IN THE UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF ARKANSAS
FORT SMITH DIVISION

SCOTT DAY and GLENDA V. WILSON, individually and on behalf of all others similarly situated, **Plaintiffs,** **vs.** **WHIRLPOOL CORPORATION,** **Defendant.**	**Civil Action No. 2:13-cv-02164-PKH**

MEMORANDUM IN SUPPORT OF DEFENDANT'S MOTION TO STRIKE OR DEFER AS PREMATURE NOTICE OF APPEARANCE OF OBJECTORS' COUNSEL AND OBJECTORS' OPPOSITION TO JOINT MOTION FOR PRELIMINARY APPROVAL OF CLASS SETTLEMENT

Defendant Whirlpool Corporation ("Whirlpool") submits this Memorandum in Support of its Motion to Strike or Defer as Premature the filing titled Putative Class Members Objection to Motion for Preliminary Approval of Class Action Settlement.

INTRODUCTION

On July 3, 2014, the Parties filed a Joint Motion for Preliminary Approval of Class Settlement with this Court. On September 12, 2014, attorneys representing certain individuals who would be members of the class, if certified by the Court, ("Prospective Class Members" or "PCMs") sought to enter an appearance in this case and filed a motion that attempts to object to the motion for preliminary approval of the proposed class settlement (Dkt. # 37). These Prospective Class Members and their counsel do not have standing to appear in this case, at this juncture, much less to file objections to the proposed class settlement at the preliminary approval stage. Accordingly, the notice of appearance of the PCMs' counsel and

the objections to the Motion for Preliminary Approval of Class Settlement should be stricken, or at least deferred until the final approval hearing.

APPLICABLE LEGAL STANDARDS

Under Federal Rule of Civil Procedure 23(e), the settlement of a class action requires court approval, which may issue "only after a hearing and on finding that [the settlement] is fair, reasonable, and adequate." Fed.R.Civ.P. 23(e)(2). Review of a proposed class-action settlement proceeds in two well-recognized stages—preliminary review and final approval. At the first stage, the parties submit the proposed settlement to the Court, which must make "a preliminary fairness evaluation." Manual for Complex Litigation (Fourth) ("Manual") § 21.632 (2004); *see also* 4 Alba Conte & Herbert Newberg, Newberg on Class Actions § 11:25, at 38-39 (4th ed. 2002) ("Newberg on Class Actions") (endorsing two-step process); *accord, e.g., Valencia v. Greater Omaha Packing*, Nos. 8:08CV88, 8:08CV161, 2013 WL 5347442, at *1 (D.Neb. Sept. 23, 2013); *Schoenbaum v. E.I. DuPont de Nemours & Co.*, No. 4:05CV01108, 2009 WL 4782082, at *2 (E.D.Mo. Dec. 8, 2009).

At the preliminary-approval stage, "the fair, reasonable and adequate standard is lowered, with emphasis only on whether the settlement is within the range of possible approval due to an absence of any glaring substantive or procedural deficiencies." *Schoenbaum*, 2009 WL 4782082, at *3 (emphasis added) (internal quotation marks and citations omitted). To grant preliminary approval, the Court need only find "the proposed settlement is the result of the parties' good faith negotiations, there are no obvious deficiencies and the settlement falls within the range of reason. *Gautreaux v. Pierce*, 690 F.2d 616, 621 n.3 (7th Cir. 1982) (the

purpose of preliminary approval "is to ascertain whether there is any reason not to notify the class members of the proposed settlement and to proceed with a fairness hearing").

In preliminarily approving a settlement class, "the Court is not endorsing any evidence or arguments that the parties will submit" and the "decision regarding the settlement class rests solely on the uncontested evidence presented by plaintiffs and the settling defendants." *Columbus Drywall & Insulation, Inc. v. Masco Corp.*, 258 F.R.D. 545, 552-53 (N.D. Ga. 2007). The Court's present task is simply to "lay the ground work for a future fairness hearing." *Alberto v. GMRI, Inc.*, 252 F.R.D. 652, 659 (E.D. Cal. 2008). Putative class members' dissatisfaction with certain proposed settlement terms is therefore not a bar to preliminary approval. *See Casey v. Citibank, N.A.*, No. 12-CV-820, 2014 WL 3468188, at *1 (N.D.N.Y. Mar. 21, 2014) ("attempt to object to the proposed settlement agreement [at preliminary approval stage] is inappropriate and premature. The proper time to present their objections is at the final approval hearing."). "Assuming preliminary approval is granted, the [premature objectors'] interests can be protected at the fairness hearing for final approval of the settlement. Moreover, if they do not wish to be bound by the settlement, they can opt out of the class and pursue their cases separately." *Id*.

"If the preliminary evaluation of the proposed settlement does not disclose grounds to doubt its fairness or other obvious deficiencies, such as unduly preferential treatment of class representatives or of segments of the class, or excessive compensation for attorneys, and appears to fall within the range of possible approval, the court should direct that notice under Rule 23(e) be given to the class members of a formal fairness hearing, at which arguments and evidence may be presented in support of and in opposition to the settlement." Newberg on Class Actions, § 11.25 (emphasis added); *see also First Nat'l Bank v. Am. Lenders Facilities,*

Inc., 2002 WL 1835646, at *1 (D. Minn. 2002) ("The proposed settlement between the Plaintiff Class and the Defendants appears, upon preliminary review, to be within the range of reasonableness and accordingly, the Notice … shall be submitted to the class members for their consideration and for hearing under Fed. R. Civ. P. 23(e).").

ARGUMENT

I. The Nonparty Prospective Class Members Lack Standing to Appear Now in this Case and Submit Objections to the Motion for Preliminary Approval of Class Settlement.

In federal court, class members may object to a proposed class settlement only after the court grants preliminary approval to the class settlement and after class notice has been sent out, and after the deadline for opting out of the settlement has passed. The Federal Rules of Civil Procedure provide that the "claims, issues, or defenses of a *certified* class may be settled, voluntarily dismissed, or compromised only with the court's approval" and that a "*class member* may object to the proposal if it requires court approval under this subdivision (e)." Fed. R. Civ. P. 23(e) (emphases added). "Under Fed. R. Civ. P. 23(e), non-class members are not permitted to assert objections to a class action settlement." *Ass'n For Disabled Americans, Inc. v. Amoco Oil Co.*, 211 F.R.D. 457, 473 (S.D. Fla. 2002); *see also In re CP Ships Ltd., Secs. Litig.*, MDL No. 1656, 2008 WL 2473684, at *1 (M.D. Fla. June 19, 2008) ("Pursuant to the plain language of Rule 23 of the Federal Rules of Civil Procedure, only 'class members' may object to a proposed class action settlement.").

The Prospective Class Members cannot put the cart before the horse. No Settlement Class has been certified, and no Class Members yet exist. For that to occur, the Court must first preliminarily approve and certify the proposed Class, after which all Class Members will receive notice of the final settlement terms, including their rights to opt out or object or enjoy

the benefits provided thereunder, as they ultimately shall choose.[1] It would be "novel and surely erroneous" to argue "that a nonnamed class member is a party to the class-action litigation *before the class is certified*." *Smith v. Bayer Corp.*, 131 S. Ct. 2368, 2379 (2011) (internal quotation marks omitted). As the Supreme Court long ago explained, "potential class members are mere passive beneficiaries of the action brought in their behalf. Not until the existence and limits of the class have been established and notice of membership has been sent does a class member have any duty to take note of the suit or to exercise any responsibility with respect to regarding it in order to profit from the eventual outcome of the case." *Am. Pipe & Constr. Co. v. Utah*, 414 U.S. 538, 552 (1974). Because no Class or Class Members yet exist, the Prospective Class Members lack standing to object. They may do so *after* the Settlement Class is preliminarily approved and certified and a fairness hearing is set for that very purpose, among others. *See, e.g.*, *Ass'n For Disabled Americans*, 211 F.R.D. at 473 (nonparty lacked standing to object); *CP Ships*, 2008 WL 2473684, at *1 (same); *In re Domestic Air Transp. Antitrust Litig.*, 148 F.R.D. 297, 343 (N.D. Ga. 1993) (same).

Because the Prospective Class Members lack the requisite standing to object to the class settlement at this time, the appearance of their counsel and their objections should be stricken or at least deferred until after the passing of the opt out deadline and the time of fairness hearing.

[1] Whirlpool notes for the Court's benefit that the parties to this action will shortly file an Amended Class Settlement Agreement to reflect certain additional terms of which the Prospective Individual Class Members or other prospective Class Members do not yet even have notice.

II. Putative Class members that Opt Out of the Class Settlement Do Not Have Standing to Object to Terms of Settlement

In the Prospective Class Members' opposition memorandum, their counsel represents: "Most, if not all, objectors will *opt-out* of the class should it receive approval." Memo. Opp. at 23 (emphasis added). This statement of intent clearly illustrates why the Prospective Class Members' objections should not be heard at this time. If the class settlement is preliminarily approved, the next step is notice to the class of the proposed settlement and the opportunity to opt out. Any putative class members that opt out of the class settlement will have no standing to object to the settlement to which they are not a party. *See Mayfield v. Barr*, 985 F.2d 1090 (D.C.Cir.1993) (explaining that individuals that opt out of a settlement have no standing to challenge the court's approval of a settlement agreement); *Olden v. LaFarge Corp.,* 472 F.Supp.2d 922, 931 (E.D.Mich.2007) (explaining that to allow a class member to simultaneously opt-out of a settlement and object to the settlement "would countenance the practice of influencing litigation—or attempting to do so—in which the class member really has no stake"); *Agretti v. ANR Freight Sys., Inc.*, 982 F.2d 242, 247 (7th Cir.1992) (concluding that a non-settling defendant lacked standing to challenge settlement); *In re School Asbestos Litig.,* 921 F.2d 1330, 1331 (3d Cir.1990) (same); *see also* Manual for Complex Litigation, § 21.643 (4th ed.) ("Any class member who does not opt out may object to a settlement, voluntary dismissal, or compromise that would bind the class.") (emphasis added).

By improperly objecting at the preliminary approval stage, the Prospective Class Members are attempting both to opt out of the class settlement and to derail it so that others may not benefit from it. To permit these objections to be made at this stage is unfair to the other class members who are fully entitled to receive proper notice of this very generous

settlement and who wish to it approved by this Court, so they can receive their just compensation both sooner and undiminished by the incurrence of wholly unnecessary litigation whose considerable expense would inure only to the benefit of the Prospective Class Members' counsel in seeking to be heard to object untimely and on behalf of prospective opt-outs. Whatever the motives behind this improper effort to impede an arm's length, sensible and more-than-adequate resolution on behalf of all putative class members who would and will welcome the right to enjoy its benefits, class action settlement procedures do not allow it, nor should this Court.

IV. The Proposed Settlement Is Generous to the Property Owners

Objections raised to the class resolution should raise no concerns for the Court, even assuming *arguendo* that the Court entertains them at this preliminary approval stage. As explained in the Joint Motion for Preliminary Approval, the proposed class settlement is generous to the class and, importantly, enables the parties to resolve their differences without costly, needless, lengthy and uncertain litigation.

The settlement will reimburse 100% of the property devaluation as determined by the Sebastian County Tax Assessor for properties located within the defined Well Ban area, which encompasses all properties with TCE groundwater contamination. The Tax Assessor's devaluation assessments are deserving of some weight, because they were rendered by an independent government official performing her assigned duties in the ordinary course. However, given the low levels of contamination; the State's public record determination that there are no pathways of exposure to the groundwater; the fact that Whirlpool is implementing a State-approved remedy; and, the published literature that reflects much smaller impacts of contamination on property values; Whirlpool believes the Tax Assessor erred in adjusting

assessed values as dramatically as she did. While Whirlpool contends, as discussed further below, that the Assessor's actions far exceeded any reasonable standard for devaluation, Whirlpool also recognizes that spending resources challenging these actions would require a substantial investment of time and money – an investment this early resolution seeks to avoid.

Whirlpool believes that paying the full property devaluations estimated by the Tax Assessor for well ban properties represents a significant concession by Whirlpool and a real benefit for the residents. Specifically, the Tax Assessor has devalued real property located in the area of a proposed well ban ***by 75%*** for real property and 50% for improvements. Studies indicate that the 75% devaluations used by the Tax Assessor are many times higher than should be expected. A study by the United States Environmental Protection Agency (EPA) indicates "price effects at properties proximate to environmental disamenities most frequently range from ***two to eight percent*** of original property values." Memorandum from Industrial Economics, Inc. to Jean Schumann, U.S. EPA, *Review of Current Property Valuation Literature* (Aug. 22, 1999). (Ex. A). Importantly, where, as here, use is unaffected, values may not be affected at all. Richard Roddewig, *Stigma, Environmental Risk and Property Value: 10 Critical Inquiries*, 64 The Appraisal Journal 375, 383 (Oct. 1996)(If use "has not been affected, and the current use is the highest and best use and is likely to continue indefinitely, then many times there may be little or no stigma from the contamination or risk.") (Ex. B). And, importantly, "risks perceived by the market change dramatically as a property moves through 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." Thomas O. Jackson & Randall Bell, *The*

Analysis of Environmental Case Studies, The Appraisal Journal 86, 113 (January 2002) (Ex. C). So, although Whirlpool is convinced based on the relevant literature that the property values in Ft. Smith will not be affected in the range estimated by the Tax Assessor, it nonetheless agreed to make these payments to compromise for all types of damages being asserted, including future remediation costs, punitive damages, and loss of use..

Given this research, it is difficult to imagine how any competent, qualified appraiser could find property devaluations of the magnitude used by the Sebastian County Tax Assessor, especially where there are no health effects from the contamination, every owner has city water, no property relies on a water well, no property owner's actual use of their property is affected in any way, and the site is being remediated under the careful scrutiny of state environmental officials. Further, Whirlpool is donating property to the City of Ft. Smith for road improvement projects and it is in the process of selling its former manufacturing facility for repurposing, which one would expect to have a very positive effect on property values.[2]

And yet, the settlement with the putative class goes further still. Precisely to mitigate any anxiety or uncertainty such as is stirred-up by counsel for the Prospective Class Members, the class settlement affords class members who do not opt out the to have their settlement award calculated by a neutral, independent appraiser--irrespective of the tax assessor's devaluation--based on the appraised current market value compared to appraised pre-contamination market value, with the further right to appeal *that* measure of damages to a Special Master independently chosen to act on behalf of the Court in that capacity.[3] Counsel

[2] It is important to also note that a future increase in appraisal values will not require the residents to pay back any of portion of the monies received in this settlement. In other words, any future windfall the owners receive is theirs to keep.

[3] The parties to this action will be filing an Amended Class Action Settlement Agreement this week which provides for a right to appeal to a special master the devaluation determined by the appraiser.

for the Prospective Class Members cannot and do not make the case that this alternative, additional claims resolution mechanism is not a fair, much less so paltry a means of compensation to justify denial of preliminary approval under applicable legal standards.

Similarly, the Fringe Subclass settlement is fair. Under the current settlement agreement each property owner will get $5,000 just for living nearby.[4] None of these owners have TCE levels in their groundwater above levels that would meet Safe Drinking Water Act standards, were anyone to have a well and want to drink it (which no one does). A well ban for this area would make no sense, and their properties should be experiencing no devaluation. Nonetheless, to address any possibility that higher levels of TCE might migrate to their groundwater in the future, Whirlpool agreed to pay these owners under the same formula as the Well Ban Subclass if their properties are later affected by TCE groundwater contamination above drinking water levels. This built-in adjustment mechanism is a fair resolution because it is unlikely these residents will see any effects of the contamination; but if they do, then their compensation is adjusted to the reimbursement for all the same reasons as the Well Ban Subclass compensation is.

V. Counsel for the Intervening Prospective Class Members is the Lone Beneficiary of Derailing the Class Settlement

If the Court grants preliminary approval to this class action settlement and it proceeds, one substantial benefit to the property owners is they will undoubtedly incur far smaller attorneys' fees than they would see after a period of vigorous motions practice, lengthy discovery, and extensive use of multiple, competing experts. As compared to the generous and efficient settlement provided by the proposed class settlement, protracted litigation, which is the path taken by counsel for the Prospective Class Members in their separate pending

[4] This rises to $ 6650 under the Amended Settlement Agreement.

lawsuits, would require many expensive expert witnesses, perhaps a hundred depositions, and a voluminous motion and discovery practice that would delay any compensation to residents for many months, if not years. At the end of that, if plaintiffs prevailed, it is highly doubtful class members damages would exceed their payments under this class settlement, even before those damages are netted of counsel's fees and expenses. The class stands to benefit by getting paid sooner and by netting a higher recovery unburdened with huge attorneys' fees. Whirlpool seeks a global resolution of this litigation which benefits all of the affected property owners, allows the community to move forward, and allows access to properties needed to complete the remediation efforts already under way. To achieve this, even after the class settlement was reached and the motion for preliminary approval was filed, Whirlpool continued to have discussions with counsel for the Prospective Class Members, seeking in good faith to address any legitimate concerns with the class settlement. Because of these discussions and with the participation and concurrence of class counsel, Whirlpool and class counsel are amending the settlement in the hope that all affected property owners will understand that participating in this class settlement offers them by far the more attractive, expeditious and satisfactory means to resolve their grievances. Some highlights of the amended class settlement agreement to be submitted shortly to the court are (1) payment of an additional 33% on top of the proposed compensation from which attorneys fees and costs can be deducted – this will net substantial additional, compensation for the class, as the Court would not likely approve a full 33% fee at this stage of the litigation; (2) the addition of an appeal process to the Well Ban Subclass appraisal option; and (3) narrowing of Whirlpool's right to withdraw from the settlement to the circumstance where 25% or more of the putative class opts out of the settlement.

CONCLUSION

The notice of appearance of the Prospective Class Members' counsel and the objections to the Motion for Preliminary Approval of Class Settlement are improper and premature. Therefore, Whirlpool requests that the notices of appearance and objections be stricken, or at least consideration of them deferred until the final approval hearing if such counsel's clients do not -- as they presently maintain they will -- opt out. If the Court denies this motion, Whirlpool requests it be given the opportunity to fully brief a response to the objections.

Respectfully submitted this 22nd day of September, 2014,

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CERTIFICATE OF SERVICE

I hereby certify that on September 22, 2014, I filed a copy of this document electronically through the CM/ECF system, which caused counsel of record in this matter to be served by electronic means.

/s/ Robert H. Brunson
Robert H. Brunson

EXHIBIT A

APPENDIX A

REVIEW OF CURRENT PROPERTY VALUATION LITERATURE

MEMORANDUM

August 22, 1999

TO: Jean Schumann, US EPA OSWER

FROM: Katherine Spector and Cynthia Manson, Industrial Economics, Inc.

SUBJECT: Review of Current Property Valuation Literature

This review compiles and summarizes current literature addressing the effect of proximity to environmental disamenities on property values. In an attempt to characterize how RCRA Subtitle C regulations affect property values near RCRA sites, we have identified price effects near general environmental disamenities as well as Superfund sites.[1] These studies yield relevant information regarding the advantages and disadvantages of various methods of property value determination, identify important variables for consideration in valuation studies, and provide an approximate range of distance-dependent price effects.

Property values generally reflect a wide range of amenities and disamenities available in a given community, including the potential negative values of a Superfund hazardous waste site. Price changes associated with proximity to a hazardous waste site may reflect the owners' evaluations of any or all of the following attributes: human health, ecological damage, cost of alternative water supplies, aesthetic damage, and economic effects such as changes in employment opportunities. Because they represent empirical data on actual consumer values of multiple attributes, property value price effects may be useful in assessing the benefits of avoided hazardous waste contamination under RCRA Subtitle C.

In the empirical and theoretical property value studies that we examined, results rely on interpretations of hedonic modeling as well as alternative methods. We therefore provide below a

[1] Superfund sites and their effects on property values may be a useful proxy in estimating the types of damage that may have occurred in the absence of the RCRA regulations. However, to assess the validity of this proxy, we also assess other, non-Superfund disamenities in this review in an attempt to distinguish any variations in price effects associated with disamenities of different types or severity.

brief summary of theoretical literature to introduce various methods for determining the price effect on property values near environmental disamenities. We then provide summaries of several studies and briefly note areas where issues raised in these theoretical discussions are applicable. Exhibit A-1 compiles several types of hedonic studies represented in the current literature. Exhibit A-2 lists variables relevant to hedonic modeling that appear in the literature, and that should be considered in future efforts of this kind. Since much of the literature presents empirical results in terms of "absolute dollar values lost," Exhibit A-3 is an attempt to express the results of all studies in terms of a "percentage of value lost" to make all cross-study results more comparable. Finally, we discuss the relevance of these findings to RCRA cost-benefit analysis and provide suggestions for how further research on this topic could proceed.

THEORETICAL DISCUSSION OF METHODS

Several studies assess the advantages and disadvantages of various methods for determining the changes in property values associated with proximity to a disamenity. While this group of methods studies does not provide empirical conclusions, it introduces key issues that are relevant to empirical investigations.

Hedonic price modeling is the dominant method for determining how various property characteristics affect values. Hedonic pricing is based on the assumption that amenities (e.g. square footage, access to recreational areas, or in-ground pool) have a cumulative effect on the value of the property; a greater number of amenities results in a higher sales price, whereas disamenities reduce value. Regression analysis isolates and quantifies the contribution of a single given amenity to the additive price effect. In this context, studies perform multiple regressions on the values of bundled good commodities (such as a house or commercial property) to isolate the value effect of proximity to an environmentally offensive site. The simplest, traditional hedonic study might measure only house features (e.g. number of rooms, lot size, etc.) and distance from a waste site. Thus, an indirect "cost" of an environmental disamenity is determined with respect to property values.

Freeman's [1979] comprehensive and oft cited study of hedonic price modeling techniques provides a useful review of the theory and assumptions guiding this method. Freeman briefly discusses application of the theory to cases of air, water and noise pollution. He concludes that, despite limitations and uncertainties, hedonic modeling has significant explanatory power. Market segmentation (i.e. division of a regional market into smaller segments each with distinct hedonic price functions), for example, is one area where Freeman encourages additional research. Freeman's recognition of differences within regional housing markets foreshadows attention to neighborhood variables in later hedonic studies.

While Freeman provides a theoretical basis for hedonic models, several methods exist for collection of the data used in these studies. **Pettit & Johnson [1987]** survey the various methods of calculating the impact on property values of proximity to a landfill. This study discusses the pros and cons of various methods of data collection, including assessed (tax generated) valuations, sales data, and willingness-to-pay surveys. Since most empirical studies employ one or more of these

techniques, Pettit & Johnson offer a useful means of estimating the strengths and limitations of other research efforts.

In addition to particular methods of data collection, some studies emphasize inclusion of specific variables in addition to the distance-from-disamenity and property characteristics traditionally included in hedonic regressions. **Roddewig [1996, 1999]** presents a theoretical discussion of variables that may potentially affect the existence or magnitude of changes in property values near environmental disamenities. For example, risk type, media interest, and remediation planning inform some of Roddewig's "critical questions" of property value determination. He poses additional questions about site characteristics that may extend the explanatory power of traditional hedonic models.

While most property values assessments recognize the effectiveness of hedonic modeling, several studies propose adaptations of these methods. **Murdoch [1988]** suggests that, when deriving hedonic price estimates, the *probability* of a given level of environmental quality over time is a more appropriate measure than the *mean* level of environmental quality over time. **Palmquist [1988]** advocates both supply- and demand-side hedonic price modeling.

Several studies recommend alternatives to hedonic price modeling. **Palmquist [1982]** offers a "statistically equivalent" method in lieu of hedonic regressions that does not demand extensive data collection. By examining repeat-sales data before and after environmental damage occurs, changes in property values attributable to the disamenity may be measured without multi-variable data collection. In other words, a single property with a constant set of characteristics is compared to itself over time, isolating the effect of the environmental disamenity. **Nieves [1993]** briefly summarizes the premises of hedonic modeling, "psychometric measures," and contingent valuation studies. In addition to comparing these methods, Nieves proposes a means for integrating the economic and psychometric approaches emphasized by these methods.

SUMMARY OF REVIEWED EMPIRICAL STUDIES

Exhibit A-1 provides summary information from each study that we examined. Pertinent variables in property value assessments suggest a range of price effects based on the literature reviewed. For each study we have included temporal and geographic data, facility type, and the range of distance examined. Some studies measure changes in property values over time, over stages of EPA action, over stages of cleanup, etc.; the emphasis of each study is noted where relevant. Finally, we summarize the property value impact in the units of measurement provided by each study, and provide general conclusions and comments about the advantages and limitations of each methodology. We have grouped the collected studies into the following categories for consideration:

- Pure hedonic regressions, including the distance-from-disamenity variable and standard property characteristics.

- Studies incorporating additional variables to determine property value changes attributable to disamenity proximity.

- Studies employing methods in comparison to or as alternatives to traditional hedonic models.

Exhibit A-1

COMPILATION AND SUMMARY OF CURRENT LITERATURE

REPRESENTATIVE BASIC HEDONIC MODELS

Study	Years of Data	Location	Type Of Site	Timing Stages	Distance Range	Property Value Impact	General Conclusions	Comments
Nelson, et al. (1992)	1979-1989	Ramsey, MN (one site, 708 houses)	Solid waste landfill (operating)	n/a	• Boundary • 1 mile • 2 to 2.5 miles	Value Loss / Distance 12 % of value / Site boundary 6% of value / 1 mile Negligible / 2 to 2.5 miles	• Property values decrease with proximity to waste site.	• Sample area consists of homogenous, single-family homes.
Thayer, et al. (1991)	1985-1986	Various (U.S.)	TSDF	n/a	•0 to 1 mile •1 to 4 miles •>4 miles	• 1.2 to 1.6 % of value	• Property values decrease with proximity to waste site.	
Reichert (1997)	1977-1994	Uniontown, OH (1 site, 1,600 homes)	Superfund toxic waste	• Pre-IEL period (1977-1987) • Post-IEL period (1988-1994)	• Ring 1 (<2,250 ft.) • Ring 2 (2,251 to 4,500 ft.) • Ring 3 (4,501 to 6,750 ft.) • Ring 4 (6,751 to 9,000 ft.)	Post-Industrial Excess Landfill Period: Value Loss / Distance 14.66% ($15,809 per house) / Ring 1 6.40% ($7,702 per house) / Ring 2 5.48% ($5,406 per house) / Ring 3 0.97% / Ring 4 $10,960,637 (cumulative) / Total area (1994 $)	• Property values negatively impacted by proximity to site, up to 6,750 feet. • Estimated cumulative damages close to $11 million.	• Very high R-squared value, indicates that variables included in regression successfully explain observed property values.

Exhibit A-1

COMPILATION AND SUMMARY OF CURRENT LITERATURE

ADDITIONAL HEDONIC REGRESSION VARIABLES

Study	Years of Data	Location	Type Of Site	Timing Stages	Distance Range	Property Value Impact	General Conclusions	Comments
Kiel & Zabel (1999)	1975-1992	Woburn, MA (2 sites, >2,000 houses)	Superfund	• Pre-discovery (1975-1976) • Discovery (1977-1981) • NPL listing (1982-1984 • Cleanup proposal (1985-1988) • Cleanup anncmt. (1989-1991) • Cleanup (1992)	0 to 3 miles	1977-81 / 1982-84 / 1985-88 / 1989-91 / 1992 0.5 m. $9,312 / $8,769 / $10,498 / $12, 466 / $16,843 1 m. $6,798 / $11,367 / $ 7,895 / $12,882 / $17,156 1.5 m. $4,609 / $11,789 / $5,544 / $11,844 / $15,583 2 m. $2,747 / $10,035 / $3,445 / $9,351 / $12,214 2.5 m. $1,210 / $6,106 / $1,597 / $5,403 / $7,020 (1992 $)	• Suggests method of calculating expected benefits of cleanup relative to costs. • Cleanup of Woburn sites valued at $150 million, which exceeds PV of cost of cleanup, yielding positive net societal benefits.	• Damage variable of greater statistical significance than other neighborhood characteristics. • Areas of uncertainty acknowledged: e.g. assumes full recovery of site after cleanup; ignores commercial use value, no-use value.
NCERQA (1998)	1979-1995	Various (U.S.)	Smelter	• ID and cleanup (1981-1986) • Post-cleanup (1987-1990) • Additional concern (1991-1995)	• Within 1 mile • Within 4 miles	• Not included	• Stigma (hysteresis, path dependence) makes full property values irrecoverable even after cleanup ONLY when houses are within one mile of site.	• Empirical evidence of conclusions not included.
Gayer, et al. (1997a)	1988-1993	Greater Grand Rapids, MI (7 sites)	Superfund	n/a	n/a	Value recovery / Information source $1,736 to $1,842 / Per 12,675 printed words $54.6 to $58.8 million / Total EPA information dissemination	• Homeowners overestimate risk of site before EPA releases information. • Risk perceptions are undated as information becomes available, and values rebound so that net price effect is zero. • Cost of information dissemination is less than potential lost property values	• Uses repeat sales data to assess changes in risk perception. • Assumes residents are Bayesian decision-makers.

Exhibit A-1

COMPILATION AND SUMMARY OF CURRENT LITERATURE

Study	Years of Data	Location	Type Of Site	Timing Stages	Distance Range	Property Value Impact	General Conclusions	Comments
Gayer, et al. (1997b)	1988-1993	Greater Grand Rapids, MI (7 sites)	Superfund HW	•Before EPA announcement of NPL listing • After EPA announcement • After information dissemination	n/a	Values Loss / Time Stage $9.1-10.1 million (cumulative) / NPL listing Reduced / After information disseminated	• Residents have incentive to inflate perceived risk to push for remediation by EPA. • Result is difference between public and private expression of risk perception. • WTP to avoid HW decrease with information availability.	• Assumes Bayesian learning (i.e. assumes that decision-makers are able to consistently incorporate new information into their decision making framework as it becomes available).
Simons, et al. (1997)	1986-1997	Greater Cleveland area, OH (>200 UST events)	UST	After contamination known	n/a	Financial Losses / Property Type 14-16% initial value / Residential 28-42% initial value / Commercial 33% drop in transaction rate / Commercial Double the rate of seller financing / Commercial	• Includes actual or likely UST-contaminated properties. • Finds significant declines in values of residential and commercial properties.	• Demonstrates importance of including commercial properties in hedonic studies.
Kiel (1995)	1975-1992	Woburn, MA (2 sites)	Superfund HW	• Pre-awareness • Discovery phase • EPA announcmt. • Cleanup intentions announced. • Cleanup plan announced • Cleanup initiated		Value Loss / Time Period Insignificant / Pre-awareness (1975 to 1976) $185 per mile / Discovery phase (1977 to 1981) $1,377 per mile / EPA announcement (1982 to 1984) $3,819 per mile / Cleanup intentions announced (1985 to 1988) $4,077 per mile / Cleanup plan announced (1989 to 1991) $6,468 per mile / Cleanup initiated (1992)	• Values are impacted prior to EPA announcement, and do not rebound after cleanup initiated. • Thus, EPA does not affect housing market with cleanup efforts, so benefits are difficult to calculate. • Prices could, however, recover after cleanup is completed and assessed.	• Compares to other studies and accounts for variation. • Distinction between discovery phase and EPA announcement measures role of public perception.

Exhibit A-1

COMPILATION AND SUMMARY OF CURRENT LITERATURE

Study	Years of Data	Location	Type Of Site	Timing Stages	Distance Range	Property Value Impact	General Conclusions	Comments
Kiel & McClain (1995)	1974-1992	North Andover, MA (1 site, 2,593 sales)	Incinerator (pre-operating; operating)	• Pre-rumor (1977-1978) • Rumor (1979-1980) • Construction (1981-1984) • Online (1985-1988) • On-going operations (1989-1992)	• Up to 3.5 miles	Value Loss — Time Period Insignificant — Pre-rumor Insignificant — Rumor $2,283 per mile — Construction $8,100 per mile — Online $6,607 per mile — On-going operations	• In response to studies that select single moments in time before and after disamenity disappears. • Distance premium lasts 7 years after operation, since those who feel strongly relocate.	• Pre-rumor and rumor stages are constants that show no inherent undesirability of property.
Greenberg & Hughes (1992)	1980-1988	New Jersey (77 areas)	Superfund HW	• 1975 to 1980 • 1980 to 1985 • 1985 to 1988	n/a	Not included.	• Some evidence (not overwhelming) that negative price effect is stronger in rural areas and hot markets. • Magnitude of hazard is insignificant variable.	• Compares Superfund communities to non-Superfund communities. • Study acknowledges limitations: e.g. large scale of data may overlook local effects; ignores initial values; includes unique communities (e.g. Atlantic City); NJ "price frenzy" may not be generalized to other areas.
Ketkar (1992)	1980	New Jersey (>500 sites)	HW (operating)	n/a	n/a	Removal of one site associated with: • property value increases of 2% • $1,200-2,000 per house • $1,236 billion cumulatively (1980 $)	• Benefits of quick cleanup of site ($1,236 billion) exceed costs of cleanup ($931 million for 129 sites) • Thus, it is worthwhile for homeowners to contribute to cleanup costs as opposed to usual polluter-pays schemes.	• Alternative to polluter-pays policy has acknowledged limitations: e.g. may create incentive for polluters to avoid responsibility; may encourage premature property sales to avoid additional taxes.

Exhibit A-1

COMPILATION AND SUMMARY OF CURRENT LITERATURE

Study	Years of Data	Location	Type Of Site	Timing Stages	Distance Range	Property Value Impact	General Conclusions	Comments
Thayer , et al. (1992)	1985-1986	Greater Baltimore area, MD	HW and other damage	n/a	Price effect observed up to 4 to 5 miles.	Value loss / Disamenity Type $2,194 to $2,320 per mile — Hazardous $1,370 per mile — Non-hazardous	• Attempts to incorporate multiple environmental quality variables into property value determinations, as opposed to a single disamenity. • Includes other air/ water/land quality variables.	• High R-squared value. • Possible multicollinearity problem since several environmental quality variables are included.
Kinnard & Geckler (1991)	1980-1989	New Jersey (3 sites)	Superfund radiation contamin.	• Before NPL listing • After NPL listing	n/a	Value loss significant in only one town, where no remediation occurred.	• Proximity effect only observed in areas where offensive site was not cleaned up. • Where remediation was quick and effective, there was no perceivable value impact before or after NPL listing.	
Kohlhase (1989)	1976, 1980, 1985	Harris County, TX (10 sites)	Superfund toxic waste	• Superfund non-existent (1976) • Superfund created (1980) •All study sites NPL listed (1985)	0 to 6.2 miles	Value Loss / Time Insignificant — 1976 Insignificant — 1980 Up to $3,310 per mile — 1985 (1985 $)	• Proximity effect appears only after Superfund listing announcement, due to public perception of risk • WTP for distance disappears after cleanup; property declines are reversible.	• Kiel (1995) comments that Kohlhase finds a more significant change in value in 1985 due to high levels of community awareness before announcement; if Kohlhase were to divide time periods in greater frequency, the two factors would be distinguished.

Exhibit A-1

COMPILATION AND SUMMARY OF CURRENT LITERATURE

Study	Years of Data	Location	Type Of Site	Timing Stages	Distance Range	Property Value Impact	General Conclusions	Comments
Smolen, et al. (1991)	1986-1990	Greater Toledo area, OH (2 sites)	Toxic chemical waste and low-level nuclear waste landfills (operating and proposed)	• Envirosafe: timing insignificant • Riga: Proposal of new site; revocation of proposal.	• 0 to 5.75 miles	Value loss / Timing / Distance Envirosafe $12,061/mile n/a 0-2.6 miles *(existent)* $12,106/mile n/a 2.61-5.75 miles Insignificant n/a >5.75 miles Riga Twp. Significant Announcement 0-5.75 miles *(proposed)* Insignificant Plan revoked 0-5.75 miles (1990 $)	• Waste site has significant, negative, distance-dependent price effect at existent site. • At proposed site, the mere announcement of the plan has negative impact on prices, which recover after plan revoked.	• Criticized as exaggerated due to role of public perception in this case (Farber, 1998).
Michaels & Smith (1990)	1977-1981	Suburban Boston, MA (11 sites, 2,182 homes)	Superfund HW	•Pre-announcement (insignificant) •Post-announcement (figures given)	Average distance to second-nearest site: • 1.08 mile (full sample) • 3.9 miles (premier) • 6.2 miles (above average) • 0.8 mile (average)	Value Loss / Property Type $124 Full sample $1,799 "Premier" $362 "Above average" $38 "Average" Insignificant "Below average" (1977 $)	• Property values are not only distance-dependent, but dependent upon the desirability/exclusivity of the property due to factors other than site proximity.	
Payne, et al. (1987)	1973-1982	Chicago, IL (1 site)	Radioact. waste	• Pre-publicity • During publicity	• Inner ring (0 to 2 blocks) • Outer ring (2 blocks to 1 mile)	Values declines observed only for older homes close to site.	• Hypothesis was that prices and deltas would not be affected in pre-publicity years, but that distance would be a value-determining factor once publicity was introduced. • This held true only for older homes in inner ring.	• Considers age of homes as variable. • Looks at sales prices AND deltas (differences between list prices and sales prices).

Exhibit A-1

COMPILATION AND SUMMARY OF CURRENT LITERATURE

Study	Years of Data	Location	Type Of Site	Timing Stages	Distance Range	Property Value Impact	General Conclusions	Comments
Harrison & Stock (1984)	1977-1981	Greater Boston area, MA (11 sites)	HW disposal (operating)	n/a	n/a	• $3.6-17.4 million (1980 $)	• Identifies variables that account for the range in observed price effect. • Most significant variables: population density, initial price, size of offensive site.	• Critical of hedonic studies that fail to include "town effects" (e.g. school quality, tax rate). • Potential benefits of living near site (e.g. employment) are not included.
Gamble, et al. (1982)	1971-1981	PA (10 sites)	Sanitary landfill (operating)	n/a	• 0 to 0.5 mile • 0 to 1 mile • Control areas	No price effect	• Rates of development are not impacted by proximity to landfill. • This trend is not explained by lower property values because hedonic studies show no evidence of this. • Near landfills handling very large volumes, rate of development somewhat reduced.	• Compares rates of development and sales prices of proximate and constant sites. • Small sample yields inconclusive and inconsistent results.
"Property Values, Stigma and Superfund"		Various (U.S.)	Superfund	n/a	n/a	2 to 8 % of initial value	• Superfund sites usually cut values by 2 to 8%. • Values usually recover upon cleanup, though some do not due to stigma (uncertainty and inertia).	• Reviews other empirical studies and anecdotal incidents. • Includes little data.

Exhibit A-1

COMPILATION AND SUMMARY OF CURRENT LITERATURE

ADDITIONAL STUDIES

Study	Years of Data	Location	Type Of Site	Timing Stages	Distance Range	Property Value Impact	General Conclusions	Comments
Farber (1998)	Various	Various	Various	n/a	n/a	n/a	• Draws conclusions based on compilation of many other property values studies. • Value losses diminish with distance from site. • Sales prices react to real and perceived risk • Values sometimes affected before NPL listing, effect magnified after listing, and tended to diminish after cleanup. • Summarizes effects of other variables.	• Literature review • Though not a formal meta-analysis, is very comprehensive compilation and summary of current literature.
OERR (1997)	Various	Various (U.S.)	Hazardous Waste	n/a	• up to 3-7 miles	2%-8% of value	• Finds range of findings in property values literature to be between 2% and 8% of original value up to 3-7 miles from hazardous waste site.	• Literature review
OERR (1996)	Various	Various (U.S.) (1,213 sites)	Superfund	n/a	• 1 mile • 2 miles	Distance — Cumulative value lost (1,213 sites) 1 m. threshold — $749,524,566 2 m. threshold — $2,103,116,418	• Cleanup of Superfund sites could generate $2.1 billion. • Comparison to other studies yields similar results, and indicates ways of improving methodology.	• Meta-analysis uses five studies. • Acknowledges limitations of method: e.g. ignores initial values; no distinction between active and inactive sites; lumps location and hazard types.

Exhibit A-1

COMPILATION AND SUMMARY OF CURRENT LITERATURE

Study	Years of Data	Location	Type Of Site	Timing Stages	Distance Range	Property Value Impact	General Conclusions	Comments
Greenberg & Hughes (1993)	1992	New Jersey	Superfund HW	n/a	Effects most pronounced within 1/4 mile of site.	• 28% of assessors believe that HW sites have negative impact on the land within 1/4 mile. • 21% of assessors believe that HW sites have negative impact on number of sales. • 16% of assessors believe that HW sites harm existing land uses. • 23% of assessors believe that HW sites deter new land uses.	• Tax assessors who perceive a negative impact on values and land uses are usually within 1/4 mile of HW sites. • HW site does not always have impact on values; more apt to at close proximities.	• Survey of tax assessors. • NJ citizens may be more sensitive to HW issues; may not be able to generalize to other geographic areas. • NJ is hot market. • Survey technique cannot replace price study.
Mendelsohn ,et al. (1992)	1969-1988	New Bedford, MA (1 site)	PCB incident	• Price effect begins in 1981 • Value losses doubled by 1985.	Distance dependent (no exact distance cited)	• 3 to 8% of value • $7,000 to $10,000 per house • $35.9 million cumulatively	• Panel approach effective for determining proximity and temporal factors affecting property values. • Values are significantly reduced after pollution effect becomes known, and are distance dependent.	• Panel study. • Looking at repeat-sales of same houses controls for house-to-house differences, captures intertemporal effects, isolates polluted area trends from trends in entire regional market.
Reichert, et al. (1991)	1985-1989	Cleveland, OH (5 sites)	Municipal landfills (operating)	n/a	Distance dependent (no exact distances cited)	Neighborhood Type — Value Loss Expensive — 5.5-7.3% of value Less expensive — 3-4% of value Rural — Insignificant	• Compares public perception to actual prices. • Initial value is importance variables to consider.	• Contingent valuation and hedonic study. • Counter-intuitive findings show positive landfill effect at most sites. This is attributed to heterogeneity of area. Exclusive focus on homogenous areas yields expected negative landfill effect.

Exhibit A-1

COMPILATION AND SUMMARY OF CURRENT LITERATURE

Study	Years of Data	Location	Type Of Site	Timing Stages	Distance Range	Property Value Impact	General Conclusions	Comments
McClelland, et al. (1989)	1983-1985	Los Angeles, CA (1 site, 4,100 homes)	Superfund HW landfill	• Before closure • After closure	n/a	Time Period — Value Loss Before site closure — $40.2 million After site closure — $19.7 million	• Perception of health risks highly variable and bimodal; differs greatly from expert perceptions. • Variation in public perception attributable to characteristics of respondents: e.g. age, gender, number of children.	• Survey approach. • Problems of survey bias acknowledged: e.g. residents who feel most strongly tend to participate in surveys. • Acknowledged influence of extensive media coverage and community mobilization in this case.
Smith & Devousges (1986)	1984	Suburban Boston, MA	HW landfill (hypothet)	n/a	Distance dependent (no exact distances cited)	• $330-495 per mile per year • $3,199 per home (1984 $)	• The average willingness to pay for distance from HW site is $330-495 per mile per year	• Contingent valuation. • Survey format yields hypothetical data only; not evidenced by price data. • Included data from very limited time period. • Very good rates of interview completion.
Swartzman, et al. (1985)	1985	Rural central IL	HW landfill (hypothet.)	n/a	• Distance dependent; proximity effect reduced by offering payment.	• When 5% tax reduction offered to survey respondents, the percentage of respondents willing to live within five miles of the hypothetical site increased from 10% to 20%.	• Offering compensation or enhanced environmental monitoring can reduce public opposition to HW siting.	• Survey approach. • Compensation options presented in survey were tax abatement and direct payments to community in the form of user's fees.

Note that several studies may merit further inquiry, but were not readily available for inclusion in this review. Studies we are still collecting include:

- Blomquist, G. "The effect of electric utility power plant location on area property value." Land Economics, 50: 97-100 (1974).
- Adler, K., Z. Cook, A. Ferguson, M. Vickers, R. Anderson and R. Dower. "The Benefits of Regulating Hazardous Disposal: Land Values as an Estimator." U.S. Environmental Protection Agency (1982).
- Clark, D.E. and L.A. Nieves. "An Interregional Hedonic Analysis of Noxious Facility Impacts on Local Wages and Property Values." Regional Science Association, 38th meeting (1991).
- Dunn, M.B. "Property Values and Potentially Hazardous Production Facilities: A Case Study of the Kanawha Valley, West Virginia." Unpublished Ph.D. dissertation (1986).

REPRESENTATIVE BASIC HEDONIC MODELS

Basic hedonic models assess property values as the dependent variable in multiple regressions that include distance-from-disamenity as a single variable among other variables characterizing individual properties only. Property characteristics typically found in hedonic models include such variables as acreage or square footage, number of bathrooms, materials used in construction, or existence of a pool or deck on the property. Multiple regression allows estimation of the relative contribution of each variable to the property value, and the direction and magnitude of each variable's impact. Basic hedonic models determine values based on either instantaneous data, or data averaged over time. The following three studies evaluate the effects of distance from various waste sites on property values:

In an investigation of properties near an operational solid waste landfill from 1979 to 1989, **Nelson, et al. [1992]** finds more significant distance-dependent value decrements. Property values are most affected at the boundaries of the landfill site, at average losses of two percent. At a one mile radius from the boundary, value losses average six percent, and diminish to negligible levels at two to two and one-half miles from the site. This study employs a typical hedonic model, but attempts to limit additional variables (e.g. demographic or neighborhood effects) by restricting the study area to a relatively homogenous sample of single-family homes in Ramsey, Minnesota.

Reichert [1997] conducts hedonic regressions over a somewhat longer period of time, looking specifically at an Ohio Superfund toxic waste site from 1977 to 1994. Reichert finds significant property value impacts are discernable only after the site achieved Superfund status. Four "rings" around the site demonstrate differential price effects; properties in the ring nearest the site lost 14.66 percent of their value, while losses were negligible past 6,750 feet from the site. Cumulative losses attributed to the Superfund site total nearly eleven million 1994 dollars. Although this model includes only standard property characteristics variables, the relatively high R-squared values obtained by the statistical regression indicate a strong link between site proximity and property values.

These pure hedonic studies evidence a basic correlation between property values and distance from a waste site. Both Reichert and Nelson, et al. selected relatively homogenous samples, and achieved robust results without including additional variables such as population or neighborhood characteristics. In heterogenous sample areas, or in studies that attempt to incorporate multiple areas with diverse characteristics, additional variables are needed to account for the significant variability in price effects between properties.

ADDITIONAL HEDONIC REGRESSION VARIABLES

Increasingly, hedonic studies attempt to include variables that represent heterogeneity within a sample area or between sample areas. For example, neighborhood characteristics are an important set of variables that may account for price differentials in some cases. **Ketkar [1992]** incorporates

a wide range of neighborhood characteristics into his hedonic model, including racial demographics, transportation accessibility, population density, student standardized test scores, and proximity to shopping sites. With these additional variables, Ketkar analyzes New Jersey municipalities with multiple hazardous waste sites. He finds that removal of one hazardous waste site increases municipality property values by an average of two percent. Ketkar's study does not distinguish between individual distances separating properties and offensive sites, but instead takes average of value losses per house within certain regions. Additionally, the study reports average values per site removed, but does not distinguish between the first site removed and subsequent sites removed.

Harrison & Stock [1984] are also critical of hedonic studies that fail to incorporate what they term "town effects" such as school quality and taxation rates. Their study of hazardous waste disposal sites in the Boston area attempts to identify variables which account for the significant range ($3.6 to $17.4 million in lost value) observed in the price effect. The most significant variables contributing to this span are population density near sites and the initial prices of properties. The magnitude of the price effect is greater in densely populated areas or where properties are more expensive. They also identify larger offensive sites as having a larger impact on local prices.

Similarly, **Michaels & Smith [1990]** find that property values are not only distance-dependent, but also dependent upon the desirability or exclusivity of the property. They quantify this effect by dividing their study sample into "premier", "above average", "average", and "below average" properties. They determine that more desirable properties suffer a far greater price effect with proximity to NPL hazardous waste sites in the Boston area. "Below average" properties, on the other hand, exhibit insignificant price impacts at comparable distances. This study reports price effects in absolute terms (dollars lost per property) for each category of property; since the study does not include percentage value losses, it is unclear how relative value losses between property types compare.

Though their published studies do not include quantitative data, both **Payne, et al. [1987]** and **Greenberg & Hughes [1992]** identify additional variables that account for differential value losses with proximity to environmental disamenities, including publicity, home age, and market activity levels. Payne, et al. compared pre- and post-publicity figures anticipating price effects only after publicity became a factor in perception of property values near a Chicago radioactive waste site. This hypothesis held true only for older homes within two blocks of the site, indicating the significance of home age in hedonic regressions. In assessing the price effects of proximity to New Jersey Superfund hazardous waste sites, Greenberg & Hughes found some evidence of a stronger price impact in rural areas (again indicating population density as a relevant variable) and in "hot" markets. Thus, regional property market activity seems to be an important variable in some cases.

While most studies limited data sets to single-family residential properties in an attempt homogenize study samples, **Simons, et al. [1997]** implies that inclusion of commercial properties is essential for determining the full effects of a disamenity on the surrounding property market. In their study of UST sites in the greater Cleveland area, Simons, et al. find that residential properties

lost fourteen to sixteen percent of their original value when contamination became known, while commercial properties lost twenty-eight to forty-two percent of their original value. These findings suggest that, in some cases, exclusion of commercial properties from study samples may lead to significant underestimates of value losses due to proximity to an environmental disamenity.

Additionally, most studies assess the effects of a single, identified disamenity on property values. **Thayer, et al. [1992]** suggest that, in a single area, several environmental disamenities may interact to affect a cumulative negative influence on property values. This study evaluates various U.S. treatment, storage and disposal facility (TSDF) sites between 1985-1986 in tandem with other forms of environmental damage in the Baltimore area. Findings demonstrate a price effect of $2194-$2320/mile (1.2 percent to 1.6 percent of original value) due to hazardous waste sites, and $761-$1370/mile as a result of other, non-hazardous environmental damage. While this study yielded a high R-squared value, multicollinearity could potentially distort findings because of likely overlap in causes of environmental damage.

One limitation of many hedonic models is a failure to distinguish between time periods during which events may influence property values and/or public perception of property values. While many hedonic models examine values before and after the existence or awareness of the disamenity (as in Reichert's study), a more precise division of time periods yields useful information about when and how property values are affected by an environmental disamenity. For example, **Kiel & Zabel [1999]** assess the influence of a Woburn, Massachusetts Superfund site on property values in the area. For the time period 1975-1992, Kiel & Zabel distinguish six time periods: pre-discovery, discovery, Superfund listing, cleanup discussion, cleanup announcement, and cleanup. They find that property values are not only dependent upon proximity to the site, but also vary over time. Kiel & Zabel found that prices do not rebound to original values even when the offensive site is cleaned up.[2] However, they found that value recovery does exceed the costs of cleanup, yielding a positive net benefit of cleanup. Most importantly, Kiel & Zabel demonstrate the importance of including the temporal variable. The study also demonstrates the significance of EPA announcements and actions in determination of property values.

Similarly, **Kiel & McClain [1995]** respond to studies that select single moments in time before and after a disamenity appears. They argue that a more frequent sampling over time illustrates subtleties in the price effect. The study found that the "pre-rumor" and "rumor" stages of an incinerator siting in Massachusetts demonstrated no price effects within 3.5 miles of the site; the time periods effectively serve as constants, confirming no inherent undesirability of the properties in question. Construction of the incinerator resulted in value losses of $2,283/mile, which escalated to $8,100/mile when the incinerator went "online." Property values recovered somewhat to $6,607/mile as operations continued. The distance premium determined by Kiel & McClain persisted

[2] This finding contradicts other studies, which have found either complete value recovery (Kinnard & Geckler [1991]) or no recovery value whatsoever. Clearly, reversibility of the effect of the disamenity is one area demonstrating considerable disagreement between studies.

for seven years after operations began, by which time those who felt most strongly about the disamenity had relocated. Frequent division of time periods provides detailed information on when and how property values are impacted by a new disamenity.

Much of the impetus for defining time periods stems from the significant influence public perception of risk can have on property values. Public perception of a disamenity may be based on several identifiable variables including the level of community communication and mobilization, the role of the media, the degree of information dissemination by government agencies, or the timing of formal EPA announcements and classifications. Several studies attempt to incorporate these variables into hedonic price models. **NCERQA [1998]**, for example, provides a general discussion of how stigma, hysteresis and path dependence (i.e. psychological and market inertia), when present, can make property values within one mile of offensive sites irrecoverable even after a cleanup is completed. **"Property values, Stigma and Superfund"** reviews empirical studies and finds property losses near Superfund sites tend to range from two percent to eight percent. The degree to which properties are able to recover from this price effect is closely tied to public perception and hysteresis.[3]

More specifically, **Smolen, et al. [1991]** compare the price effects of proximity to an existing hazardous waste landfill in Ohio to the price effects of proximity to a *proposed* nuclear waste facility. Value losses of approximately $12,000 per house occurred within 5.75 miles of the existent site. At the proposed site, the mere announcement of the planned facility had a significant negative impact on property values in the area, which dissipated after the plan was revoked. Though Farber [1998] criticized this study as exaggerated due to an extreme role of public awareness, other studies indicate the relative importance of public perception in the determination of property values. It is likely that in a national study of various sites, public perception would play a varying role.

Just as the siting announcement in the Smolen, et al. study evoked negative changes in property values, announcements of Superfund status illicit similar results. **Kohlhase [1991]** finds that price effects were insignificant near a Texas toxic waste site until the site's Superfund listing was announced. Value losses of up to $3,310/mile were observed up to 6.2 miles from the site after the announcement. This study also demonstrated that property value declines were reversible in this case; willingness to pay for distance from the offensive site disappeared after cleanup. Although Kiel (1995) commented that infrequent data sampling may misrepresent the value loss attributable to the NPL announcement itself (value declines may have started in the five years preceding the announcement, during which no data was collected), the Kohlhase study does demonstrate the potentially negative property value impacts of formal EPA classification.

Gayer [1997a,b], however, shows that EPA-generated information can also have a protective effect on otherwise threatened values of properties near disamenities. Using repeat sales data in his hedonic regressions, Gayer assumes that residents are rational, Bayesian decision-makers capable

[3] We are still looking for complete bibliographic information for this study.

of updating their perception of their universe as information becomes available. Both of Gayer's 1997 studies were conducted in Michigan near Superfund hazardous waste sites. The first found that, although homeowners overestimate the risk of site proximity before the EPA releases information, they are able to update their perception so that values rebound completely. Gayer determines a value/printed word estimate, and finds that the costs of information dissemination is less than the potential costs of lost property values. Gayer's second 1997 study presents residents as strategic decision-makers, who have an incentive to inflate their perceived risk in an effort to encourage EPA remediation. As EPA released information, differences between public and private expressions of risk perception became less divergent. While cumulative losses totaled $9.1-$10.1 million before EPA's announcement, this figure was significantly reduced as information became available.

Public perception, EPA actions, and information availability variables appear to be the greatest sources of discrepancy between studies not only in terms of the magnitude of the effects, but even in the direction of their effects. Unlike Kohlhase's and Gayer's findings, **Kiel [1995]** found that property values were in fact negatively affected before the Woburn, Massachusetts hazardous waste site was Superfund listed, and persisted after cleanup plans were announced and initiated. Though Kiel's study does not include data after the completion and assessment of cleanup efforts, information released regarding the planned cleanup did not seem to reverse negative price impacts in this case.

In light of conflicting conclusions about the impact of information availability, information dissemination appears to have two types of effects. First, knowledge of the problem, in the form of an EPA announcement of NPL listing for example, tends to adversely affect prices relative to their levels had the disamenity been an unknown risk. Second, provision of clear information regarding the actual level of risk posed by the disamenity as well as plans for remediation seem to stimulate partial or full price recovery.

While most studies found negative price effects with proximity to environmental disamenities, two studies find no significant net property value losses attributable to local disamenities. **Gamble, et al. [1982]** found that rates of development were not affected by proximity to a sanitary landfill. Hedonic studies yielded no evidence of a price effect within a one mile radius of landfills. The study's admittedly small sample size yielded inconsistent and inconclusive results, however. The model did demonstrate somewhat reduced rates of development near landfills handling very large volumes of waste, which suggested the need for a study with a larger, more representative data set.

Kinnard & Geckler [1991] researched price effects near radiation contaminated sites in suburban New Jersey, both before and after NPL Superfund listing. They found a distant-dependent price effect only in areas where the offensive site was not remediated. Where remediation was quick and effective, there was no perceivable value impact before or after NPL listing.

ADDITIONAL STUDIES

While several pure hedonic models incorporated variables pertaining to public perception of risk and value loss, other studies used survey or contingent valuation techniques to directly ascertain the public's willingness to pay for risk avoidance.

To assess public perception of risk and property values near municipal landfills in the Cleveland area, **Reichert, et al. [1991]** used a combination of surveys and hedonic regressions based on actual sales prices. Comparison of public perception to documented prices highlighted the importance of several variables mentioned above. In particular, initial property values and population densities delineated price effects. While expensive neighborhoods suffered losses of 5.5 to 7.3 percent of initial value, older, less expensive neighborhoods lost three to four percent of initial value. In rural areas, value losses were insignificant.

Like Reichert, et al., **McClelland, et al. [1989]** employed survey methods to assess changes in property values before and after a Los Angeles Superfund hazardous waste site was closed. Notably, the survey results demonstrated a considerable divergence in residents' and experts' perceptions of health risks. In addition to the influence of media and community mobilization variables, McClelland, et al. found that variation in public perceptions of risk were attributable to specific characteristics of the respondents. With these additional variables derived from the survey technique, the study found that, before site closure, value losses totaled $40.2 million. After site closure values partially rebounded, demonstrating value losses of $19.7 million. Though the survey technique yielded new information about how variations in public perceptions of risk impact property values, the authors acknowledged standard problems of survey bias. Examples of survey bias include intentional misrepresentations of risk perception in an effort to influence policy outcomes.

Contingent valuation studies are one type of survey method designed to estimate the average willingness to pay to avoid a disamenity. Contingent valuation studies rely on survey data to reveal how affected parties value avoidance of hypothetical disamenities, as opposed to using manifested preferences as documented by actual sales price data. **Smith & Devousges [1986]** used survey techniques to determine that willingness to pay for distance from a Boston-area hazardous waste landfill averaged $330-$495/mile per year, or $2,472-$3,199/mile per home. Though the study had very good rates of interview completion, the inherent problem with the interview format is that it yields hypothetical data only, rather than confirmed sales prices. Again, respondents may intentionally or unintentionally misrepresent their willingness to pay when not faced with an actual choice of action.

However, even when studies use only documented sales data, there are variations in what types of data are used in hedonic modeling. For example, while most hedonic studies used sales price figures, some chose to follow repeat sales of the same properties over time. **Mendelsohn, et al. [1992]** employed this method in what he termed the "panel model" to control for house-to-house variations, capture intertemporal effects, and to isolate trends in the polluted area from trends in the

regional market as a whole. Using this style of data collection, the study found value losses of three to eight per, or a cumulative $35.9 million in the area proximate to a Massachusetts PCB incident. Gayer [1997a] also chose to follow repeat sales of properties in the study area to isolate changes in risk perception from changes in other cross-property variables.

Additionally, while most studies looked only at sales prices of properties, some included other real estate transaction characteristics, such as the difference between listing prices and sales prices. Payne, et al. [1987] looked both at sales prices and deltas in their determination of price effects. Gamble, et al [1982] looked not only at sales prices but at rates of development in areas proximate to sanitary landfills in Pennsylvania (see further discussion below).

Given the inevitable heterogeneity of price effects of environmental disamenities and the wide range of potentially relevant variables in each case, a universal hedonic formula is elusive. However, meta-analysis could be an effective method of summing a collection of empirical studies in an attempt to make generalizations about the effect environmental disamenities have on property values. To this end, **OERR [1996]** offers a meta-analysis of five empirical studies of various Superfund sites in the U.S. The study found that the cumulative value loss of the 1,213 sites covered by the studies totals to approximately $750 million at the one mile threshold, and $2.1 billion at the two mile threshold. Thus, the study projects a $2.1 billion value for cleanup of Superfund sites. Though these conclusions were dismissed by a later OERR study [1997], the 1996 study suggests an promising potential method of pooling multiple data sets, while acknowledging the strengths and limitations of methodologies employed by each study.

Though not a meta-analysis, **Farber (1998)** offers a comprehensive summary of empirical studies of property values proximate to environmental disamenities. Farber organizes his by types of offensive sites or damages. This literature review found that, for many types of disamenities, property values are adversely affected by proximity to the offensive site. Property values are subject to "the real or perceived risks" posed by the disamenity, which Farber characterizes as rational based on value changes at various stages of time. Though values are generally impacted before formal announcements such as NPL listing, values are most affected after such announcements. Values tend to recover to varying extents after site cleanup. While studies focusing on hazardous waste sites reached similar conclusions, findings regarding sites such as landfills or refineries were mixed. Farber as well as other authors suggest that regional heterogeneity may preclude uniform results.

Similarly, the **Office of Emergency and Remedial Response [1997]** finds that price effects range from two to eight percent of original value up to three to seven miles from disamenities. However, the OERR survey also acknowledges several limitations to reconciling hedonic studies. As noted here, several studies provide incomplete quantitative data. Differing statistical techniques and metrics made comparisons difficult. Additionally, this study dismissed the 1996 OERR meta-analysis included in this literature review. Conclusions found in that meta-analysis did not prove robust when additional studies were added to the determined equation. However, given the limitations of reconciling property values literature, the range determined by OERR is comparable to the range determined by our literature review.

SUMMARY OF COLLECTIVE FINDINGS

Various methods were employed in attempts to calculate the property value price effect of proximity to environmental disamenities. Contingent valuation studies and similar survey techniques tried to pinpoint consumer willingness to pay for avoidance of disamenities. Though these studies yield useful information about public perception of risk and factors affecting this perception, survey bias and the inherently hypothetical nature of contingent valuation studies limits their empirical integrity. Despite multiple methods of data collection, various forms of hedonic modeling remain the dominant approach to property valuation studies. While traditional hedonic regressions include the distance variable along with characteristics of the property in question, many studies have recognized the importance of additional variables in these determinations.

Exhibit A-2 below summarizes variables that may be relevant to hedonic modeling of the price effect of proximity to a hazardous waste site:

Exhibit A-2

SUMMARY OF VARIABLES RELEVANT TO HEDONIC MODELING NEAR DISAMENITIES

Disamenity	Neighborhood	Property	Residents	Information Perception
• *Number* - single or multiple offensive sites • *Distance* - of nearest disamenity - of second nearest disamenity • *Size* - physical size of offensive site - volume of materials handled • *Status* - Closed or operational - completion of, plans for, or absence of cleanup effort • *Risk* - type of hazard - magnitude of hazard - geographic or temporal span	• *Density of residences* - urban/rural • *Tax rates* • *Employment access* - generated or inhibited by disamenity • *Real estate market characteristics* - sluggish or "hot" - rate of development - price deltas • *Other* - school quality - crime - recreational facilities - racial demographics - etc.	• *Type of property* - residential/ commercial • *Initial property values* - desirability, exclusivity • *Age of property* • *Acreage/footage* • *Other* - number of rooms - pool/deck - etc.	• *Expectations* - of remediation, compensation, or future value • *Perception of health risk* • *Degree of risk aversion* • *Other* - gender - age - number of children - education/profession - etc.	• *EPA actions* - NPL listing - cleanup plan and actions • *Information dissemination* - by EPA - by other government agencies - by media • *Mobilization* - degree of community organization, communication • *Irrational stigma, hysteresis, path dependence*

RANGE OF PRICE EFFECTS

The studies included in this review are difficult to compare for several reasons. First, some studies do not report the empirical evidence on which conclusions are based making it difficult to determine relative price effects. Second, various studies use different units of measurement, cover different periods of time, and study different geographical ranges. Reconciling these conclusions requires assumptions about the density and median values of housing in study areas.

In an effort to compare property effects between studies, we estimate the percentage of value lost with proximity to environmental disamenities. Several studies provide this figure; for studies that provide absolute dollar values lost, we convert this figure to percentage value lost per house using census data on median value and densities for the geographical areas and time periods studied. Exhibit A-3 summarizes these findings for studies that provide sufficient quantitative conclusions.

From these calculations, we find that price effects at properties proximate to environmental disamenities most frequently range from two to eight percent of original property values. Extremes of range include price effects of zero to twenty percent of value. Based on other literature reviews that established comparable ranges of property effects, we believe that the range determined here, though quite preliminary, is a reasonable estimate of the proximity effect.

Exhibit A-3

PRICE EFFECTS AS PERCENTAGES OF PROPERTY VALUES[A]

Study	Geographic Area	Time Period	Quantitative Conclusion	Percentage Value Lost
Kiel & Zabel (1999)	Woburn, MA	1975-1992	1977-81 1982-84 1985-88 1989-91 1992 0.5 m. $9,312 $8,769 $10,498 $12, 466 $16,843 1 m. $6,798 $11,367 $ 7,895 $12,882 $17,156 1.5 m. $4,609 $11,789 $5,544 $11,844 $15,583 2 m. $2,747 $10,035 $3,445 $9,351 $12,214 2.5 m. $1,210 $6,106 $1,597 $5,403 $7,020 (1992 $)	1977-81 1982-84 1985-88 1989-91 1992 0.5 m. 9.7% 6.8% 6.6% 6.1% 8.3% 1 m. 7.1% 8.8% 4.9% 6.3% 8.6% 1.5 m. 4.8% 9.1% 3.5% 5.8% 7.7% 2 m. 2.9% 7.8% 2.2% 4.6% 6.0% 2.5 m. 1.3% 4.7% 1.0% 2.6% 3.5%
Smith & Devousges (1986)	Suburban Boston, MA	1984	$330-$495 per mile per year $3,199 per home	0.29%- 0.43% per mile per year 2.8% per home
Harrison & Stock (1984)	Greater Boston area, MA	1977-1981	$3.6-$17.4 million per site	1.1%-5.3% per house
Ketkar (1992)	New Jersey	1980	$1,200-2,000 per house $1,236 billion cumulatively	2.0%-3.3% per house
McClelland, et al. (1989)	Los Angeles, CA	1983-1985	Before closure: $40.2 million cumulatively After closure: $19.7 million cumulatively	Before closure: 6.2% per house After closure: 3.1% per house
Reichert, et al. (1991)	Cleveland, OH	1985-1989	Expensive: 5.5%-7.3% Less Expensive: 3%-4% Rural: Insignificant	Expensive: 5.5%-7.3% Less Expensive: 3%-4% Rural: Insignificant
Smolen, et al. (1991)	Greater Toledo area, OH	1986-1990	0-2.6 m. $12,061/m. 2.61-5.75 m. $12,106/m. >5.75 m. Insignificant	0-2.6 m. 21.05% per house 2.61-5.75 m 21.13% per house >5.75 m. Insignificant
Michaels & Smith (1990)	Suburban Boston, MA	1977-1981	Full Sample $124 per house Premier $1,799 per house Above Average $362 per house Average $38 per house Below Average Insignificant	Full Sample 0.6% per house Premier 8.0% per house Above Average 1.6% per house Average 0.2% per house Below Average Insignificant
Kohlhase (1991)	Harris County, TX	1976, 1980, 1985	$3,310 per mile (1985)	5.6% per mile (1985)

Exhibit A-3

PRICE EFFECTS AS PERCENTAGES OF PROPERTY VALUES[A]

Study	Geographic Area	Time Period	Quantitative Conclusion	Percentage Value Lost
Nelson, et al. (1992)	Ramsey, MN	1979-1989	Site boundary: 12% 1 mile: 6% 2-2.5 mile: Insignificant	Site boundary: 12% 1 mile: 6% 2-2.5 mile: Insignificant
Mendelsohn, et al. (1992)	New Bedford, MA	1969-1988	3%-8% of value	3%-8% of value
Gayer, et al. (1997)a	Greater Grand Rapids, MI	1988-1993	$54.6-$58.8 million recovered after total EPA information dissemination	10.8%-11.6% per house recovered after information dissemination
Gayer, et al. (1997)b	Greater Grand Rapids, MI	1988-1993	$9.1-$10.1 million (cumulative) after NPL listing	1.8%-2.0% after NPL listing
Kiel (1995)	Woburn, MA	1975-1992	Pre-awareness Insignificant Discovery phase $185 per mile EPA announcement $1,377 per mile Cleanup intentions announced $3,819 per mile Cleanup plan announced $4,077 per mile Cleanup initiated $6,468 per mile	Pre-awareness Insignificant Discovery phase 0.7% EPA announcement 1.8% Cleanup intentions announced 3.1% Cleanup plan announced 2.1% Cleanup initiated 3.0%
Thayer, et al. (1992)	Greater Baltimore area, MD	1985-1986	Hazardous waste $2,194-$2,320 per mile Non-Hazardous disamenity $1,370 per mile	Hazardous waste 2.8-3.0% Non-hazardous disamenity 1.8%
Kiel & McClain (1995)	North Andover, MA	1974-1992	Pre-rumor Insignificant Rumor Insignificant Construction $2,283 per mile Online $8,100 per mile On-going operations $6,607 per mile	Pre-rumor Insignificant Rumor Insignificant Construction 3.6% Online 7.2% On-going operations 3.6%

[a] Where not provided by individual studies, percentage estimates rely on Census Bureau data for median housing prices and population densities.

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APPENDIX B

SUMMARY DESCRIPTIONS OF PROPOSED METHODS

Exhibit B-1

METHODOLOGIES: HUMAN HEALTH BENEFITS (APPROACHES B, C and D)

	Long-Term Multiple Pathway Exposure Estimate of Human Health Benefits Estimates the transport of contaminants under different release scenarios, identifies "human exposure points", and estimates the cost of expected health effects			**Estimate of Avoided Health Effects from Acute Events** Estimates change in frequency and severity of acute events before and after RCRA
Methodological Steps	**Approach B** ▸ Use the *Corrective Action RIA* baseline to identify with-RCRA human health risks from existing contamination at pre-RCRA waste disposal units ▸ Adjust MMSOILS model to determine exposure to continued waste disposal in the absence of RCRA ▸ Estimate the economic value of the difference in human health risks under the two scenarios ▸ Apply the range of results from this methodology to the Approach A estimate of avoided TSD facilities	**Approach C** ▸ Select sample of facilities and multi-pathway model ▸ Model human health risks from existing contamination at sample facilities (with-RCRA scenario) ▸ Model exposure to continued waste disposal in the absence of RCRA ▸ Estimate the economic value of the difference in human health risks under the two scenarios ▸ Apply the range of results from this methodology to the Approach A estimate of avoided TSD facilities	**Approach D** ▸ Select sample of industries and identify pre-RCRA waste management practices ▸ Estimate without-RCRA waste management patterns in these industries today ▸ Use HWIR 3MRA model to estimate damage from without-RCRA waste management ▸ Estimate the economic value of the difference in human health risks under the two scenarios	▸ Compare the number of hazardous waste-related acute events from 1977 to 1979 (pre-RCRA) to the number of acute events from 1993 to 1995 (post-RCRA) ▸ Identify average monetary value of acute events, including injury and loss of life, and apply to number of avoided events ▸ Characterize the probability and average cost of a rare but catastrophic event (such as the Bhopal disaster in 1984 or large US flood events in the 1990s) before and since RCRA; extrapolate the average annual cost of catastrophic events
Results	▸ Predicts the value of estimated difference in human health risks between the current "with RCRA" universe and the "without RCRA" universe had waste disposal practices continued unchanged			▸ Predicts the estimated change in human health risk from acute events before and after RCRA

Exhibit B-1

METHODOLOGIES: HUMAN HEALTH BENEFITS (APPROACHES B, C and D)

Advantages/ Disadvantages	Advantages: Provides national estimate by adapting previously collected data and reliable method Disadvantages: Addresses TSDs only; does not include generators regulated under RCRA Does not address newer RCRA regulations because the approach looks only at SWMUs closed by 1982	Advantages: Provides flexibility in model selection, sample selection according to specific analytic objectives Disadvantages: Requires considerable resources for sample selection and modeling, including on-site facility information collection about current state of waste management and contamination	Advantages: Does not require identification of sample facilities; uses newly developed modeling Disadvantages: Requires considerable resources to develop without-RCRA scenario, requires review of model to determine whether protocols, sample facilities are appropriate for current analysis	Advantages: Incorporates potentially costly "short-run" human health risks from acute events Disadvantages: Involves significant uncertainty due to incomplete identification of waste-related incidents, few data points (only two years representing each scenario) Benefits may be insignificant relative to other costs and benefits of RCRA
Data Requirements and Available Sources	*Corrective Action RIA* sample facility information and modeling data Updated data on human health risks, facility-specific information MMSOILS model	Construction of universe, sample frame data (EPA databases including BRS, RCRIS) Facility-specific model input data on waste management practices, waste constituents, and receptors	Construction of universe, without-RCRA scenario using BRS, RCRIS, *Industry Assessments* Industry-level facility distribution and waste management practices, waste constituents, and receptors	1996 ICF memorandum: *Results of Analysis on Releases from Waste Facilities* 1980 EPA report, *Hazardous Materials Incidents Reported to U.S. Environmental Protection Agency Regional Offices from October 1977 through September 1979* 1996 EPA *Economic Impact Analysis o Final Rule on Risk Management Program Regulations for Chemical Accident Release Prevention*
Approaches for Addressing Uncertainty	Sensitivity analysis of different key modeling parameters, including timing of release, exposure risk scenarios (e.g., the maximum exposed individual), and approaches to assigning values to human health risks			Sensitivity analysis using range of potential "waste incident" categories Qualitative discussion of the uncertainly in assigning monetary values to human health risks
Level of Resources Required	Very High: process will require modeling effort and extensive data analysis	Very high: process will require extensive information collection, (possibly an ICR) modeling effort and data analysis	Very high: process will require information collection, modeling effort and data analysis	Low - analysis uses available data and simple methodologies

Exhibit B-2

METHODOLOGIES: ECOLOGICAL BENEFITS (APPROACHES B, C and D)

RCRA prevention regulations primarily address land disposal practices. As a result, the effects of avoided land releases may include contamination of soil and groundwater. In addition, water and air pollution can also affect ecological health. Damages may effect resources used by humans (e.g. health of fish stocks), or "non-use" values (e.g., habitat preservation or species diversity).

	Analysis 1: Model Ecological Benefits using Multi-pathway Analysis	**Analysis 2: Describe Benefits of Improved Siting**
Methodological Steps	Use baseline MMSoils model results from Corrective Action RIA to identify with-RCRA Subtitle C damage Adjust the Corrective Action RIA data, MMSOILS model to identify the ecological impact of continued waste disposal in the absence of RCRA If data are available, expand model to additional pathways such as air and soil Expected damage from continued disposal indicates damage avoided under RCRA. Where literature values exist for ecological effects, apply values to damage avoided under RCRA Supplementary sampling may provide a basis for a national estimate	Identify locations of sample of pre-1980, post-1980 RCRA facilities Use a GIS to perform a spatial analysis comparing proximity of pre-1980, post-1980 RCRA facilities to ecologically sensitive areas (e.g, flood plains) Use USGS historical flood data to identify number of floods experienced at sample facilities
Results	Model of ecological benefits at sample RCRA facilities that accounts for a range of wastes, quantities, and proximity to ecological resources	Identifies potential benefits of changes in siting trends, including number of facilities in sensitive locations, number of flood events at facilities

Exhibit B-2

METHODOLOGIES: ECOLOGICAL BENEFITS (APPROACHES B, C and D)

Advantages/ Disadvantages	Advantages: Provides more detailed modeling of a variety of ecological effects - quantifiable benefits for most effects; potentially monetizeable benefits for some effects (e.g., closure of fishing area) Allows construction of advanced GIS system that can be updated as methodologies advance Disadvantages: May require significant effort (including IRC) if sample is extended beyond *Corrective Action RIA* sample Ability to quantify, monetize benefits depends on site-specific features Ability to extend results to national estimate may be limited by *Corrective Action RIA* sample facilities Does not address damage from acute events	Advantages: Addresses reduced potential for acute events in examining flood plains, flood events Requires only available data Disadvantages: Does not quantify or monetize avoided damages attributable to acute events such as floods
Data Requirements and Available Sources	*Corrective Action RIA* MMSOILS model May require additional site specific land use data	BRS/RCRIS data on facility age, siting USGS digital data on flood plains, wilderness areas, and past flood events
Approaches for Addressing Uncertainty	Sensitivity analysis of model parameters regarding timing, movement of contamination on pathways Sensitivity analysis of valuation techniques for any monetizeable benefits	Data quality verification using multiple for location of facilities and ecologically sensitive areas
Level of Resources Required	High: requires modeling, supplementary data collection effort, spatial analysis	Low-Medium: requires spatial analysis of available data

Exhibit B-3

METHODOLOGIES: AVOIDED COSTS (APPROACHES B, C, AND D)

	Option 1 **Alternative Water Costs**	**Option 2** **Alternative Water Costs**
Methodological Steps	Assume that water supply damage (and replacement costs) have a linear relationship with the spatial extent of groundwater contamination Identify spatial extent of groundwater contamination with and without RCRA from modeling data generated in the human health benefits evaluation (see Exhibit B-1) Calculate costs per facility by adjusting *Corrective Action RIA* total cost to account for percentage increase in total area Apply range of total cost per facility to the number of "avoided TSD facilities" identified in Approach A	Use *Corrective Action RIA* to determine population of well users affected for each sample facility, alternative source for each site, and costs associated with the most reasonable alternative water option for each facility Model without-RCRA scenario Estimate total costs of without-RCRA alternative water supplies and calculate benefits by subtracting with-RCRA estimate *(value in RIA)* Extrapolate results to existing TSDs with on-site pre-RCRA SMWUs Estimate costs of avoided facilities by applying the ratio of without RCRA: with RCRA costs to avoided TSD facilities identified in Approach A
Results	Estimates total costs averted by avoiding water supply replacement at RCRA TSD facilities	Estimates total costs averted by avoiding water supply replacement at RCRA TSD facilities Addresses cost variability by modeling the extent of additional without-RCRA disposal effects in real settings
Advantages/ Disadvantages	<u>Advantages</u>: Few data requirements, calculations <u>Disadvantages</u>: This option assumes a linear relationship between the extent of damage and averted costs. Thus, this option ignores case-specific circumstances	<u>Advantages</u>: Uses actual site data and cost estimates for more defensible estimate of averted costs Addresses the possibility that marginal averted costs at already contaminated sites may differ from total project costs <u>Disadvantages</u>: May require significant effort and data collection

Exhibit B-3

METHODOLOGIES: AVOIDED COSTS (APPROACHES B, C, AND D)

Data Requirements and Available Sources	*Corrective Action RIA* Approach A results	*Corrective Action RIA* Approach A results Modeling results
Approaches for Addressing Uncertainty	Sensitivity analysis using range of estimates for spatial contamination	Sensitivity analysis using range of estimates for spatial contamination Alternative analysis using volume of contamination as driver
Level of Resources Required	Low: uses available data and simple methods	Medium: requires modeling effort; may require an ICR if available data are not sufficient for national analysis

Exhibit B-4

METHODOLOGIES: IMPROVED AESTHETICS AND HISTORICAL PRESERVATION (APPROACHES B, C, AND D)

Improved aesthetics and historical preservation may include changes in visibility, noise and odor experienced by facility neighbors as facilities alter waste management practices to comply with RCRA regulations. Regulations mandating appropriate waste management may improve the quality of the areas immediately surrounding RCRA sites. Conversely, regulations that increase offsite waste management may result in reduced aesthetic quality (e.g., increased truck traffic or noise).

	Aesthetics		**Historic Preservation**	**Both Aesthetics and Historic Preservation**
	Option 1	**Option 2**		
Methodological Steps	Collect data from American Housing Survey for the U.S., 1983-1995. Identify locations where residents report "smoke and odors, non-residential land use, and other disamenities" Identify correlation, trends between RCRA sites and reported disamenities by mapping reported disamenities with RCRA sites using two years of BRS data Extrapolate changes over time	Identify "noxious facilities" and practices in key industries using *Industry Assessments* (e.g., oil refineries) likely to affect aesthetics Identify pre-RCRA practices and waste facilities that would likely have been "noxious" Estimate changes in the number of facilities and use of waste management practices since RCRA Predict the likely change in effects on aesthetics	Develop GIS database showing locations of large RCRA facilities over time (using BRS data) Identify proximate historical sites and population densities to determine "affected resources" (e.g. areas where facility practices have influenced traffic patterns) If available literature exists, use contingent valuation or hedonic studies to estimate the value of historical sites.	Conduct case studies, addressing changes in practice at pre/post-RCRA facilities Examine changes in historical sites based on active facilities near historical locations and population centers
Results	Identifies concurrence between perceived aesthetic disamenities and RCRA sites	Qualitative estimate of the types and degree of changes in aesthetic quality since RCRA.	Estimates the coincidence of RCRA facilities and historical sites, and applies a value to proximate historical sites.	Site-specific estimates of the effect of a proximate RCRA site on local historic sites.

Exhibit B-4

METHODOLOGIES: IMPROVED AESTHETICS AND HISTORICAL PRESERVATION (APPROACHES B, C, AND D)

Advantages/ Disadvantages	Advantages: Provides nationally consistent information Directly measures key variables at different points in time (assumes disaggregated data describing identifiable areas) Disadvantages: Shows correlation, but does not prove causal relationship with RCRA Does not incorporate pre-RCRA data Location data for RCRA sites may be incomplete before 1991	Advantages: Focuses directly on RCRA practices Contributes to development of a "pre-RCRA" scenario. Disadvantages: Requires specific technical knowledge about waste management practices and location of noxious facilities Assesses only key industries Shows correlation, but does not prove causal relationship with RCRA; some noxious facilities may be regulated under air or other laws	Advantages: Specifically addresses proximity to historic sites Could be adjusted to include natural and cultural resources, such as national parks GIS data could be useful in other analyses Disadvantages: Historical site data may be maintained on a local basis but hard to obtain Spatial data for RCRA sites may be incomplete Existing economic studies may not provide an adequate estimate of the value of historical sites	Advantages: Site-specific approach could precipitate data more useful to the current project and to assessment of other attributes Case facilities can be selected to represent full distribution of RCRA facilities Disadvantages: Selection of representative sample could be difficult Involves intensive data collection Will likely need to be used in combination with another method(s) to verify results.
Data Requirements and Sources	"American Housing Survey for the U.S." (1983-1995) BRS data 1993, 1995	Industry Assessments Arthur D. Little, Inc. (1991) BRS data May require additional engineering expertise	BRS data provides spatial information on RCRA sites Census data provides population statistics Local sources may provide information on historic sites	May require information collection request (ICR) and survey development Census data, home sales data, RCRIS/BRS data
Approaches for Addressing Uncertainty	Site sampling (site visits, or other verification such as media reports) could substantiate predicted aesthetic effects		Qualitative discussion of the difficulty in pricing historic, cultural or natural resources Qualitative discussion of the difficulty in establishing a causal relationship between RCRA sites and historical value	Study design would incorporate error rates, based on the number of sites, interviews, etc. Results may only be illustrative is small number of sites Verification with literature review of contingent valuation methods

Exhibit B-4

METHODOLOGIES: IMPROVED AESTHETICS AND HISTORICAL PRESERVATION (APPROACHES B, C, AND D)

Level of Effort Required	Low-Medium: Uses available data but requires correlation, trend analysis	Medium - High: Requires site specific information, engineering expertise	Medium: Requires spatial analysis, may require local data collection	High: Requires site specific information, interviews

Exhibit B-5

METHODOLOGIES: LONG-TERM BENEFITS (SUSTAINABILITY)

Long-term benefits include four general aspects: avoided continuation of damages over long time horizons; avoided increases in damages due to changes in population density and other exposure-related variables; "precautionary principle" effects, or protection from unforeseen events; and benefits due to changes in the value of environmental quality. Although these benefits may represent some important benefits of the RCRA program, they are difficult to quantify and value because of the long time-horizons involved. Therefore, our methods for addressing RCRA long-term benefits would be mainly qualitative. We also recommend attention to continuing developments in economic literature addressing long-term issues.

Category	Conservation of Groundwater (avoided long-term damages) Addresses conservation of ground water over long time horizons.	Precautionary Principle Effect (protection from unforeseen events) RCRA may also prevent currently unknown risks. In this sense, RCRA is "insurance" against future damages	Changes in Valuation Addresses changes in value of environmental quality in future generations
Methodological Steps	Identify the number of contamination incidents averted under RCRA (approach A) Identify the average extent of contamination and apply to the number of avoided incidents	<u>Approach One</u>: Using data from RIAs for RCRA wastes listed since 1981, identify the number of facilities that were already compliant as a result of earlier waste treatment investments under RCRA Identify, where possible, the total savings in cost of compliance for facilities already upgraded <u>Approach Two</u>: Identify historical examples of underestimated hazardous waste risks (e.g., lead) Characterize damages associated with these wastes (from published data)	<u>Approach One</u>: Provide qualitative discussion of changes in valuation of environmental goods over time Compare past trends in value of environmental quality with past trends in acceptable risk levels <u>Approach Two</u>: Identify potential impacts of increase in value of environmental quality on value of groundwater contamination avoided
Results	Estimates the quantity of groundwater spared from contamination (or use) under RCRA	<u>Approach 1</u> Estimates retrospective "insurance effect" of RCRA using program data - illustrates that even in the short term protective standards have value <u>Approach 2</u> Addresses the extent of damage possible due to unknown risks of "safe" wastes	<u>Approach 1</u> Estimates retrospective changes in value of environmental quality and resources <u>Approach 2</u> Addresses the possible effect of a change in value on the benefits associated with avoided groundwater contamination

Exhibit B-5

METHODOLOGIES: LONG-TERM BENEFITS (SUSTAINABILITY)

Advantages/ Disadvantages	Advantages: Both approaches require only publicly available data Approaches address common indicators such as waste quantity reductions that are not specifically analyzed in other analyses Disadvantages: May overestimate benefits if considerable water contamination or land use already exists due to non-RCRA sites.	Advantages: Both approaches address aspect of inter-generational equity that is often overlooked Uses RCRA itself to describe benefits Disadvantages: Does not estimate future insurance effects under RCRA, but instead relies on retrospective analysis.	Advantages: Not resource intensive - uses only publicly available information Addresses issues related to valuation of groundwater resources Disadvantages: Does not address causality, unless it is apparent in specific case studies Does not provide monetary estimate of definite benefits.
Data Requirements and Sources	For percentage of hazardous waste sites that require groundwater remediation: Superfund, Corrective Action and state data. For land and raw materials estimates, BRS and RCRIS	RCRA RIA data to determine compliant facilities Literature/damage studies on specific wastes	Various studies; *Corrective Action RIA* and other sources to identify future groundwater demand and valuation
Approaches for Addressing Uncertainty	Qualitative discussion	Qualitative discussion	Qualitative discussion; analysis of magnitude of impact on value of groundwater
Level of Effort	Low	Low	Low

Exhibit B-6

METHODOLOGIES: ECONOMIC EQUITY

The economic equity attribute addresses the economic distribution consequences of RCRA. RCRA financial requirements and technical standards comprise two aspects of economic equity, or "polluter pays" principle: (1) increased economic efficiency resulting from removal of pollution externalities from the burden of the public sector, and (2) increased fairness in competition by requiring all firms to invest in the resources necessary to ensure responsible behavior.

	Improved Competition		Public/Private Equity	
			Option 1	**Option 2**
Methodological Steps	Qualitative discussion of the redistributional implications of RCRA, including the inherent "value of efficiency" For example, the *Combustion RIA* provides theoretical discussion of these issues, and data pertaining to cement kilns and incinerators. Literature on competition (e.g, DOJ antitrust literature) also provides theoretical background to competition discussion.	Use pre-RCRA industry studies, RIAs for Land Disposal Regulations to determine the number of facilities that are already meeting standards as compared to those that still must meet standards Identify potential "improved competitive advantage" as advantage of facilities that are already compliant	Develop a profile of the public and private distributions for RCRA Corrective Action, RCRA Prevention programs and the Superfund program (*Cost of Clean, Corrective Action RIA*). Identify and compare the public-private "leverage" of prevention programs and cleanup programs.	Estimate the percentage of GDP spent on public cleanups of pre-RCRA wastes (as part of Superfund or RCRA Corrective Action) based on *Cost of Clean*. Compare these figures to allocations of prevention funding.
Results	General, theoretical discussion of economic equity issues as they might pertain to the RCRA legislation.	Number of facilities likely to be positively affected by RCRA	Develops basis for comparing the public/private sector distribution of pre/post-RCRA costs.	

Exhibit B-6

METHODOLOGIES: ECONOMIC EQUITY

Advantages/ Disadvantages	Advantages: Simple analysis of available data Disadvantages: General, qualitative discussion only Not likely to be RCRA-specific	Advantages: Identifies number of "gainers" under RCRA both in absolute terms and as a proportion of total Uses available data used in Intergenerational Equity methods Disadvantages: Does not provide a national-level or program-level estimate	Advantages: Provides quantitative, RCRA-specific estimates of cost distribution before and after RCRA Disadvantages: More data intensive Quantification requires some development of a "without RCRA" scenario
Data Requirements and Sources	Current literature (e.g. Porter, 1991; DOJ Antitrust literature; Combustion RIA)	RCRA RIAs	*Cost of Clean.* *Corrective Action RIA*.
Approaches for Addressing Uncertainty	Qualitative discussion of how literature may or may not apply to RCRA	Qualitative discussion of how results may indicate national-level benefit	Industry-specific survey could verify national estimates, address amount of variation in results (depending on survey format ICR might be necessary).
Level of Resources Required	Low: available data only	Low: available data only	Low- Medium: Quantification requires data collection from public sources, some analysis of data quality

Exhibit B-7

METHODOLOGIES: ENVIRONMENTAL JUSTICE

Some literature suggests that hazardous waste TSDs may be disproportionately located in areas near sensitive and/or disadvantaged populations. Benefits of the RCRA prevention program include reduction of risk to these populations if facilities are more often: closed down, cleaned up, better managed or less frequently sited in these areas as a result of RCRA. Conversely, increased public awareness of hazardous waste may result in TSD sitings in communities with relatively little economic or political power. We suggest a mapping methodology for proximity studies of these issues, in part because demographic data are readily available from the U.S. Census.

	Option 1: Literature Search for Negative Effects of RCRA	**Option 2: Demographic Changes near Facilities** Comparison of Analyses 1 and 2 would provide information about whether new facilities are more or less likely than old facilities to be located in disadvantaged areas.	
		Analysis 1 - "Old facilities"	**Analysis 2 - "New facilities"**
Methodological Steps	Collect current studies that describe the relationship between demographics and distribution of environmental risks, with particular attention to studies that include hazardous waste sites Extrapolate these effects to our characterization of the current RCRA scenario, and identify consistent patterns that may be attributable to RCRA	Map locations of *Corrective Action RIA* sample facilities Map demographic patterns (i.e., ethnicity, income, age, housing density) around each facility in 1980 and 1990 using U.S. Census block level data Compare local demographic patterns at sample facilities to national and county averages to account for changes in demographics over time Extrapolate results to national pre-RCRA universe	Collect a sample of "new" TSDs from recent BRS data (i.e., facilities first reporting in 1993 or 1995) Analyze demographic patterns surrounding these sites Compare these local demographic patterns to national and county averages Compare "new" to "old" TSDs to determine reductions/increases in disadvantaged populations affected by RCRA
Results	Identification of potential negative economic equity effects due to RCRA	Trend analysis of changes in demographics around new, old RCRA facilities Comparison of number of sensitive subgroups affected by pre-RCRA, new facilities	

Exhibit B-7

METHODOLOGIES: ENVIRONMENTAL JUSTICE

Advantages/ Disadvantage	Advantages: Simple, few data requirements Provides general, comparative discussion of "with/without RCRA" justice issues Disadvantages: General, qualitative discussion only Unlikely to capture changes in waste management practices at non-TSDs Available literature may not differentiate effects at RCRA sites from effects at other remediation sites (e.g., CERCLA)	Advantages: Relies on available data; statistically defensible Captures a potentially significant impact of the RCRA program that is not captured elsewhere Allows for pre/post-RCRA comparison over time Effort invested in GIS mapping may be applicable to other analyses (e.g., historic sites, ecologically sensitive areas) Disadvantages: Result depends on the policy-driven definition of "high proportion of sensitive subgroups" Results are sensitive to sample size, and require data collection to identify, locate "new" sites No causal relationship may be determined (i.e., whether TSDs are sited disproportionately in disadvantaged communities, or whether the disamenity perceived in the TSDs causes communities to become predominantly lower-income and thus politically under-represented)	
Data Requirements and Sources	Multiple studies of specific areas (e.g., St. Louis, Seattle, Pittsburgh/Alleghany County) Some national studies (e.g., UCC, 1987)	Corrective Action RIA U.S. Census data	BRS, RCRIS U.S. Census data
Approaches for Addressing Uncertainty	Qualitative discussion of the limitations of using multiple sources to draw general conclusions	Discussion of the sensitivity of the "disadvantaged or sensitive subgroups" definition Perform sensitivity analysis to determine the uncertainty associated with the sample size Discussion of the uncertainty of the causal relationship	
Level of Resources Required	Low: effort limited to focused literature search	Medium: requires spatial analysis using GIS with publicly available data, trend analysis	

Exhibit B-8

METHODOLOGIES: INTER-GENERATIONAL EQUITY

Range of Options	Approach One: Collect pre-RCRA land disposal data and several years of BRS data to identify changes in quantity and percentage of waste disposed by key industries in land disposal units Estimate benefits as total and percentage reduction in the quantity of land-disposed waste and the number and percentage of facilities using land-disposal technologies Approach Two: Identify the number of hazardous waste sites avoided under RCRA Select a sample of CERCLA sites that would have been regulated under RCRA (post 1970 activity, manufacturing) Use site specific narrative data to determine the average length of time between a polluting incident and discovery of contamination Apply this average to the total number of avoided sites (Approach A)
Results	Approach 1 Measures inter-generational equity by determining the reduction in land disposal practices that are associated with future contamination Approach 2 Measures inter-generational equity benefit based on the expected delay of remediation of contamination had RCRA not existed
Advantages/ Disadvantages	Advantages: Both approaches rely on available data Provides approach for identifying the lack of inter-generational equity associated with Superfund cleanup Disadvantages: May double count other attributes such as economic equity While it does not double-count human health risks, it is important to identify distinct uses of same data
Data Requirements and Sources	CERCLIS, RCRIS data to determine length of cleanup *Industry Assessment,* BRS data to determine number of land-based units
Approaches for Addressing Uncertainty	Qualitative discussion
Level of Effort	Low - Medium: some CERCLIS data required

Exhibit B-9

METHODOLOGIES: TECHNOLOGY-FORCING

The treatment and disposal standards of RCRA Subtitle C may have contributed to rapid technological advancement by creating economic incentives to avoid generation of hazardous waste or to improve its treatment and disposal. The benefits attributable to RCRA are the improved consumer or producer surplus from process advances that would not have been implemented in the absence of the regulation. While relevant literature is currently unavailable, we anticipate that it may develop rapidly and recommend examination of calculated estimates in the future.

	Existing Data - New Methods This approach incorporates three indicators that address the relationship between compliance costs, production, and profitability in industries regulated by RCRA:			**New Data - New Methods**
	Indicator 1	**Indicator 2**	**Indicator 3**	
Methodological Steps	Compare pre-RCRA estimates of compliance costs with actual compliance costs; if pre-regulation estimates are significantly higher than reported costs, then technological advances may be responsible for all or part of the difference	Compare inflation-adjusted product price and production trends with waste trends for the top hazardous waste producing industries; if prices are flat or decreasing as waste decreases, this may indicate that cost structures are not negatively affected by waste reduction technologies	Identify trends in waste generation per dollar value added (profitability) over time; compare industry profitability with national profitability. This measure identifies correlations between profitability and waste production in key industries	Conduct interviews with industry representatives (e.g., technology suppliers, engineers at TSD facilities) The extent to which regulation drives R&D and marketing efforts of these companies may indicate the extent to which technology adoption has been advanced as a result of regulation
Results	These four indicators characterize the relationship between compliance costs and profitability in industries regulated by RCRA			Incremental profits from sales of technology required by regulation may be a good estimate of technology forcing benefits
Advantages/ Disadvantages	Advantages: Simple if data are available Disadvantages: Data may be difficult to obtain Links to technology forcing may be tenuous	Advantages: Simple Disadvantages: Links to technology forcing may be tenuous	Advantages: Simple Disadvantages: Links to technology forcing may be tenuous	Advantages: Potentially a more defensible data set Disadvantages: Data intensive Need to identify experts Data may be anecdotal or targeted to narrow product classifications ICR may be necessary
Data Requirements and Sources	Compare *Cost of Clean* estimates with estimates from *Economic Impact Analysis of RCRA Interim Status Standards* (1981)	Price trends from *Statistical Abstract of the U.S.* or trade journals Inflation trends from *Economic Report of the President*	Waste generation from *Statistical Abstract of the U.S.* or trade journals Dollar value added from *Census of Manufacturers*	Primary data accumulation

Exhibit B-9 METHODOLOGIES: TECHNOLOGY-FORCING				
Approaches for Addressing Uncertainty	Qualitative discussion (e.g. *On the Accuracy of Regulatory Cost Estimates*, 1999)	Qualitative discussion.	Qualitative discussion.	Qualitative discussion of the limitations of survey techniques.
Level of Resources Required	Low: simple analysis of available data	Low: simple analysis of available data	Low: can be done as part of Economic Impact Analysis	Medium-High: Requires survey development, data collection effort

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EXHIBIT B

Richard Roddewig, MAI

Stigma, Environmental Risk and Property Value: 10 Critical Inquiries

In the last two decades, the real estate appraisal community has learned how to evaluate the impact of environmental risks on property values and markets. Appraisers have learned to distinguish the impact of cleanup costs from the impact of stigma on market value. This article defines "stigma" and "environmental risk" and then summarizes 10 critical inquiries in an investigation of real estate impacts. Included is a discussion of the types of environmental site assessments, the impact of Superfund designation and remediation programs on value, the importance of guarantees or insurance in offsetting some types of risks, and an evaluation of the various cycles—including the public relations and regulatory—that affect the valuation process.

Over the past two decades, real estate appraisers have gained considerable experience in valuing property affected by environmental risk. In fact, many in the appraisal community are now so comfortable analyzing those impacts on property markets and market values that some now specialize in environmental risk analysis. The increased comfort level of both the marketplace and appraisers with this type of analysis is, in part, a result of improved techniques for environmental assessment, wider availability of data about the numbers, types and locations of properties likely to be affected by environmental risks, better information about health risks posed by some environmental conditions, and enhancements in removal/remediation techniques. The simple passage of time has also helped. It has allowed real estate owners, developers, lenders, buyers, sellers, and appraisers to become familiar with processes for the appropriate analysis of the potential impact of environmental risks on property.

The Appraisal Institute and its predecessor organizations have been instrumental in this process as well. For example, since 1985, *The Appraisal Journal* has published at least 70 articles dealing with environmental topics.[1] In addition, the Appraisal Institute launched a new publication called *Environmental Watch* in 1988. This newsletter concentrated on en-

1. See, for example, Danny J. Martin, "The New URAR and Environmental Hazards," *The Appraisal Journal* (January 1995): 47–52; Peter J. Patchin, "Contaminated Properties and the Sales Comparison Approach," *The Appraisal Journal* (July 1994): 402–409; Robert Simons, "How Clean Is Clean?" *The Appraisal Journal* (July 1994): 424–438; and Albert R. Wilson, "The Environmental Opinion: Basis for an Impaired Value Opinion," *The Appraisal Journal* (July 1994): 410–423

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vironmental issues pertinent to appraisers.[2] In 1989, the American Institute of Real Estate Appraisers adopted Guide Note 8 which dealt with "The Consideration of Hazardous Substances in the Appraisal Process." That note was adopted in 1991 in its entirety by the Appraisal Institute. In 1992, the Appraisal Institute Board of Directors appointed a special Appraisers' Environmental Responsibility Task Force that subsequently promulgated a voluntary Property Observation Checklist, which appraisers may use when inspecting property likely to be affected by environmental risks. In 1993 the Appraisal Institute published a video titled *Hidden Factors: Environmental Risks and the Real Estate Appraiser*, that gives special attention to the environmental site assessment process. In 1994, the Appraisal Institute introduced a new seminar titled "Environmental Risk and the Real Estate Appraisal Process," which has been taught in many locations across the country. The essence of many of the articles published in *The Appraisal Journal* and *Environmental Watch*, and the information in the *Hidden Risks* video, and the seminar course can be distilled to 10 critical inquiries that every real estate appraiser should bear in mind in assignments involving contaminated properties.

STIGMA AND ENVIRONMENTAL RISK: WHAT ARE THEY?

The concept of environmental risk as applied to real estate is broad and covers a range of substances, events and land use activities. We may typically think of environmental risk as emanating from such things as groundwater contamination or soil contamination by hazardous substances. But it can be generated in many other ways as well, for example, by air pollution or movement of airborne contaminants on the wind, by pollution of lakes or streams, by contamination of drinking water distribution systems, or even by noise such as might emanate from a busy expressway or an airport. An event, such as a marine oil spill or a railroad derailment involving tank cars carrying chemicals, may create temporary environmental risks until cleanup is completed. Also, certain types of land uses, such as power plants, electrical transmission lines, landfills, waste incinerators, chemical or radioactive material storage facilities, may be perceived in some locations as creating environmental risk for adjacent or nearby real estate.

In analyzing environmental risk, however, real estate appraisers must carefully bear in mind the following points. Not every use of a hazardous substance results in contamination. Not every use of a hazardous substance that does result in contamination necessarily creates an environmental risk. And not every use of a hazardous substance that results in contamination and results in environmental impact and environmental risk necessarily results in a real estate market impact.[3]

The Appraisal Institute emphasizes that environmental risk should be evaluated in the context of a system. The substance itself may be a big part of the risk, but the amount of real estate impact, if any, depends on many other systemic factors such as how the substance is controlled, how it is spread, how many people are potentially affected by the risk, and the degree to which people may be affected.[4]

Stigma, as it applies to real estate affected by environmental risk, is generally defined as "an adverse public perception about a property that is intangible or not directly quantifiable."[5] It is an additional impact on value, over and above the cost of cleanup or remediation. Stigma can occur on sites that once contained contaminants and have been cleaned up, on sites undergoing cleanup, or on sites that were never contaminated but neighbor a property that contains or once contained contaminants.

In many appraisal assignments, the costs of cleanup or remediation are known or have been reasonably quantified by technical environmental assessment specialists. The appraiser's principal task may be to provide an opinion of the additional impact, if any, arising from the "stigma" as-

2. Appraisal Institute, *Environmental Watch* (Chicago: Appraisal Institute). Publication of this newsletter was terminated in 1995 because of the increased availability of information on environmental issues from other sources.
3. Appraisal Institute, *Environmental Risk and the Real Estate Appraisal Process*, Seminar Workbook, Chap. 1 (Chicago: Appraisal Institute, 1994), 21.
4. Ibid. See also *Hidden Factors: Environmental Risk Evaluation and the Real Estate Appraiser*, video, Appraisal Institute, Chicago, 1992.
5. *Environmental Risk and the Real Estate Appraisal Process*, 128.

related with the site in the marketplace before, during, or after the cleanup process.

QUESTION 1: WHAT TYPE OF RISK OR CONTAMINATION IS PRESENT?

Not every contaminant or hazardous substance creates the same level of health risk. And not every contaminant creates the same level of risk of impact on property values or markets. Therefore, for the appraiser to do his or her job effectively, the character of the contaminant and its technical environmental impacts and potential health impacts should be understood.

What types of information about the substance should the appraiser obtain in order to understand the real estate impact risks? They can be summarized as follows: the most likely locations, typical transport media, typical transport mechanisms, types of environmental impact and potential health effects, and accepted remediation techniques.

An appraiser needs to know about the typical or most common sources of the substance or risk. Are they widespread or localized? Are the locations well known and carefully documented, or of uncertain extent? How does the substance get into the environment? Does it get into soil, air, groundwater, surface water? Does it get into the food chain? Does it result from natural processes, such as with radon emissions? Or does it get into the environment only as a result of human processes, such as with PCBs?

How does it move through the environment? For example, is it transported by erosion, water, air currents, human or animal activities? The speed at which it moves and the distance it can travel can be affected by such factors as topography, soil type, geology, hydrology, or even wind and air patterns. How do such factors as temperature and humidity affect its movement and presence?

What are the known or suspected impacts on human health? Is the substance a known carcinogen or only suspected of contributing to cancer? How conclusive is the scientific evidence about the link between the substance and health impacts? At what stage is the research on the health effects? These are all things an appraiser may need to know something about because they may be at the core of the real estate marketplace reaction to owning property containing or affected by proximity to the substance or risk.

Knowledge of the appropriate remediation techniques is also crucial to the appraiser's inquiries. Some substances and risks can be easily controlled or remediated, while others cannot. Remediation techniques may include physical removal, on-site treatment, or encapsulation. On-site treatment techniques may vary depending on the nature of the substance, the degree of contamination, or the media in which the substance is located, such as in groundwater or soil. Appropriate remediation techniques may vary from one substance or risk to another. For example, physical removal of some substances, like PCBs, may be the only appropriate technique while on-site encapsulation is appropriate for others like urea-formaldehyde insulation or some types of asbestos.

The real estate impact of an environmental contaminant depends on how the substance is controlled, how it is spread, how many people are potentially affected, and the degree to which people may be affected.

QUESTION 2: HOW DO THE FIVE CRITICAL CYCLES AFFECT PERCEPTIONS OF THE RISK?

Every appraiser experienced with evaluating environmental risks soon notices discernible stages in the market concern about environmental impacts of any particular substance. To understand how this works, consider the history of the concern about asbestos as a hazardous substance. Asbestos was widely used in the construction industry in the 1950s and 1960s. Use grew substantially in the early 1970s as well until studies began to conclusively document that asbestos fibers could get into the lungs and cause asbestosis, a potentially fatal condition. Between 1972 and 1975, the Environmental Protection Agency (EPA) issued a series of regulations about the use of asbestos, in many cases banning its use in construction.

Newspapers in the early 1970s had extensive coverage of the asbestos health risks,[6] causing near panic in some sectors of the real estate marketplace. Many properties containing asbestos were stigmatized, becoming unmarketable virtually overnight when many major lenders and financial institutions adopted policies

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6. See, for example, "Perilous Particle: Tiny Asbestos Fibers Pose a Health Threat to Workers," *The Wall Street Journal* (June 8, 1972): col. 1, 1.

against lending on any property containing asbestos, and some prospective tenants adopted policies against leasing in buildings containing asbestos.[7] By the early 1990s, however, the situation was completely changed. Buildings in which asbestos had been removed, and even buildings with asbestos in place, were routinely bought and sold in the marketplace, and most lenders and tenants were quite comfortable in evaluating the risks.

What happened in the intervening 20 years that so dramatically changed the situation? The marketplace simply got more comfortable in evaluating the risks associated with ownership of a building containing or once containing asbestos. This naturally occurred as a result of the normal evolution of five critical cycles that affect the market for properties affected by environmental risk: the health risk cycle, the remediation cycle, the public relations (media) cycle, the regulatory cycle, and the lending cycle. All of these five cycles are interrelated. In fact, they may more properly be considered as part of one larger systemic cycle that repeats itself over and over again with each new substance or environmental risk that gets attention in the real estate marketplace. To evaluate the impact of environmental risk on real estate, the appraiser needs to understand each component and how the five cycles fit into a larger pattern.

A reason that a marketplace may shut down is due to lack of information about types and costs of remediation techniques.

The Health Risk Cycle

The health risk cycle typically begins with the publication of a groundbreaking study linking some common substance in the environment with a health effect. This initial study typically finds some correlation between the substance and a serious disease or condition, often an increased incidence of cancer in persons exposed to the substance. Appearance of the first study typically begets additional studies showing the same effects or focuses attention on other earlier studies showing the same results.

Soon, however, a scientific dialogue emerges, as additional studies critically evaluate the results of the initial studies, poke holes in the methodology, or refine the analysis to better clarify the situations in which health impacts may or may not be likely. This is typically accompanied by better measurement and understanding of the concentrations necessary to create health risks, better data about the locations of sources of the substance, and information on simple ways to limit exposure to the contaminant.

With most of the significant environmental risks that have initially been considered to have widespread impacts on the real estate marketplace in recent years—consider asbestos, PCBs, radon, and electromagnetic fields, for example—the result has been the same: As more scientific information becomes available, general alarm and concern in the real estate community abates and becomes more narrowly focused on a smaller pool of properties than first suspected.

The Remediation Cycle

Once the potential health risk posed by a substance becomes a factor in the real estate marketplace, the real estate community immediately begins to seek information about techniques to remediate or lessen the risk. One reason why a marketplace may shut down, as it did in the wake of early concerns about asbestos in commercial buildings, is due to lack of information about types and costs of remediation techniques. As time passes, however, if the market gets more information about remediation, the stigma typically decreases.

Attention given to developing remediation techniques is often directly proportional to the perceived magnitude of the health risks and the number of properties potentially affected by the environmental risk. Remediation techniques are proposed, evaluated, and tested. Results of the tests are publicized, leading to further refinements. A remediation "industry" may actually develop to apply appropriate techniques to the problem properties. Initially, remediation costs may be high, but as more research is done, and more competitors for remediation business enter the marketplace, the cost of remediation is driven down. Eventually, the real estate marketplace becomes more comfortable with its ability to estimate remediation costs for particular types of environmental risks in a variety of settings. Over time, that often

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7. See, for example, Janis L. Kirkland, "What's Current in Asbestos Regulation," *University of Richmond Law Review*, v. 23 (Spring 1989): 375–402, citing Adams and Baker, "Sale or Lease of Asbestos-Contaminated Buildings: Legal and Marketplace Issues," 4 *National Asbestos Council Journal* (1986): 50, 53.

means a decrease in the component of stigma caused by uncertainty about remediation techniques and costs.

The Public Relations (Media) Cycle

The old conundrum about falling trees, noise, and human ears applies to the publication of articles about the health effects of substances commonly found in the environment. If it is published only in the scientific or technical literature, and gets no mention in the popular press or at least in professional real estate publications, the substance may have little effect on real estate markets.

Consider the recent concern about the impact of electromagnetic fields emitted by power lines on property values. The first U.S. epidemiological study showing a possible relationship between power lines and some forms of cancer was published in 1979.[8] It was not until a decade later that this study received serious attention. This was the result of an article published in *The New Yorker* magazine by an author whose book, published a year later, put the issue before the general public for the first time.[9]

The popular media treatment of environmental risks typically runs in three phases. In the first phase of the cycle, there is extensive newspaper and electronic media reporting of studies asserting some adverse health effect associated with a substance, building material, or land use previously perceived by the public as being of no environmental concern. This first phase of the cycle also typically involves allegations that the substance, material, or land use creates a widespread risk of serious magnitude, and includes interviews with concerned citizens and environmental groups emphasizing possible dangers from exposure. As the first phase continues, government authorities promise investigation and response, and promise new regulations, if necessary, to lessen the risk.

The second phase of the cycle typically begins with the publication of information on ways of avoiding, remediating, ameliorating, or limiting exposure to the potential problem, publication of additional studies indicating that the health effects are not as conclusive or as serious as first reported, or at least not likely to be as widespread or occur as frequently as first suspected.

In the second phase also, the media begin to report on technologies and techniques for control, cleanup, remediation, or avoidance of the risk. As this information becomes more widely available, the costs associated with the techniques become better understood and more easily quantifiable. Information also becomes available about the situations in which the risks are likely to be high and those in which exposure or proximity to the risk is limited. Much of the information resulting from this second phase comes as a result of the government process of investigating the existence and seriousness of the risk and determining if there is any need for new regulation of the causes.

In the third phase of the cycle, the market has completely digested the information and makes more informed decisions about the level of risk, if any, and the costs of avoiding or ameliorating it. In this third phase, initial perceptions about potential impacts may be greatly diminished. When the potential impacts relate to property values, the concerns of the marketplace about the number and type of properties potentially affected may also be greatly reduced. And with respect to some types of risks, the market may no longer perceive any adverse impact on property values.

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The Regulatory Cycle

There is also a cycle in the way regulators and lawmakers respond to public concerns about possible environmental risks. It typically follows the same pattern as the three phases of the media cycle. In the first phase, lawmakers and regulators respond with cries of concern and alarm, and promises to investigate and "do something" about the problem, if there is one. In the second phase, they launch investigations of the problem, and perhaps hold public hearings to determine its seriousness and garner different points of view. Regulators publish technical studies and propose new regulations or improved laws

8. See N. Wertheimer and E. Leeper, "Electrical Wiring Configurations and Childhood Cancer," *American Journal of Epidemiology*, v. 109, no. 3 (March 1979): 273–284.

9. See Paul Brodeur, "Annals of Radiation: The Hazards of Electromagnetic Fields," *The New Yorker* (June 12, 1989): 51–88; (June 19, 1989): 47–73; and (June 26, 1989): 39–68, later published as *Currents of Death: Power Lines, Computer Terminals and the Attempt to Cover Up Their Threat to Your Health* (New York City: Simon and Shuster, 1989). See also Gary Taubes, "Fields of Fear," *The Atlantic Monthly* (November 1994): 94, for a discussion of the sequence of publications and public inquiry into the issue.

to control the problem. In the third phase, the new laws are put into practice and then monitored to determine if they are having the intended effect, or whether the laws themselves are creating unforeseen problems and need to be adjusted.

If the laws enacted are very strict, they may have unintended consequences. That is exactly what has happened as a result of some of the Superfund program and the state programs modeled on it. In some older industrial areas, so-called "brownfields," so many properties have contamination problems that qualify or potentially qualify for federal or state Superfund programs, that the real estate market, in some cases, has virtually evaporated. In other markets, it simply creates further impetus for suburban rather than inner-city development. Federal and state regulators are now trying to modify and streamline regulations in order to eliminate some of these regulatory impediments to sale and redevelopment, now reversing past trends for ever-tighter environmental regulations.

The Lending Cycle

The lending community has also gone through a cycle in the way it has reacted to environmental risk, and now has institutionalized and regularized its procedures for dealing with those risks. In the early 1980s, lenders were so nervous about environmental risk and the real estate marketplace that even the hint of a contamination problem might cause entire categories of properties to be unmortgageable.

That attitude has changed dramatically. Lenders have become more comfortable in evaluating environmental risks. Some of this is the result of the institutionalization of the environmental site assessment process as part of customary mortgage lending practice. Some of it is the result of changes in laws and regulations that clarify when mortgage lenders are, and are not, responsible for cleanup costs. Some of it results from the Federal Deposit Insurance Corporation (FDIC) guidelines issued in February 1993, outlining the steps that member banks should take to implement a proper program for analysis of environmental risk.[10] One of the recommendations of the FDIC is that every institution should appoint a designated senior officer to be responsible for environmental program implementation. Some of it is the simple result of lenders gaining more knowledge about comparative risks created by various environmental conditions.

QUESTION 3: HAS THERE BEEN AN ENVIRONMENTAL SITE ASSESSMENT?

Thanks to the cycle that has occurred in the lending community, a new industry in environmental site assessment has developed since 1986. Most major lenders now routinely insist on some kind of environmental analysis on commercial properties before making a loan, and the standard Uniform Residential Appraisal Report (URAR) form specifically requires an appraiser to comment on "adverse environmental conditions (such as, but not limited to, hazardous wastes, toxic substances, etc.) present in the improvements, on the site, or in the immediate vicinity of the subject property."[11]

The purpose of the analysis is to gather as much information as possible about existing or potential environmental conditions that might affect value and the security of the mortgage loan. Site assessments are undertaken in stages, typically known as Phase I, Phase II, and Phase III site assessments. Phase I assessments usually consist of four areas of research and inquiry: (1) interviews with current owners/operators and inspection of owner or operator documents and records; (2) search of the chain of title for any evidence that past owners, operators, or tenants undertook activities that might have resulted in discharges of contamination; (3) inquiry to government agencies for information about past discharges or storage of potential contaminants on site or nearby; and (4) actual onsite inspection.

If the Phase I work results in some evidence of possible surface or subsurface contamination or past or present violations of environmental laws and regulations, a Phase II assessment may be undertaken. The purpose of this second phase is to con-

10. See *Environmental Watch*, v. 6, no. 1 (Spring 1993): 1, for a discussion of these FDIC guidelines.

11. Federal National Mortgage Association (Fannie Mae), Uniform Residential Appraisal Report Form 1004 (Washington, D.C.: Fannie Mae, 1993), 1. For additional commentary on this requirement, see Danny J. Martin, "The New URAR and Environmental Hazards," *The Appraisal Journal* (January 1995): 47–52.

firm the presence or absence of contamination, and document the types, amounts and locations, and possible rates of migration through soil or groundwater. Soil testing and even groundwater testing may be undertaken during the Phase II investigation. Following completion of the Phase II assessment, there may be a Phase III assessment that further analyzes the site and better defines the amount, location, and control or cleanup techniques and costs.

The information gathered in the environmental site assessment process can be very significant to the potential mortgage lender, the real estate marketplace, and therefore the appraiser in estimating value. The site assessment process pinpoints the location and amount of any contaminants, and, if it proceeds into a Phase II or Phase III assessment, the appropriate control or remediation techniques and their costs. The availability of accurate information about the levels of contamination and the costs and duration of control or cleanup can cut down dramatically on the risk associated with ownership of property affected by environmental risk.

QUESTION 4: IS IT A DESIGNATED FEDERAL OR STATE SUPERFUND SITE?

The federal program known as "Superfund" was established by the Comprehensive Environmental Response, Compensation and Liability Act of 1980, known better by its acronym, CERCLA.[12] The principal focus of the program is to identify abandoned and inactive hazardous waste sites and stimulate their cleanup. The Superfund itself is the pot of money appropriated by Congress to clean up specifically designated sites.

As of the end of 1994, just over 38,000 sites all over the country had been brought into the program. However, only about 1,300 of these sites are actual Superfund sites with cleanup programs in process. These 1,300 properties are on the National Priority List (NPL), and have been selected from the larger group of sites based on a scoring system that evaluates many factors, including relative toxicity of substances on site, location, size of the population at risk, potential for groundwater contamination or drinking water contamination, and potential threat to air quality. The larger database from which NPL sites is drawn is called the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS). Qualifying sites can be brought to the attention of the EPA in many ways, including as a result of actual government monitoring of reported releases of hazardous substances at the site, citizen complaints, or government investigations.[13]

Inclusion of a property in either the CERCLIS or NPL lists can often have significant consequences for the value of the property and even the value of adjacent properties.[14] The principal reason is that the EPA can undertake a remedial cleanup plan and hold current or past owners or operators of NPL sites liable for reimbursement of those cleanup costs.[15] A current or past owner or operator can be liable whether or not it had any involvement in the handling, disposal, or treatment of the hazardous substance on the site.[16] And because cleanup responsibility is "joint and several," each current or former owner or operator can be held liable for the entire costs of cleanup. That means the owner or operator with the deepest pockets is often the one pursued hardest, even when that entity made no contribution to the problem.

Those factors by themselves might be enough to create significant market stigma for many Superfund sites. But there is another reason also. Lenders are extremely reluctant to make a loan on a site that is or potentially could be part of the Superfund program because as the law is currently

In the early 1980s, lenders were so nervous about environmental risk and the real estate marketplace that even the hint of contamination might cause entire categories of properties to be unmortgageable.

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12. 42 U.S.C., sec. 9601 et seq.
13. 42 U.S.C., sec. 9603(a) and (c), 9604(b), 9659(a).
14. According to EPA administrator Carol M. Browner, "The mere fact that these sites have remained in CERCLIS has caused potential developers to shy away from them and many lending and real estate investment communities have denied loans for businesses in or near CERCLIS sites as a matter of policy." Statement of Carol M. Browner, Administrator, U.S. Environmental Protection Agency before the Commerce, Trade, and Hazardous Materials Subcommittee, Committee on Commerce, U.S. House of Representatives, March 16, 1995.
15. EPA's policy is not to seek cleanup costs from residential property owners unless those owners caused the contamination. See Policy Towards Owners of Residential Property at Superfund Sites, OSWER Directive No. 9834.6, July 3, 1991.
16. Most courts have found an exception for state government. See, for example, *United States v. Dart Indus., Inc.*, 847 F.2d 144 (4th Cir. 1988).

being applied by the courts, in some circumstances a lender can be declared to be an owner or operator—and therefore a party potentially responsible for cleanup—even in the absence of a foreclosure action.[17]

One way a buyer or prospective operator of a site included in the CERCLA program can avoid liability for cleanup costs is to meet the legal definition of an "innocent landowner."[18] That exception is available when an owner did not know at the time of purchase, or had no reason to know, that hazardous substances were on the property. The proof is evidence that before the purchase the buyer made all reasonable inquiries consistent with good commercial or customary practice, thus, the impetus for Phase I and Phase II environmental assessments.

At least 35 states[19] have adopted their own programs modeled on the federal Superfund concept. Some states may have their own equivalent of the CERCLIS list, the scoring system, and the NPL list of properties with the highest priority for cleanup.[20] Also, many of these properties may not otherwise qualify for the federal Superfund program. State listing too may create responsibilities for cleanup, with the same kind of joint and several "no fault" liability.[21]

All of this means, however, that an appraiser should carefully evaluate the potential for a property to be part of the Superfund program. Information about existing properties on the CERCLIS or NPL lists can be obtained from regional offices of the EPA. It may even provide maps. State environmental protection agencies can also provide information on either federal or state equivalent listings.

But the regulatory environment is changing quickly. Early in 1995, the EPA removed about 25,000 sites from CERCLIS. These were generally sites that had been investigated by the EPA and found no longer to be of federal interest either because they were found to contain no or little contamination or were being cleaned up under state programs. The intention was to remove some of the stigma that accompanies inclusion in CERCLIS, and encourage more sale and redevelopment of brownfields, which are typically in the Northeast and Midwest. And Congress has before it a number of legislative initiatives that would clarify and limit the responsibility of lenders for cleanup, help identify portions of contaminated sites that do not require cleanup, and match the appropriate remediation technique to "reasonably expected future land uses at sites."[22] All of these pending changes may, in the future, reduce the amount of stigma associated with Superfund site listing.

QUESTION 5: IS THERE AN APPROVED OR COMPLETED REMEDIATION PLAN?

There are many different types of control and cleanup techniques and methods. In fact, there are many different definitions of the word "remediation." It can have a technical, legal term that can carefully differentiate some types of control or cleanup activities from others, for example, by differentiating a "remedial action" from a "removal action."[23]

17. When CERCLA was first adopted, lenders thought they were exempted from the strict liability rule for cleanup. However, a series of court cases, culminating in *United States* v. *Fleet Factors Corp.*, 724 F.Supp. 955 (S.D. Ga. 1988), 901 F.2d 1550, *reh'g denied, en banc*, 911 F.2d 742 (11th Cir. 1990), held that in some limited circumstances, a mortgage lender could be held to be an "operator" and therefore potentially liable for cleanup costs. In the wake of the Fleet Factors decision, the U.S. EPA, at the urging of the lending community, adopted a regulation that specifically exempted lenders from strict liability for cleanup. However, that regulation was eventually struck down by the courts on the basis that it exceeded the agency's rulemaking authority.

18. 42 U.S.C., sec. 9607(b)(3).

19. The following states either do not have their own Superfund legislation, or have more limited legislation: Alabama; Connecticut (state only has authority to act under CERCLA and has no independent state provision); Washington, D.C.; Georgia; Nebraska; Nevada (very limited CERCLA-like provisions); Ohio (state has no independent liability provisions); Rhode Island (no clear liability standards of its own); South Dakota; West Virginia (no liability provision of its own); Wisconsin (limited CERCLA-like provisions); and Wyoming.

20. See, for example, Wisconsin Stat. Ann., sec, 144.442(4), and Utah Code Ann., sec. 19–6-311.

21. See, for example, New Jersey Stat. Ann., sec. 58.10–23.11g(c); Or. Rev. Stat., sec. 466.567 and 466.640; and Pennsylvania Stat. Ann., sec. 60320.702.

22. See, generally, the testimony of Carol Browner, supra.

23. "Remedial action" has been defined, in part, as follows: "Those actions consistent with permanent remedy taken instead of, or in addition to, removal action in the event of a release or threatened release of a hazardous substance into the environment, to prevent or minimize the release of hazardous substances so that they do not migrate to cause substantial danger to present or future public health or welfare or the environment."

Under Superfund and its state-level surrogates, a federal or state environmental protection agency typically undertakes a remedial investigation and feasibility study to determine type of contamination, extent, possible cleanup technologies and options, and likely costs. The same kind of investigation is undertaken in some other types of environmental programs, for example, under state programs requiring removal of underground storage tanks.[24] A common element in these types of programs is that a federal, state or local agency with environmental responsibility eventually approves a plan for action to lessen the risk of a release of a contaminant or assure cleanup to an appropriate standard.

The approval of such a plan, therefore, can eliminate some of the environmental risk associated with owning a contaminated site. The basis of the action plan is a site investigation. The testing and monitoring provides data about the nature and extent of the problem that allows selection of the appropriate technology for cleanup and a quantification of the cost. But most importantly, approval of the plan by a government agency often defines the legal cleanup responsibility of parties involved with the property and the cleanup attainment standard that must be met. All of that narrows risk.

As part of this inquiry the appraiser should ask the following questions:

- Is there an approved remediation plan?
- Who has approved it and how?
- How certain is the remediation approval?
- Is there any risk of additional remediation being ordered after completion?
- What is the approved remediation technique?
- How long will the remediation process take?
- What will be the level of cleanup after remediation?
- Does the remediation require ongoing monitoring? If so, for how long, and who pays for monitoring costs?
- What will the remediation cost?
- Who will pay the cost of remediation?
- Is there a federal or state program to reimburse for remediation costs?

QUESTION 6: HOW DOES THE CONTAMINATION AFFECT CURRENT USE?

Some uses may be more affected by contamination or environmental risk than others. For example, a use that sits above a contaminated aquifer and needs unpolluted groundwater for on-site drinking water may be more affected than a use on the same site that does not need to use the groundwater.

So the appraiser has to undertake a highest and best use analysis, taking into account the presence of the environmental risk. A careful analysis should be undertaken to determine if the current use has, in any way, been affected by the risk. If it has not been affected, and the current use is the highest and best use and is likely to continue indefinitely, then many times there may be little or no stigma from the contamination or risk.

Sometimes, for example, in litigation, the appraiser may be asked to consider the highest and best use of the property both before and after considering the environmental risk. In some situations, the current use may not be the highest and best use of the property when the value of the property is considered free and clear of the contamination. However, an analysis of the past operations of the current use may indicate that it can continue indefinitely even with the contamination in place. If so, there may be some continuing use of the property after considering the contamination, and that use may indeed be the highest and best use.

QUESTION 7: HOW DOES THE CONTAMINATION AFFECT SURROUNDING USES?

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This inquiry may be important in two contexts. First, the appraiser may be valuing property adjacent to a source of potential contamination or risk, for example, property next to a landfill or adjacent to overhead transmission lines or a service station

"Removal action" has been defined as follows: "Short-term immediate actions taken to address releases of hazardous substances that require expedited response." See Thomas F. P. Sullivan, ed., *Environmental Regulatory Glossary*, 6th ed. (Rockville, Maryland: Government Institutes, Inc., 1093): 469–471.

24. See, for example, Florida Stat. Ann. Ch. 376–3071(5).

With some types of environmental risk, it has become common for property owners to provide an indemnity to purchasers against liability for future cleanup costs and other potential impacts of the contamination.

with a leaking underground storage tank. Second, the appraiser may be valuing the property that is itself the source of potential contamination or risk, but trying to determine the implications of actual or possible off-site migration or transmission on the value of the source property.

In either context, perceptions in the marketplace may be as important as the reality of whether the contamination or substance is actually physically affecting surrounding property. But the appraiser must take care to determine real market impacts on adjacent property from mere allegations of market impact. The appraiser's job is to investigate the market for evidence that indicates an impact on value, and if so, how far the off-site impact extends.

The starting point for the inquiry is usually the factual basis of any off-site migration or physical effects. What do the technical assessments and off-site testing show about the actual location and intensity of off-site impacts? Does the extent of the off-site migration vary, depending on such factors as soil conditions, slopes, wind patterns, etc.? How have local governments with land use and zoning authority responded? Have they imposed, or are they likely to impose in the future, development moratoria, limitations on use, special hearing requirements, or other land use regulations around the source of the risk?

Many types of uses, such as sanitary landfills, power plants, transmission lines, airports, expressways, and hazardous waste sites have been studied in a variety of settings to determine their off-site impacts, if any.[25] The appraiser may be able to use these other case studies as evidence of the actual or potential impact of similar uses in other settings. Care must be taken, however, to make adjustments as appropriate when considering case studies from other locations or based on past events or different contamination or risk situations.

Actual or potential impact on surrounding uses may affect the value of the source property. The risk of owning the property that is the source of the contamination may be increased if there is the possibility of impact on surrounding properties as well.

QUESTION 8: ARE THERE GOVERNMENT PROGRAMS TO OFFSET RISKS?

Many states have been assisting the private sector in cleaning up contaminated properties. Other states have been trying to limit the exposure of property owners to damage claims as a way of encouraging the redevelopment of older industrial areas. These programs, when effective, can go a long way to offsetting the risk associated with owning some types of properties affected by environmental risk.

For some types of environmental cleanup, there is special state funding available to reimburse cleanup expenditures. This is most frequently available for the removal of leaking underground storage tanks and the remediation of soil or groundwater contamination problems that may have resulted. Often "Petrofund" programs, they are typically paid for by a special tax on gasoline sales,[26] and may go far to offsetting the impact of environmental risk on the value of the properties that qualify for the program.[27]

In some states, regulatory agencies will issue various "letters" to relieve property owners of their anxiety regarding environmental risk on their properties. Among the types of letters are the "no action" letters, which are intended to assure future buyers that once a plan for cleanup has been approved, no further cleanup actions will be required. "No association" or "good neighbor" letters state that if an owner did not cause the original contamination and has voluntarily undertaken approved testing and cleanup on the property, there is no liability for further cleanup.[28]

25. For a good summary of many of these studies and articles, see *Environmental Risk and the Real Estate Appraisal Process*, Addenda N and O.

26. See generally, Nebraska Rev. Stat., sec. 81-15 and Wisconsin Stat. Ann., sec. 101.43.

27. In some states, there may be limits on the amount of money that can be allocated to any one particular site. For example, in Arkansas the fund will reimburse an owner, after he has expended $25,000, up to the maximum amount of $1.0 million per occurrence. Arkansas Code Ann., sec. 8-7-907(a). In other states, such as Illinois, while there may be a "Petrofund" program on the books, funding is so limited that the program is ineffective, and property owners in effect pay their own cleanup costs.

28. For a discussion of one of the recent programs, in Minnesota, see "Minnesota's Superfund Shield," Planning (June 1995): 22-23.

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The EPA has a number of programs in the works to "help remove the barriers to property transfer and revitalization"[29] of contaminated sites in the CERCLIS and NPL programs. These are the so-called brownfield initiatives, designed to encourage the reuse of older contaminated, manufacturing sites in major urban areas. As a result of one of the initiatives, the EPA has promised to develop "guidance" to "reassure lenders and prospective purchasers of the safety of their investments, and to thereby encourage the cleanup and redevelopment of contaminated properties."[30] As these brownfield initiatives develop, the perceptions of risk associated with actual or potential Superfund listing may be significantly reduced for some properties.

QUESTION 9: ARE THERE GUARANTEE OR INSURANCE PROGRAMS FOR BUYERS?

With some types of environmental risks, it has become quite common for property owners to provide an indemnity to purchasers and even neighbors against liability for future cleanup costs and other potential impacts of the contamination. This has become quite common, for example, when major oil companies sell service station/convenience store sites. It also has become common practice among major landfill operators to provide property value guarantee programs as part of the process of seeking government approval for expansion or construction of landfills.[31]

Such a guarantee program can offset some or all of the stigma risk associated with owning a previously contaminated property, or owning a property adjacent to a source of environmental risk. There are some critical questions that the appraiser should ask about the guarantee or indemnity, including the following:

- What does the guarantee cover? Are all cleanup costs, including testing, monitoring and consultants fees covered? Are only future cleanup costs covered, or are other types of impacts such as potential stigma impact on value also covered?
- How long does the guarantee run?
- Does it extend to third parties, such as future owners and tenants?
- What is the credit rating of the company providing the guarantee? Is it a large national concern with significant assets?
- Is the guarantee structured to survive merger, sale, or acquisition of the company?
- What is the track record of the guarantor? Do they stand behind their promises? Do they cooperate when claims are made for indemnification on environmental risk guarantees?

Availability of environmental insurance should also be explored by the appraiser. True "environmental impairment liability" policies are available to provide site-specific coverage for some types of land uses that may create environmental risks, for example, landfills, hazardous waste storage and treatment facilities, and manufacturing sites where potential pollutants are used in or produced as a by-product of the manufacturing process.[32] These policies generally provide third-party, bodily injury and property damage coverage for loss, along with cleanup costs and legal expenses generated by pollution accidents.[33] Policy premiums can be expensive—$200,000 per year for simple third-person property damage and bodily injury coverage to $2.0 million or more for facilities that produce or store vast quantities of potential pollutants. As new insurers enter the marketplace, premium costs are expected to decrease substantially.[34] An appraiser's job is to observe the marketplace's response to the availability of such insurance programs. If the marketplace begins

29. See the testimony of Carol M. Browner, supra.

30. Ibid. Administrator Browner's testimony indicated that some of the focus will be on "soil screening guidance" to help identify appropriate portions of contaminated properties that do not need remediation, as well as on modifying remediation standards to fit the most likely land use that a property will be devoted to in the future.

31. See, for example, discussion of such programs in "Report of the Subcommitee on Land Use and Solid Waste," *The Urban Lawyer*, v. 23, no. 4 (Fall 1991): 773–784.

32. See, generally, Evelyn Hall, "EIL Is Poised for Growth," *Best's Review—Property & Casualty* (April 1995): 40–43.

33. Ibid. Usually, coverage only applies to pollution that is accidental and sudden and which takes place onsite. For an additional premium, some insurers will include first-party, offsite cleanup or coverage for non-sudden and gradual pollution.

34. Ibid., 42–43.

to consider it a standard operating expense item for certain types of property, then an appraiser may have to make an adjustment to operating expenses or to market value to reflect the costs. That may, in turn, affect the appropriate capitalization or discount rate on income-producing property.

QUESTION 10: HOW GOOD ARE THE "COMPARABLE" SALES?

As the appraisal profession becomes more comfortable with valuation of properties affected by environmental risk, it is developing a better database of sales transactions and market studies involving property affected by environmental risk. This sales information is typically collected by appraisers in one of four ways:

- From inquiries to appraisers who specialize in valuation of properties affected by environmental risk
- As a result of a notice in the Appraisal Institute's newsletter, *Appraiser News*,[35] requesting sales or other market data involving a particular risk
- From independent research into contaminated property sales, beginning with data about properties included in various federal or state lists of contaminated properties

Even the best sales information about properties affected by environmental risk obtained from a reliable source may not fit the standard definition of a comparable sale. The appraisal profession typically thinks of a comparable as property similar in many respects to the property being appraised. Often, the best the appraiser may be able to do when evaluating stigma impact of environmental risk is to find sales of other property affected by a different type or intensity of contaminant, in a different location, and for a different use. Is that a comparable? Probably not in the strict definition of the term. Nevertheless, it may be quite helpful in arriving at an opinion on the impact of stigma on value. It should properly be considered as a case study rather than a comparable sale.

When collecting sales information from other appraisers about stigma-affected properties, it is more important than ever to verify the accuracy of the information. Valuation of property affected by environmental risk is such a new area of appraisal practice that the thoroughness of data collection practices vary considerably from one appraiser to another.

As part of the evaluation of the comparable sale or case study, the appraiser may have to compare and contrast that sale with the property being appraised on many points that might affect the appraiser's conclusion regarding the amount of stigma, including the following factors:

- Type of environmental risk, contamination or event creating potential for stigma, including comparison on such points as toxicity, persistence, amount or physical extent of contamination (for example, on-site or off-site migration)
- Regulatory framework affecting the risk or substance
- Physical characteristics of the site
- Amount and quality of the testing, assessment, and monitoring (meaning the extent and reasonable accuracy of the data)
- Type and level of cleanup
- Date of sale, especially considering the importance of the five cycles
- Location
- Media coverage
- Conditions of the sale, including availability of an indemnity or insurance program
- Use of the property
- Motivations of buyers and sellers
- Lenders' attitudes

CONCLUSION

It is not enough for an appraiser today simply to conclude that if a property is contaminated, there is no market for it. That may still be true for some types of properties, but the number of such totally stigmatized properties is relatively small. It is also not good enough for the appraiser to expect that he or she will always be able to assume away the presence of the contamination and appraise the property as if unaffected by environmental risk. While there may still be times when such an approach is absolutely the right thing to do, more

35. The publication of *Appraiser News* was terminated after its December 1995 issue and its contents have been merged with *Valuation Insights & Perspectives*, a quarterly magazine, which debuted in February 1996.

and more users of appraisal services want answers to tough questions about the actual impact, if any, of specific types of environmental risk on property values, and will go to another vendor of appraisal services if their usual appraiser rejects the assignment.

But in valuing property affected by environmental risk, appraisers have to be ever alert to the nuances of the marketplace. Our job, as always, is to look to the marketplace to see how it actually prices property and determines value. As the marketplace adjusts to risks and prices the real estate product to reflect changing perceptions, so too must old appraisal theory give way to new professional practice techniques that incorporate those changes in the marketplace.

That is especially true today in the rapidly changing practice area involving contaminated properties and other forms of real estate affected by environmental risk. The appraiser's job is to ask the right questions and then listen to the market as it reveals its reasons for acting the way it does. Only if the appraiser does that can he or she gain enough understanding of the market to apply that knowledge to other appraisal situations correctly.

PO45503

EXHIBIT C

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

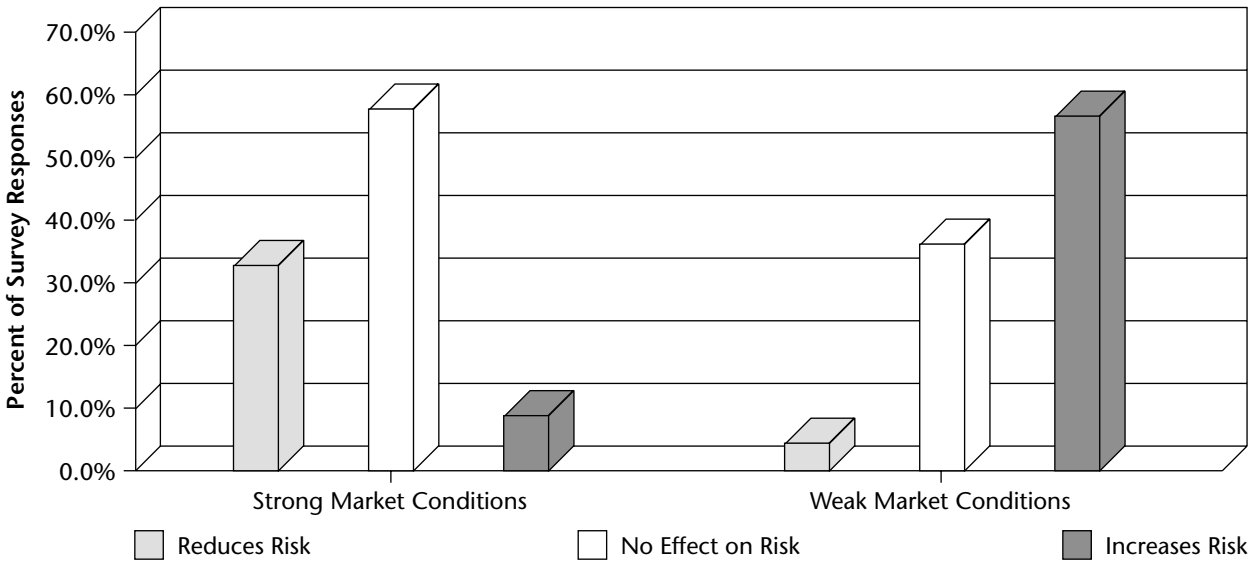
Property Type

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]

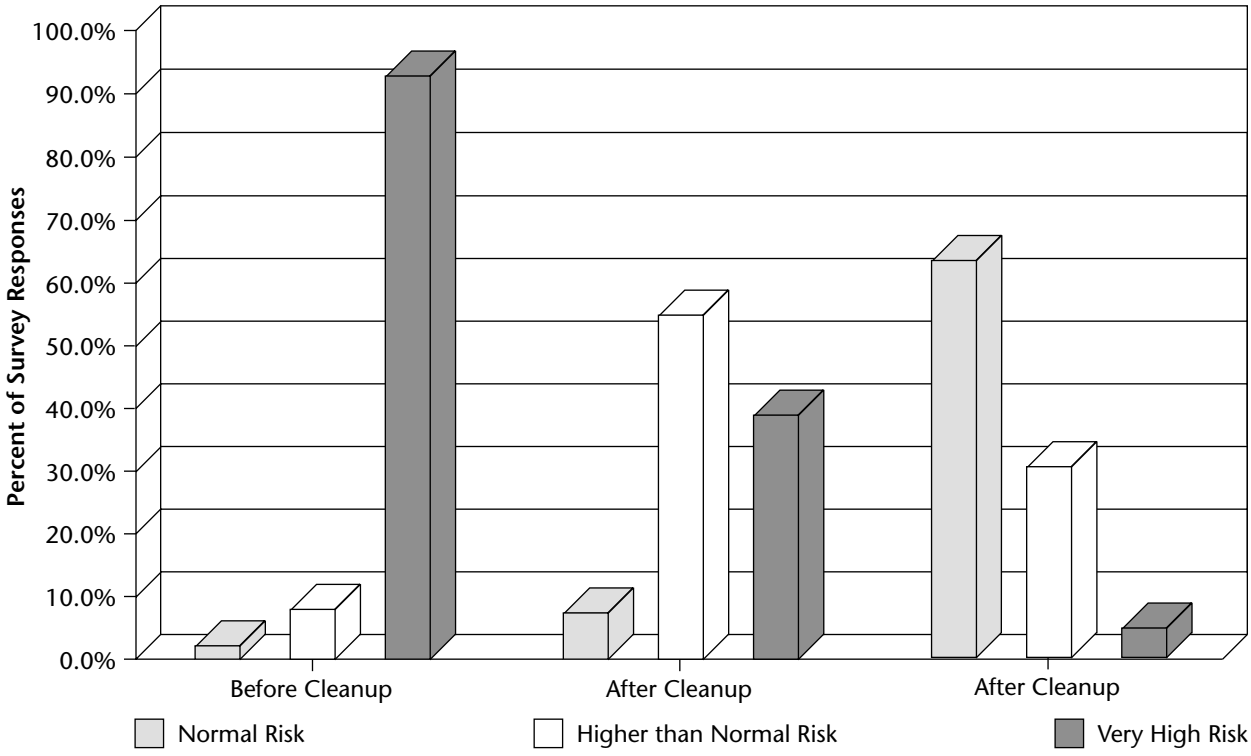
The Before Cleanup/Assessment Stage

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-

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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.