimal and, in most cases, disappear.[7] Bell outlines three condition stages: assessment, repair, and ongoing stages.[8] Similarly, Jackson analyzes the changes in environmental risk and impacts on property value in three categories: before, during, and after cleanup.[9] Within each category or stage, the costs, use, and risks associated with an environmental condition vary and will impact real estate differently.

6. Anderson, 322–332.
7. Jackson, 200–210.
8. Randall Bell, *Real Estate Damages: An Analysis of Detrimental Conditions* (Chicago: Appraisal Institute, 1999): 8-10.
9. Jackson, 271-288.

The generalized effect of the three remediation stages on environmental risk is illustrated in Figure 2. This figure is based on the 1999 lender survey previously discussed. As shown, over 90% of the lenders surveyed indicated that before cleanup of a contaminated source site, property risks would be very high. During cleanup most of the lenders indicated higher than normal risk, while after cleanup, more than 60% indicated that environmental risks would be normal, and loans would be provided at typical rates and terms. In the survey, very high risk was equated to a situation in which a mortgage loan would not be provided due to excessive environmental concerns. Higher than normal risk indicated that a mortgage loan would be provided, but with some adjustments to the loan amount, rate, amortization, term, or conditions. All of the changes in risk perceptions were statistically significant at the 0.05 level, and the survey sample was a probability-based, representative national sample of mortgage lenders.[10]

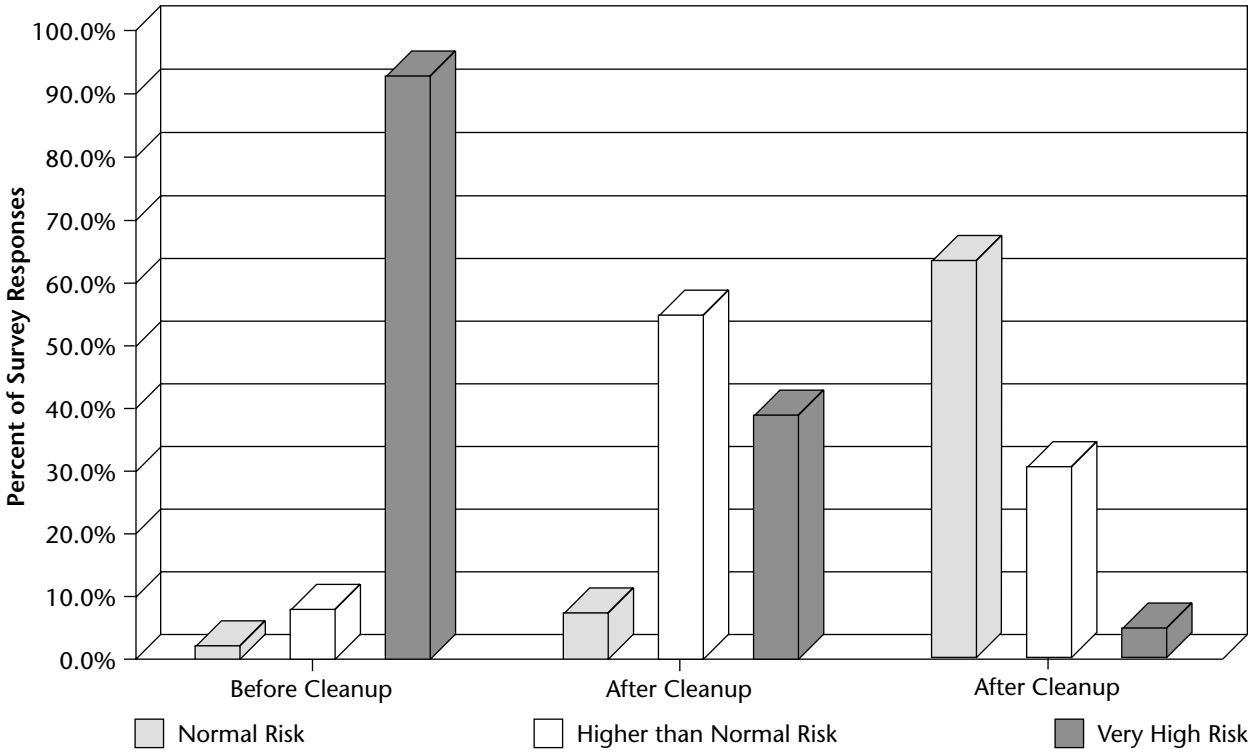
The Before Cleanup/Assessment Stage

Prior to being assessed, there may be great uncertainty about the environmental condition of the subject property, thereby generating uncertainty and a discount to account for the unknown characterization of the property's condition. Upon assessment, this uncertainty is reduced. The principle underlying this effect is that risk is directly related to uncertainty about, and potential variance in, future cash flows. If there is little known about an environmental problem that might later require substantial expenditures for remediation, then future cash flows are less predictable and the investor would require a higher rate of return to compensate for this unknown risk and uncertainty. Indeed, there may be a level at which risk and uncertainty are so high that a property is unmarketable until greater knowledge becomes available. For contaminated properties, greater knowledge involves the nature and extent of the contamination, as well as the requirements, costs, and timing of the remediation effort.

The During Cleanup/Repair or Remediation Stage

Upon being assessed, a contaminated property typically goes through a remediation phase where the contaminants are removed, treated, enclosed, or left to "bioremediation" through a more passive cleanup

Figure 2 Effect of Remediation Status on Environmental Risk



Source: Thomas O. Jackson, "Environmental Risk Perceptions of Commercial and Industrial Real Estate Lenders," *Journal of Real Estate Research* (Nov–Dec, 2001): 271–288.

10. *Ibid.*

strategy. Often there are significant costs associated with a remediation project, and like any property that requires rehabilitation, there is risk associated with these efforts. The assessment of risk during this stage considers whether the cleanup plan has been approved by the appropriate regulatory authority and is being conducted in compliance with the provisions of such a plan. If a property is sold in an assessed but unremediated state, there may be a discount to account for project risk. This can be considered the "project incentive" required by the buyer, if the buyer is responsible for the cleanup. Otherwise, the risk could be termed "market resistance" if another party is responsible for the cleanup costs and related activities. It is likely that there is some combination of these two categories of risk operative at this stage.

The After Cleanup/Ongoing Stage

Research shows that lenders are generally willing to provide mortgage loans after property has been remediated, has achieved a "no further action" status with the appropriate regulatory agencies, and the property value impacts have dissipated (Figure 2).[11] More specifically, the research presented in Figure 2 shows that the perceptions of environmental risk by lenders and investors declines significantly as property is remediated, and that most lenders and investors perceive no additional risk after cleanup to applicable standards and the achievement of "no further action" status. In addition, sales price analyses have shown a similar pattern, with no statistically significant effect on prices after remediation due to previous environmental contamination.[12] Even in situations where there may be ongoing monitoring, operations and monitoring (O&M) programs, and other issues, any residual risk, termed "market resistance," may be eliminated through indemnification, cost cap insurance, secured creditor insurance, value assurance programs, re-opener insurance or other factors. In a case study analysis, special attention must be paid to the specific status and condition of the subject property within the remediation lifecycle as of its date of value. Case studies in a similar remediation stage should be selected, as these would be most reflective of the subject's environmental impacts. Clearly, the risks associated with a contaminated property that has not yet been assessed are greatly different from risks associated with property that has been fully assessed, fully remediated and is in the after cleanup stage of its lifecycle. Identifying the specific lifecycle is critical for a valid and reliable analysis.

Other/Related Issues

Costs and Responsibility for Remediation

The issue of responsibility for cleanup costs has profound implications if remediation is necessary and the subject property is evaluated in a non-remediated state. Whether or not the potentially responsible party (PRP) is known, has assumed responsibility for the environmental contamination, and has offered or provided indemnities to other parties and property owners makes a significant difference in the market's environmental risk perception. A site for which the PRP has not been identified or for which the PRP does not accept responsibility for remediation will be more adversely impacted than an otherwise similar site for which the PRP accepts responsibility and has fully financed the cleanup plan. In addition, the financial strength of the party responsible for site remediation affects the market's perception of environmental risks. Much of the risk associated with contamination is centered on who is going to have to pay for cleanup and whether or not the responsible party is financially solvent.

For example, consider two service station sites that have been sold with leaking underground storage tank issues. A major oil company, which has assumed all responsibility for cleanup costs, owns Service Station A. The company is solvent and financially responsible. Furthermore, not only will the oil company remediate the site, but it will also provide a full written indemnification to future owners of the property whereby it accepts any future liability associated with the contamination it caused. On the other hand, consider an otherwise similar Service Station B that has been owned by a now retired husband and wife who have moved out of state. The property has changed hands on several occasions, and it is uncertain who is responsible for the releases. Furthermore, all the potentially responsible parties deny any responsibility and have limited financial resources. Clearly, the impact of contamination on the value of Service Station A will not be comparable with Service Station B.

11. *Ibid.*

12. Jackson, 200–210.

Scale of Project

Simply stated, some projects are quite large and some are quite small. For example, some of the largest contamination cases in history have involved radioactive contamination in the Marshall Islands (from nuclear testing on the Bikini Atoll) and Chernobyl. The dynamics of these cases obviously differ substantially from a radon case in a single-family residence or a leaking underground storage tank near a commercial property. While an extreme example, the same concept applies. Valid case studies should be generally similar to the subject property in terms of scale of the project.

Impacts on Use and Use Limitations

Whether or not a property's utility has been impacted is another key factor. A situation where the contamination has resulted in the property being vacated is clearly different from a situation where the remediation is non-intrusive and the user can continue operations with little or no disruption. In addition, this element should capture the effects of risk-based cleanups, as previously discussed. Risk-based cleanups typically allow remediation standards to be tailored to specific risk exposures and can allow for regulatory closure without removal of all constituents. For example, an industrial property would be remediated to industrial standards, rather than more costly residential standards. There would then be a future use restriction on such a property, perhaps allowing only industrial uses or land uses with similar risk profiles. This restriction is typically recorded as a deed restriction. Deed restrictions may have an impact on use if the prohibited uses represented are a real and material impact on the use of the property, such a restriction to develop homes where residential uses would otherwise have been the highest and best use. On the other hand, a historic museum that is always expected to remain a museum would not likely have any material impact from a deed restriction for school, daycare, hospital, or residential use.

Third Party Liabilities

Where contaminants have migrated off site from a source property, there may be the risk of litigation from the non-source property owners. Some non-source or adjacent property owners may litigate, even though they have not been impacted in any material way. This risk to the source property owner must be considered, even though the merits of the case may be questionable. If a contaminant plume migration causes a market-recognized concern from a publicized incursion into the groundwater providing potable water in a residential neighborhood, there may be significant risk. In addition, employees or tenants of the contaminated property may pursue claims for personal injury and this may have a detrimental effect. In sum, third-party claims, especially from off-site migration of groundwater contamination, pose an additional risk factor that must be evaluated in a case study analysis. Surrounding property types and neighborhood characteristics are important in this evaluation.

Time Frame and Market Experience

The sale of the case study property ideally should have occurred during the same period as the subject property's date of value. Due to the rapidly changing nature of the market and its experience and ability to deal with environmental risks in real estate transac-

Thomas O. Jackson, PhD, MAI, CRE, AICP, is the president of Real Property Analytics, Inc. in Bryan, Texas, where he specializes in the analysis of real property damages due to environmental contamination and other sources. In addition, he teaches real property valuation in the land economics and real estate program of the Lowry Mays College & Graduate School of Business at Texas A&M University, and is a member of the Appraisal Standards Board of The Appraisal Foundation. **Contact: (979) 823-5243; email: tomjackson@real-analytics.com.**

Randall Bell, MAI, is an applied economist specializing in real estate damage valuation. He is the author of the Appraisal Institute's textbook *Real Estate Damages* as well as the *Detrimental Conditions* and *Real Estate Disclosure* seminars, which he frequently instructs. He is also on the Advisory Board of the Bureau of National Affairs. Mr. Bell has an MBA Degree from UCLA and is the CEO of Bell Anderson & Sanders LLC in Laguna Beach, California. **Contact: (949) 497-7600; email: Bell@RealEstateDamages.com.**

tions, contaminated properties sold many years ago may not be appropriate for more current dates of value. Brownfields programs, more flexible regulations, risk-based cleanup standards, and the increased experience of lenders and investors with environmental issues have all resulted in a lessening of the impacts of contamination on real estate values.[13]

Indemnification and Insurance

An indemnification is the written assurance of the responsible party that they will incur all costs associated with the contamination. Where an indemnifying party is financially solvent and willing to pay for all required remediation costs, the risk is reduced or may be eliminated altogether. Also, many risks can be insured. For example, remediation cost overruns, third-party liability, loss in property value, agency "re-openers" and other concerns may be virtually eliminated by insurance.

Summary and Conclusions

Case studies can be useful in valuing environmentally impacted properties. However, a case study, like any comparable, should be similar to the subject property being studied. For example, case studies involving leaking underground storage tanks (LUSTs) should include other situations with LUSTs. Asbestos situations should utilize case studies with asbestos. Oil spills should be considered with other oil spills. Ideally, case studies are similar with respect to the type of contaminant and the other issues set forth in this paper. The best and most comparable case studies would be similar to the subject property in terms the SNAP issues, being an accidental versus a permitted discharge, and remediation lifecycle stage. Other elements can be addressed through a sales comparison type analysis, with market-derived quantitative adjustments or qualitative comparisons. With this framework, case studies may be a useful addition to the tools for assessing the effects of adverse environmental conditions and other detrimental conditions on real property. Indeed, the case studies framework outlined herein could be applied to the analysis of a variety of detrimental conditions, although the elements of comparison would be different.

13. Thomas O. Jackson, "Investing in Contaminated Real Estate," *Real Estate Review* (Winter 1997): 38–43.