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Groundwater Research Report  
WRC GRR 95-06

**THE ECONOMIC EFFECTS OF GROUNDWATER  
CONTAMINATION ON REAL ESTATE**

Harvey Rabinowitz  
G. William Page

1995  
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# CONTAMINATION ON REAL ESTATE

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Groundwater Research Report  
WRC GRR 95-06  
University of Wisconsin System  
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1995

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Investigations on which this report is based were completed in 1992.

## ABSTRACT

The effect of property contamination has been considerable in the real estate sector; other factors are transitory. Overbuilding is absorbed, difficulties in obtaining financing become less restrictive; and onerous taxes are moderated. Contamination has affected commercial real estate transactions including sales, leases, financing and assessments, and participants (single-family dwellings are different). Standard real estate forms have been modified; loan underwriting criteria now include hazards; specialists have been added to commercial real estate organizations; laws require notification and action; and technical firms involved in investigations and cleanup have increased. Legal problems with sites may be as devastating as cleanup costs. Many transactions have stopped due to contractual difficulties. For instance, some owners may require indemnification from the purchaser, i.e., they want to avoid future involvement with the site. The purchaser's attorney usually advises against acceptance. Even after cleanup and inspection the buyer may still not provide indemnification. The owner may also want such a clause. Financial institutions may require such warranties before committing mortgages. Owners may want to sell a property "as is" at a discounted price -- but without inspections. Effects of this issue on real estate change as the implications of hazardous materials filter through the industry. Future effects may include: Lowering the assessed value of contaminated property for tax purposes; changing the law affecting existing substances not now considered hazardous; developing specialized zoning and building regulations in fragile areas; and allocating cost of cleanup. The trend is for tougher choices to be made in the future. Some properties cost more to clean up than their market value. Owners, lenders, operators, tenants, heirs, and governments do not want involvement with such sites and will give up their interests, creating "orphaned properties." Sites are tainted with suspicion until proved immaculate and remediated sites are always suspect. Sales transactions are inevitably delayed by: 1. Inspections; 2. contractual language about contamination discovered in the future; and 3. difficulty of agreeing on a fair price. Standard contracts are being developed for commercial and residential real estate to deal with new situations.

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## ACRONYMS

ALTA	American Land Title Association
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CMO	Collatorized Mortgage Obligations
ECRA	Environmental Cleanup Responsibility Act
EPA	U.S. Environmental Protection Agency
FNMA	Federal National Mortgage Association
GNMA	Government National Mortgage Association
HMTA	Hazardous Materials Transportation Act
MGIC	Mortgage Guarantee Insurance Company
PCBs	Polychlorinated Biphenyls
PDER	Pennsylvania Department of Environmental Regulation
SARA	Superfund Amendment and Reauthorization Act
VOCs	Volatile Organic Compounds
WDNR	Wisconsin Department of Natural Resources



## **INTRODUCTION AND BACKGROUND**

The last decade has witnessed dramatic changes in the attitudes of the real estate community towards the presence of hazardous substances on sites and in buildings. In the early 1980s little concern was shown about this problem. However, strict attention to this subject has become a standard feature of real estate transactions. The sale, leasing, renovation, financing, and even inheritance of property is affected.

Much research in the area of environmental contamination has focused on the causes of contamination and effects on the environment and people. Concerns prompted epidemiological studies. Regulations as well as legal actions ensued and liability has become a major concern. The attribution of liability focused on determining the responsibility of individuals and entities, and finally, on the remediation of contaminated sites.

Regulations, the response of the marketplace, and liability issues related to contamination, have been a source of anxiety to the real estate industry. Early warnings of the nature and scope of such problems emerged in the 1970s; regulation was initiated in the early 1980s; and the marketplace was affected by the end of the 1980s. The effects are significant and have often changed real property values.

Until recently real estate values, in either the multi-family residential or the commercial and industrial categories, have been generally determined by the profitability of the properties. Such elements of value include location, e.g., access to transport and communications, and other amenities; government regulations affecting the site, such as zoning; and functional considerations, including the obsolescence and condition of the facility. Recently, environmental contamination has become an important consideration in the determination of real estate values.

In the 1980s information on the effects of toxic substance regulations was changed and liability issues were handled by the courts. While much has been settled, legal rulings, regulatory changes and new scientific information continue to create uncertainty in the real estate market.

In the context of uncertainty in real estate, groundwater contamination has added a new dimension to assessment of property values. Groundwater contamination is subject to all of the precedents in the areas of regulation, law and the marketplace. However, groundwater degradation has characteristics that amplify its consequences and contributes to uncertainty. Contamination of an aquifer has an especially important impact on real estate because groundwater moves without respect for property boundaries, is not visible from the land surface, and its direction and rate of movement are difficult to predict. Even the fear of groundwater contamination can affect real estate values. Locating the source of contamination requires hydrologic monitoring and since the rate of movement of contaminants is in question, it may take appreciable time and expense before the extent of the contaminated plume is revealed. In addition, a plume of groundwater contamination may be discovered while its source remains unknown.

## GOALS

The goals of the study were to:

1. Determine if groundwater contamination affects real property values. Has the value of real estate been affected by groundwater contamination? Can the estimate of value differ based on the state of a property?
2. Examine the magnitude of the loss of value due to contamination. If there are economic effects due to the presence of toxic chemicals, what are they and how are they measured?
3. Examine whether the loss of value differs among property types. There may be differences in economic effects of contamination based on such characteristics of the property as size or scale of the property, its ownership and the uses it is subjected to.
4. Analyze effects on trends and building values issuing from groundwater degradation. Concerns about the contamination of real estate is a relatively recent but growing phenomenon.
5. Investigate the effects of contamination on other aspects of real estate. Though, in general, economic effects are quantified, there are other measures that affect property values such as whether to sell the property, the ability to lease the property or the future liability for contamination.

Those benefitting from the research include:

1. Policymakers developing regulations concerning compensation of victims of groundwater contamination and methods to calculate fair reparation for such claims.
2. Policymakers involved with legislation which affects the cleanup of contaminated sites or transactions involving potentially contaminated real estate.
3. Owners of contaminated real estate and neighboring owners.
4. Others associated contractually with such property; including financial institutions, tenants and government agencies involved with the potential ownership of real estate, and insurance companies.
5. The real estate industry in general, including brokers, real estate consultants, and attorneys.

## **THEORY**

When someone purchases real estate, a package of rights and entitlements related to the property are acquired with it. The rights encompass entitlements to the use of the real estate including rights to sell, develop, occupy, rent, use as collateral, or otherwise use the real estate owned in an economically productive manner. Contamination of a site with toxic chemicals has the potential to affect the rights and entitlements to the real estate negatively. Groundwater contamination can exacerbate the negative impacts and decrease property values.

Value in real estate exists in the perception of prospective buyers and sellers. "Where known groundwater pollution exists, the willingness of any buyer to invest in such property does not exist. Because there are always substitute properties that will perform a like function, there is not incentive to purchase property with any form of pollution" (Lunz, 1989). For example, four companies collectively spent over \$12 million on properties contaminated by previous owners and for which they became liable after purchase (Freshwater Foundation, 1989). "Some businesses have been advised to not even lease property with pollution for fear that someone might attempt to attach future liability to them as a result of their tenancy" (Lunz, 1989).

When groundwater is found to be contaminated with toxic chemicals, the package of rights and entitlements associated with real estate are usually reduced to the right to occupy the real estate. The value of such real estate has been reduced to its "value in use" rather than its "market value." Thus, it is frequently impossible to use such land as collateral for a loan because in the case of a default the lending institution would not be interested in taking the property through foreclosure (Lunz, 1989).

Groundwater contaminated with toxic chemicals affects the "highest and best use" of real estate. Property that may have been ideally located and suited to large scale development may only be suited for public park land after groundwater contamination is discovered. By affecting the potential for property development, groundwater contamination with toxic chemicals directly affects its value.

The location of property and the use of neighboring property is a prime determinant of the "highest and best" use of property and therefore of its value. The uncertainties surrounding groundwater contamination -- such as its extent, potential movement and liability -- create a climate of fear that may extend to property outside but in the vicinity of known groundwater contamination. While an understanding of real estate predicts this impact, no studies have investigated its existence.

### **Other Forms of Pollution Affecting Real Estate Value**

There are studies of the effects of other forms of pollution on real estate values. Some are general such as a study in St. Louis showing that residents are willing to pay additional premiums in housing costs to avoid flood risk, noise pollution, or air pollution (Mark, 1980). Several studies have investigated the effect of noise on property values. According to Gaurin (1976), De Vany (1976) and Mieszkowsky and Saper (1978), noise from airport operations significantly decreased property values. Traffic noise, especially from highways, lowers property values (Gamble et al., 1974; Vaughn and Huckins, 1975; Langley, 1976; Nelson, 1978).

The effects of air pollution on property values are less definitive. Anderson and Crocker (1971) and Bendarz (1975) found a significant inverse relationship between air pollution and property values, while Smith and Deyak (1975) found no statistically significant relationship.

The effects of solid waste landfills on property values is also unclear. Several studies show an inverse relationship between property values and landfills in terms of distance from the fill and degrees away from the prevailing downwind direction (Havilicek et al., 1975; Hockman et al., 1976). Other studies, however, have found no such effect (Schmalensee et al., 1975; Petit and Johnson, 1987; Zeiss and Atwater, 1989; Cartee, 1989).

Surface water pollution decreases the value of adjacent property. Residential property along polluted and clean streams in Pennsylvania were compared and the polluted streams decreased property values (Epp and Al-Ani, 1979). Along Barnegat Bay in New Jersey, beach closings because of pollution depreciated property values an average of 23% (Polhemus et al., 1985).

Most research on the costs of groundwater contamination has addressed the expense of remediation. Research has been conducted on the costs of groundwater contamination to water utilities, municipalities, and industrial properties (Page, 1987). The responses of Wisconsin municipalities to the discovery of groundwater contamination with toxic chemicals were suboptimal from an environmental perspective because of the inability to remediate groundwater contamination (Page, 1988a). The costs to Wisconsin municipalities and their publicly owned water utilities were manageable when spread across a large number of water utility customers (Page, 1988b).

Some investigations have been conducted into the loss to the municipal tax base arising from groundwater contamination. A survey in Minnesota showed that the major cost associated with groundwater contamination was tax base loss caused by real estate devaluations and lack of business development (Freshwater Foundation, 1989); five cities collectively lost over \$8 million in tax revenues.

Costs to industry of groundwater contamination is generally greater than to municipalities because of liability for past practices. In Minnesota 18 companies experiencing groundwater contamination problems spent \$21 million in site cleanup/remediation, \$13 million in consulting services, and \$7 million in soil and water testing (Freshwater Foundation, 1989).

## METHODOLOGY

The value of real estate is best determined through analysis of transactions and negotiations where such decisions are made. To obtain information involves discussions with a range of participants in the real estate industry as well as a review of such traditional sources of data as research literature and governmental statistics. A variety of methods were used to accomplish this task:

- Interviews. Interviews were conducted with owners of property, attorneys, brokers, planners, assessors, appraisers, lenders, insurers and environmental consultants. The interviews identified the implications of contamination variables on their own specialties as well as general trends. The participants' experiences in dealing with contaminated property were discussed and the potential for identifying case studies was assessed.
- Case Studies. The case studies were selected to present a range of situations, including a number of locations, functions, scales of effects, and types of contamination. Approximately half of the projects were residential and half commercial.
- Government Data. Data was collected to track property sales and assessments and determine the effects of contamination on property value.
- Literature Search. The search included information on regulatory and legal decisions; the frequency of articles on contamination in real estate journals; and changes in the forms, procedures, and documents used in various types of real estate contracts.

Possible case studies were identified through the interview process and the Wisconsin Department of Natural Resources (WDNR) well contamination files. Wells with contamination identified between 5 and 10 years ago were selected for investigation to insure that there was sufficient time to observe changes in real estate value. Wells in a variety of settings -- rural, suburban and urban -- were chosen. Controls or comparable properties -- for a sample of the residential cases -- were chosen to contrast the trend in values of properties with and without contamination. The 10 case studies represented a spectrum of contamination situations, providing an opportunity to make comparisons and identify a variety of problems.

Criteria for selecting specific sites for the case studies included:

- Whether the sites were residential or commercial. Early in this study we suspected that attitudes towards value in the two categories differed substantially. We divided the project into single family residential and commercial projects to examine this possibility.
- A few out-of-state sites were chosen to examine the possibility of different contamination, regulatory and remediation experiences. However, even in Wisconsin situations varied sufficiently to compare experiences.

- Sites were chosen to represent a range of scales of contamination.
- A number of contaminated sites where groundwater was not affected were studied for comparative purposes.

Data for most case studies were obtained through interviews with those concerned with site management. Where available, any documentation on site problems was obtained, e.g., in one case extensive information was obtained from a taped conference presentation. Interviews with participants in the various branches of the real estate industry, which would be affected by contamination, were conducted. Property owners or their representatives, financial institutions, real estate brokers, mortgage firms, municipal and state officials (including those from the WDNR, City of Milwaukee, City of Wausau, City of Pittsburgh), appraisers, title company officers, remediation consultants and attorneys were interviewed. The interviews were designed to examine the scope and growth of problems associated with contaminated properties and to ascertain the role of the organization with respect to these problems and determine the costs -- time and money -- involved in remediating such situations.

## DATA COLLECTION AND ANALYSIS

### LITERATURE SEARCH

The effects of contamination on real estate values is clearly indicated in the literature. A variety of general texts in the field of real estate (see bibliography for full citations) are addressed first. These include:

- 1983. *Income Property Lending* (Institute of Financial Education, 1983), a practical text on the subject which does not mention environmental problems in real estate.
- 1988. *Investing in Real Estate* (Case, 1988), second revised edition, briefly mentions the need for environmental impact statements for real estate projects.
- 1989. *Property Development* (McMahon, 1989), briefly discusses environmental impact statements, the Clean Air Act, existing statutes on asbestos and the possibility of additional regulations. The authors also published a journal article on the problem of toxic contamination on real estate.
- 1991. *Real Estate Development: Principles and Process* (Miles et al., 1991), discusses the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) legislation as well as state laws, and contains comment on other environmental concerns.

These texts reflect the expanding profile of the effect of toxic substances on the real estate industry. The 1983 volume does not address the subject while subsequent texts devote increasing amounts of detail. The most recent book discusses specific legislation and contains about 10 pages on environmental matters. The books reflect the situation in the real estate industry. It has taken a decade to begin to comprehend the nature of the changes that took place in the early 1980s as legislation was passed, rules for enforcement promulgated, entities sued, and legal precedents developed.

A second approach to the literature search was wide ranging in that our criteria included all articles connecting contamination to the general industry, not specifically tying property values to contamination. A set of general indices was first explored.

An index to the journal *Real Estate Issues* (index to volumes 1-15:1976-1990) references more than 300 articles. Only one was listed as published -- in 1989 -- on the subject of contamination.

Similarly, a search through a broader range of journals in the *Business Periodical Index* was made for articles on real estate and environmental contamination over the past 10 years. The search elicited only 15 articles. One was written in 1979/1980; one during 1981/1982; four in 1986/1977; one in 1987/1988; four in 1988/1989; and four in 1989/1990.

Another indicator of the growing importance of this subject is the publication of *Environmental Watch*, a newsletter established in 1989 by the Appraisal Institute -- the major organization of real estate appraisers in the United States. Newsletters are not included in the aforementioned indices, so this important resource, published quarterly, may be easily overlooked. Nevertheless, it is one of the only publications whose intent is to link the value of real property to environmental concerns.

The literature indicates the clear and recent trend towards concern over environmental issues in the real estate industry. Although the CERCLA law was passed as early as 1980, the time necessary for enforcement, litigation, interpretation, research and publication has been almost a decade. Early publications tended to be descriptive and only recently has empirically and theoretically based research been published. Our bibliography shows a rapidly growing literature in the field, one often dominated by legal concerns, but one in which questions of value and contamination are beginning to be addressed, e.g., as in the *Environmental Watch* newsletter.

### **Government Regulation of Contaminated Property**

**Federal Regulations.** The CERCLA and the Superfund Amendment and Reauthorization Act (SARA) were developed in 1980 and 1986 for cleaning up the most polluted sites in the country. The laws had a profound effect on real estate in contaminated locations. The laws themselves and the court cases that interpreted them, alarmed all those associated with contaminated sites. While these statutes provided \$8.5 billion for cleaning up hazardous sites, they also gave the U.S. Environmental Protection Agency (EPA) power to sue the entities responsible for the contamination to recover the costs of the entire cleanup process, including the investigation, actual cleanup, and administrative and enforcement costs. In addition, CERCLA includes provisions for punitive damages of up to three times the government costs as well as for jail terms.

The current owners and operators of the sites are the first targets of the Superfund agency, but all parties involved with the site or contamination can be held individually and severally liable for the cleanup's entire cost. In addition, owners and operators are often held liable for contamination which may have occurred before they were involved, and before the Superfund laws became effective. Consideration of future liability is also a possibility. Section 107(e)(1) of CERCLA also prohibits indemnification of any party responsible for a Superfund site.

Current and past owners of sites and buildings, notwithstanding their lack of responsibility for the actual contamination on the site, are held liable (*New York vs. Shore Realty* 1985; *United States vs. Argent* 1984) as are those actually causing the contamination. Although they were "passive owners," the owners in the North Shore case knew that hazardous substances were being brought to the site. However, what of the "innocent landowner," the owner who is not directly involved in the contamination caused by a third party such as a tenant? Although the owner in this case may have no contractual relationship dealing with contamination in any way and may exercise care in preventing contamination, he/she too, is liable under SARA section 101(35). Other provisions under SARA almost eliminate the possibility of an "innocent landowner" defense.

A further court interpretation (*United States vs. Mirabile*, 1985) held that lenders may be liable. The lender in this case helped the borrowing company with its financial management only and was not liable. However, if the lender had made environmental decisions or been involved in day-to-day



operations it would have assumed a degree of liability. The more recent Fleet Factors case (United States vs. Fleet Factors, 1990) concluded that the lender's degree of participation in the financial management of a company was enough to influence decisions affecting hazardous wastes and the lender was held liable. What if a bank forecloses on a company that contains contaminated substances? In the United States vs. Maryland Bank and Trust (1986), the bank which purchased property after foreclosure was also held liable. Cleanup costs of this site totaled \$550,000, compared with the bank's mortgage of \$380,000.

Legal interpretations of the Superfund legislation have penetrated the corporate field. Officers of a corporation who are personally involved in decisions affecting hazardous substances are held personally liable (United States vs. Northeastern Pharmaceutical and Chemical, 1986; United States vs. Northern Plating, 1987). Individual employees who are not management also may be liable for their own acts as in United States vs. Carr (1989). In this case, a maintenance foreman responsible for a facility was held liable "even though he was clearly neither an owner nor an operator" (see also United States vs. Johnson and Towers 1984).

The Clean Air Act, the Clean Water Act, the Hazardous Materials Transportation Act (HMTA) of 1975 and CERCLA, among others, contain provisions for criminal penalties including imprisonment.

The response of owners of contaminated properties with potential liabilities is to bring anyone who may be responsible into the case -- previous owners, operators, adjacent landowners, lessees, management entities, insurance companies, brokers, etc. These laws and their subsequent interpretations are creating a market for new and active legal expertise -- the contamination lawyer -- who must be involved in almost every property transaction and suit resulting from contaminated sites. The interviews we have conducted with real estate personnel clearly demonstrate the growth in this area. Law firms and mortgage lenders now contain environmental departments specifically focused on hazardous substances, departments which did not exist 2 years ago.

**State Regulations.** On the last day of 1983, the New Jersey Environmental Cleanup Responsibility Act (ECRA) became effective. New Jersey was the first state to create regulations requiring site cleanup on transfer of ownership of industrial property involved with hazardous substances. The transfer of ownership includes the transfer of a business, for instance, or the sale of one company to another, the cessation of operations, or bankruptcy. About 1,200 facilities were found to warrant a full environmental evaluation by ECRA in 1988, and \$70 million worth of cleanups were approved (New Jersey Department of Environmental Protection, 1988).

The seller is responsible for the cleanup. This, however, may take considerable time, and to expedite transactions a bond covering estimated cleanup cost can be posted with the state and the sale of the property completed. The amount of the bond is based on the cleanup cost and is estimated by New Jersey's Department of Environmental Protection. Some \$514 million in financial assurance is now in place to cover these transactions.

Massachusetts, Connecticut, and New York have enacted legislation similar to that in New Jersey; Illinois and Indiana have passed legislation that directs the owner of a property to disclose all contamination present and gives the purchaser time to terminate the sale based on this information.

However, the Illinois law, which became effective in 1990, has already been supplanted by owners and attorneys who are using more rigorous disclosure through the due diligence process.

Although the regulations discussed above have focused on large sources of contamination or industrial property, regulations may also affect homeowners. For example, regulation of wells may affect the value of property -- primarily rural residential property -- though some suburbs use wells. Almost all states regulate the quality of new wells for residential or commercial use. Invariably only a single, simple bacteriological test is needed before a well is approved.

Recently, however, the Michigan legislature considered a bill which would require a battery of tests for approval of a new well or upon the transfer of property containing a well. Some 83 compounds based on the EPA's known contaminants list were to be tested for. The legislation passed the Michigan House of Representatives but did not make it through the entire legislative process. One barrier to the passage of the bill was the cost of testing -- more than \$800. A new bill which would add only testing for nitrates is now being considered. The bill calls for the option of County Health Departments requiring additional testing for known problems in the area. This proposed legislation points out the varying scales of properties affected by such regulations as well as the potential for changes through additional future legislation.

### **Regulation by the Marketplace**

Though Superfund legislation and state laws have affected the liability of those responsible for contamination, values of all properties with the potential for contamination have been affected. The possibility of future liability and the potential size of such liability are clear threats to value, as are regulations that may develop in the future. In terms of real estate values, these problems are of direct concern to the owners and developers of properties, and to others having any contractual relationship with the property, e.g., financial institutions.

**Owners.** Owners of contaminated property are the first target for regulators even though they may not have been the source of the contamination or have known about it. While information on the sources of hazardous substances is collected and responsibilities determined, the owner sits on a problem property which probably cannot be sold, financed, leased or operated without cleanup. Other properties may be as problematical but their effects are not as extensive. Others have significant contamination restricted to the building and site. All these properties are problems to various degrees; all may accrue a significant loss of value and some may actually have a negative value.

Owners have a number of reasons to have environmental audits of their properties conducted. They should be aware of problems with their property, and many may have the option of remediating them over time. In addition, an environmental audit provides the owner with well documented baseline data if he/she should sell. Subsequent owners would then be held responsible for additional problems on the site.

Small and/or less sophisticated owners may be quickly overwhelmed by the size, cost, and complexity of a cleanup. Larger owners with substantial assets can more easily bear the burden of such costs.

**Lessees.** Lessees may be well aware of contamination in buildings and sites. Some lessees, such as Federal agencies or a few large corporations will not consider leasing space in buildings containing asbestos. Though this is only a small portion of potential tenants, it affects the perception and the value of real estate. One site we investigated, on which an extensive cleanup has been almost completed, has experienced difficulty renting to large national tenants because of previous problems with the property. On the other hand, owners are wary of their tenants. Leases now contain language which does not allow the use of hazardous materials.

**Financial Institutions.** Financial institutions enjoy a passive involvement with real estate, or at least they attempt to keep their role passive. These lenders solicit opportunities for mortgage investments, select the most promising, and collect interest for the life of the loan. If, however, a loan is in default or reaches the foreclosure stage, the institution's role becomes more active; a "workout" has to be conducted to increase the value of the asset now being operated or owned by the lender.

Under these circumstances a number of court interpretations have involved the financial community in a chain of liability for contaminated sites. These lenders who previously based their financing determinations on the strength of collateral, the mortgagor's *pro formas* and track record, and financial indicators, now must include an environmental review in their underwriting process. They may someday become the unwilling or unwitting owners or operators of these properties; and even if they do not have an active role, future judicial interpretations may make them responsible for the sites. Lenders who are currently in the position of taking over property due to foreclosure, or other action for nonpayment of debt service, have to think twice about a foreclosure or other action on contaminated property which may have a potentially negative value.

In addition, some states have, and others are considering "superlien" legislation. Under this legislation the state has the right to a primary environmental lien for cleaning up the site which takes precedence over the lender's first mortgage. This, in effect, can wipe out the full or partial value of a loan. The Fleet Factors Case (United States vs. Fleet Factors, 1990) is the most recent and critical case in this regard. Fleet Factors, a major creditor of a company which went bankrupt, was held responsible for the company's management decisions after bankruptcy. This included hiring contractors which were partially responsible for the contamination. The lender was found to have liability in the case. This reinforced the earlier Mirabile case (1985) which involved the mortgagee (lender). The critical distinction between the two cases was the right of the secured parties to protect their interest while at the same time not participating in the management of the enterprise which caused the liability.

Financial institutions now routinely scrutinize property for contamination during the underwriting process. Most lenders have either in-house environmental specialists to monitor existing and potential loans or they hire such expertise on an *ad hoc* basis. Since financing is critical to virtually all real estate transactions, this self regulation by the mortgage lending industry has now become a condition of the marketplace, and in a sense supplants governmental regulation. For instance, more than one interviewee noted that the finance industry is now more rigorous in reviewing potential site contamination than are state officials.

***The Secondary Mortgage Market.*** Most residential mortgages are sold by banks and other financial institutions within a few years of their origination. By selling these mortgages the financial institutions have a ready source of liquidity to fund new home mortgages. The Federal government created organizations such as Fannie Mae (FNMA - The Federal National Mortgage Association) for exactly this reason, namely to purchase mortgages from banks and put more money into circulation for new mortgages. Some 34% of all outstanding home mortgages, \$580 billion have been sold in the secondary market (Miles et al., 1991).

Because the originating lender may still service the mortgage, the owners of the property may never know the mortgage ownership has been transferred. There has been a secondary market for mortgages for some time (for instance through FNMA) and the agencies purchasing these mortgages have held them in their own accounts and collected interest. In the 1970s a new entity, the Government National Mortgage Association (GNMA) issued government-backed securities collateralized by such mortgages which became very popular investments with the public, yielding relatively high interest at a low risk. For standard home mortgages, the foreclosure rate is very low (<1%).

Currently, a number of nationally based organizations are in the process of "packaging" a large group of mortgages and selling them to investors on the public market. At each stage in the process some profit is made by the bank, the secondary purchasers and finally the financial institution issuing securities backed by home mortgages or collateralized mortgage obligations (CMOs).

At the time that these mortgage investments became popular with the public and the investment community, the environmental risks of real estate began to emerge. Participants in the industry had to protect the quality and credibility of the investments. Secondary market organizations modified their criteria for accepting home mortgages and placing responsibility for potential environmental contamination on local lenders. These criteria included:

- The value of such property should reflect environmental hazards;
- The local lending institution is responsible for examining the property for environmental problems; and
- Loan losses incurred through contamination of these properties remain the responsibility of the originating lender.

The only person actually evaluating the property for the lending institution is the appraiser and much of the responsibility lies in his/her hands.

A secondary market for commercial real estate mortgages is beginning to develop. The numbers of such offerings are still small and the ability to rate such obligations difficult. This market may grow in importance in the future but securing such real estate is not a major factor at the present time.

***Appraisers.*** Appraisers are key to determining the value of real estate. Sellers of real estate use appraisers to determine a value for their property so they can establish an asking price; purchasers use appraisers to help them formulate an offer for property; banks and other lenders use appraisers to help

them calculate the size of the loan they should make; cities use appraisers to determine fair market values and thus the amount of property tax. Until recently the presence of hazardous substances, such as asbestos, did not affect the value of real estate; however, at the present time any prudent participant in the industry must factor such problems into the property value.

In determining the value of single family detached housing, however, we found that the effect of contamination, whether real or potential, was problematical. Almost all of the decisions relative to the acceptability and size of a home mortgage is done through paperwork and record searches. In the lending process for such homes, appraisers are the only persons actually visiting the site. Lenders may cover their environmental risks by asking for a standard well test upon sale and through an environmental "checkoff" survey for the appraiser to fill out. One of these survey forms for appraisers appears in the Appendix.

The appraiser is left with the responsibility of determining environmental hazards and potential liability. Appraiser's insurance coverage specifically does not cover such environmental inspections and insurance carriers (Price, 1990) recommend that the appraisers not fill out such surveys.

***Title Insurance Companies.*** A title company checks the chain of ownership of a property to determine if any liens, claims or other problems exist with the clear ownership of the land. A title search of a property is a standard part of any real estate transaction, as is the purchase of insurance from the same entity to protect the new owner from any liabilities from liens and clouds on the title to the land or building.

Regulations and the growing concern with environmental problems may become a large potential liability for such organizations. Title companies provide the owner with the equivalent of a warrantee that the site is "clear" from legal and monetary claims, or advise the seller and purchaser of a defective title which should be remedied. What of the liability for hazardous substances that the purchaser may encounter?

The standard transaction form used by the American Land Title Association (ALTA) was modified to avoid such problems, another indicator of the change in the laws which affect the real estate industry. This change makes the responsibility of the title organization limited to those liens recorded in specific documents and places. Conversely, because of their expertise in obtaining information on the chain of title to a site, title companies provide critical information to lenders and owners. Who owned the site in the past? What activities were conducted there? Did such activities result in contamination? In part, owners and lenders make their decisions on purchasing or operating such sites based on this information. This responsibility increases the potential liability of title insurance companies for the accuracy of information. Since the total costs of remediating contamination are so large, risk to the title insurance companies is expanding. The American Land Title Association is now working on new forms to limit liability in their industry.

***Insurance Companies.*** Owners -- past and present -- are turning to their insurers -- past and present -- for relief from the liability associated with contaminated sites. Comprehensive General Liability involved with these sites when the contamination took place, or any time subsequently, are other participants in this litigation. The liability potential for such insurers is overwhelming and "most insurance companies view this exposure as the most serious economic problem of the 1990s"

(Bozarth, 1989). Insurance companies are also a likely focus for lawsuits because of their considerable assets.

Litigation between those associated with contaminated sites to assess responsibility and costs is ongoing. Some cases involved hundreds of participants and no precedent for fixing responsibilities has been found in the literature.

Mortgage insurance companies insure the risks banks take when providing loans on houses at high loan: value ratios. For instance, a bank is more likely to give a 90 or 95% loan on the value of a house when loss on the mortgage is assumed by a mortgage insurance company. The mortgage insurance company receives premiums from the homeowner -- through the bank -- for this insurance enabling the owner to make a small down payment. Mortgage insurance companies have high standards for providing insurance. Not many home loans go into default or foreclosure (<1%) and the criteria they use even decreases the chances of problem loans. The latest application form used by Mortgage Guarantee Insurance Company (MGIC), the largest such insurer, contains one area for comments on environmental hazards with the following directions: "The appraiser must comment on any conditions known or observed, as well as provide an estimate of its affect on its value." No further questions are asked.

**Law Firms.** Most of the literature we have reviewed in the area of the contamination of real estate and its effects on value concerns legal issues. Indeed, these concerns have created a mini-boom in this relatively new specialization in the legal profession. Firms that did not have any full time attorneys in this area now have entire hazardous substance groups, some of which include environmental consultants. While the number of real estate transactions and leases, which kept lawyers busy during the real estate boom of the 1980s, has withered away due to overbuilding, the amount of work involving toxic substances in real estate has substantially increased.

Most of the legal discussions concern litigation and negotiations regarding the responsibility for contaminated sites. The EPA will cleanup a Superfund site and sue various parties for the entire cleanup costs. The concerned parties, which include present and former owners, operators, manufacturers of substances, and even mortgagees, in turn, sue each other. So many organizations and individuals are involved that the legal process often can continue for years.

**Real Estate Brokers.** Real estate brokers are paid when a transaction is completed. Though transactions in the single family residential area have not been particularly affected by environmental concerns, the commercial brokerage area has been significantly affected, despite present travails of the industry due to overbuilding, the dearth of financing, and the state of the economy. The industrial real estate sector has been especially hard hit. Many transactions have not been completed because of legal concerns, particularly the need to be indemnified from future litigation and responsibility by the seller or purchaser or both. No party wants potential liability for such problems. Though the uncertainties of cleanup costs are a concern, affecting the ability to find a "comfort level" for the value of the property for those involved, legal concerns seem to be affecting transactions at least as much, if not more for certain properties. Contaminated property is difficult to sell, especially properties with substantial amounts of toxic substances. Occasionally, substantial discounts have been given to buyers in order for the motivated owner to eliminate his or her interest in such properties. Even properties which have been remediated are sold at a discount because of the risk of new discoveries.

**Local Government.** How does contaminated real estate affect local government? In the area of regulation it has been the federal and state presence that has affected buildings, sites, and building value. However, local governments are beginning to be affected by contamination.

The City of Milwaukee has stopped taking selected buildings in lieu of taxes owed. The City and County of Milwaukee provide forbearance of late property taxes for approximately 3 years, while charging interest, before initiating proceedings to take a property in lieu of those taxes. The City of Milwaukee's experience with a few contaminated properties in which the City's cleanup costs exceeded the value of the property by a factor of 10 to 20 required a change in policy. For example, a former chrome plating plant was taken in lieu of \$30,000 in taxes. The cleanup costs when completed may reach \$600,000; the value of the property after remediation will be about \$30,000. Milwaukee is no longer accepting properties which have been used in the past, or are now being used, for functions such as industrial production, gas stations, and cleaning stores. Some 108 such sites were listed as of May 1991 with a potential cleanup cost of \$30 to \$40 million.

Many of the properties have been abandoned and the City of Milwaukee is even loath to fence in or manage the properties for safety reasons. Participation in the operations or management of a property when taken by a creditor may lead to liability as found in the Fleet Factors, Mirabile, or Maryland Bank cases. If the city takes title in lieu of taxes it owns the contaminated property; if the property is fenced in for safety reasons the city may be liable by virtue of its management role. In both cases the potential for substantial liability is real. Some abandoned properties are becoming public nuisances. The owners have left them; the cities will not control them; and they are a problem in the neighborhood. What should be done?

A second potential problem regarding the effects of contaminated properties on municipal government is on assessments for property tax. If a property has a significant defect, such as contamination, should it be valued at the same amount as a comparable property next door without such a defect? If the contaminated property is valued less its owners would pay less taxes. A relatively old city, such as Milwaukee, which has a large number of relatively old industrial properties, can lose a considerable portion of its tax base. Even buildings only a few decades old which contain asbestos may provide a case for a lowered assessment,.

A few owners have appealed their valuations based on contamination. The valuation of a major New York office building was significantly reduced due to the presence of asbestos fireproofing. The assessment of the building was reduced for a number of reasons, but many millions of the total reduction of \$360 million was attributable directly to asbestos. In two Michigan cases assessments were reduced for homes that were near heavily contaminated landfills. However, the Supreme Court of New Jersey held that the cleanup costs were a part of an ongoing business and not part of the value of the site. Thus, there are inconsistencies in court decisions leaving the possibility for a number of other types of cases and decisions in which assessments may be reduced.

## **CONCLUSIONS**

### **OVERALL EFFECTS OF CONTAMINATION ON THE REAL ESTATE INDUSTRY**

The effect of hazardous contamination on the real estate industry has been considerable. While the effects of other factors on real estate are significant, they are transitory. Overbuilding will be absorbed over time, as has occurred in previous markets; the difficulties of obtaining financing will be gradually replaced by a less restrictive process; onerous tax rules will be moderated. In time, these issues will be forgotten; however, the investigation of contamination in real estate through the due diligence procedures, will continue to be required in all real estate transactions, as well as in the management of real estate.

The research conducted for this study demonstrates that the issue of contamination has affected all commercial real estate transactions, including sales, leases, financing, assessments, and all participants in the process (effects on single family dwellings are quite different and are discussed later). Standard real estate forms used on a national and statewide basis have been modified; loan underwriting criteria now includes the investigation of hazards; personnel specializing in this area have been added to all organizations involved in commercial real estate transactions; an increasing number of national and state laws require notification and action in this area; the business of and the number of technical firms involved in investigations and cleanup in this area have rapidly increased. The effects have been universal and comprehensive.

Legal costs and problems with sites may sometimes be as problematic as the cleanup costs. Many transactions have not been completed because of contractual difficulties. For instance, a number of owners may require indemnification from the purchaser; in other words, they want to avoid all future involvement with the site, and the purchaser's attorneys advise against such clauses. Even after a complete cleanup and an inspection by the purchaser's consultants, the buyer may still not provide an indemnification. The owner may also want such a clause. Financial institutions may also require warranties before committing mortgages. Other owners may want to sell a property "as is" at a very heavily discounted price, but without any inspections. Even inheriting property or acquiring property through donations can be problematical.

The effects of this issue on real estate continue to evolve as the industry becomes aware of the implications of hazardous materials. The results of recent litigation are also affecting others in the industry. Future effects may be as significant as those during the past decade and include decreasing the assessed-value of a contaminated property; changes in the laws affecting existing substances not now considered hazardous; the state of sites with contamination, where compensation is not available from previous owners and operators or other parties; the development of specialized zoning and building regulations in fragile geological and hydrological areas; the cost of cleanups; etc.

In some cases the effects will be onerous. The cost of cleaning up some properties will exceed their market values. Owners, lenders, operators, tenants, heirs, and governments do not want to be



involved with such sites and will increasingly abandon their interest in such properties -- creating a state of "limbo" for these orphaned properties.

Even clean sites are held suspect until proven otherwise and those that have been remediated are not above suspicion. All sales transactions are now inevitably delayed by phase one and possibly phase two inspections, contractual language to allocate responsibility if any contamination is ever discovered in the future, and the difficulty of coming to an agreement on the purchase price.

The effects of hazardous substances on real estate are widespread. Standard procedures and contracts have been, and are still being developed in all aspects of the commercial and residential real estate industry to deal with these situations as experience with contaminated real estate is gained.

## **EFFECTS ON VALUE**

The valuation of real estate is not perfect by any means, but there is a known market, and market prices, as well as professional and reasonably standard methods to value property. For commercial real estate the income approach is used; that is, the projected income from the property, or its productivity as an operating property, is the basis for its value. If a property is projected to generate large revenues in the future then a buyer is willing to pay more for the building. Other property, notably land, is based on market value or transactions on comparable sites. This is the price on which a willing buyer and a willing seller can agree.

In the commercial and land markets other variables must be considered in the calculation of value. Some variables are well known and are relatively fixed (e.g., the effect of tax laws on income from real estate). Some variables are not fixed but their escalation can be extrapolated with some certainty or controlled in some other way, such as passing such costs on to lessees. Energy costs may be placed in this category. Increases in property taxes can also seriously affect the profitability of real estate and owners attempt to insure against such escalation by passing these costs on to tenants, through lease terms if possible. For many costs and in many buildings such "pass through" clauses are not possible and escalation remains part of the risk in real estate investment. There are also market risks, such as the development of competitive projects, changing demographics, changes in the local and national economy, etc. These are the traditional risks and exposures with which the participants in real estate are familiar and are willing to accept in exchange for the rewards from their properties. These are known risks and ones which can be estimated in the calculation of value for investment purposes. In some cases even probabilistic approaches to value have been used to measure the sensitivity of changes in a number of these variables to investment returns.

In contrast to these procedures, the issue of real estate containing hazardous substances is not easily managed. Uncertainty exists because substantial changes have taken place which affect property values, and such changes are still being made. For instance:

- Environmental considerations did not seriously affect the value of real estate before the 1980s. Thus, owners purchased and ascribed value to their real estate without considering this variable.
- Governmental regulations in this area are retroactive, i.e., contamination that has already occurred must be remediated. In contrast, zoning and building code provisions are not retroactive.

- The sums involved in cleanups can be very large and significantly affect the value and operations of real estate.
- Changes in the regulatory and legal environment are still occurring.
- Property is in a state of "limbo" if hazards are discovered. The time involved in the legal proceedings and remediation for such projects can be significant while leasing and other real estate transactions for the property are difficult.
- A "cloud" hangs over the property even after it is remediated. Future liability is possible, even after ownership is terminated.

For projects involving groundwater contamination uncertainty is exacerbated by the following factors:

- The contamination is hidden from view. Although extensive testing and monitoring may be conducted, the vagaries of the underground hydrology pose future risks.
- The plume of contamination can still move after the source is eliminated.
- Remediation of groundwater contamination is inherently more expensive than remediation of surface water or soil contamination because of the unknown extent of the contamination, the large quantities of water involved, the technology employed, and the additional costs of many monitoring wells.
- Neighboring properties are often affected and the additional costs of litigation, monitoring, remediating, and the decreased value of these off-site properties must be considered.

### **Values in an Uncertain Market**

The disheartening situation described above creates an imperfect market and therefore great variations in price. Owners and operators of a contaminated facility who are using it productively and with no intention to sell will place a high value on such real estate. Conversely, an owner motivated to sell a comparable property for any number of reasons, may accept a low offer.

In some ways, the uncertainty associated with contaminated property has continued to increase since the early 1980s, particularly in terms of the number of responsible parties involved with contaminated sites. In other ways, the effects of uncertainty have leveled off or diminished; there is much more experience in the remediation industry and many sites have been cleaned up at reasonable cost.

In the early and mid-1980s properties containing asbestos were perceived as extremely hazardous. While Congress developed legislation to remove all asbestos from schools, some in the real estate industry viewed this as a prelude to a larger scope of legislation outlawing asbestos completely. This legislation has not been developed, and as better understanding of asbestos problems have been gained, research on the deleterious effects of the removal process and new

findings on indoor air quality may make the removal of asbestos in many cases a moot point. Property which was severely affected by uncertainty about asbestos 10 years ago may actually have gained substantially in value since that time. Speculators who were willing to take some risk at that time by investing in such real estate have done well.

Recent wetlands legislation, which includes strict standards for the definition of wetlands, for all intents and purposes eliminated such areas for development purposes and has negatively impacted the value of such land. However, since the earlier legislation there has been a movement towards easing the strict definition of wetlands. A great proportion of these lands might again become available for development and certainly regain their former value. The General Electric Medical Systems Division in Milwaukee recently purchased wetlands at relatively low prices, given the recent market in such lands, to create significant natural buffers around their facilities. If proposed legislation is passed which redefines wetlands these areas would be valuable sites for development.

Values can fluctuate through changes in legislation and through the motivation of sellers and entrepreneurial purchasers in an uncertain market. However, notwithstanding the capriciousness of certain transactions in the marketplace, some stability has occurred as well as an ability to deal with uncertain situations.

### **Effects of Uncertainty**

The degrees of uncertainty affecting contaminated sites are beginning to be understood and placed into perspective. The panic resulting from involvement with such sites is being replaced by a reasoned approach as professionals begin handling such problems. Real estate contaminated with hazardous substances was once to be avoided at all costs; at this time there is an attitude that the costs can be calculated and such problems can be overcome. The number of property transactions which have been completed through the New Jersey ECRA law, as well as documented in the case studies in this report, indicates that reasonable procedures are now being used to modify the standard techniques to determine the value of contaminated property.

The overall effects of contamination on the value of property can now be outlined. Many transactions and remediations of contaminated properties have been negotiated and acceptable guidelines are in place.

In general, the value of a building or a site containing toxic substances is discounted by the cost to remediate the hazardous situation completely. These costs include all phase one, two, and three costs, namely inspection, testing, and remediation and any monitoring, legal, indirect and associated costs. Thus, the owner of a \$1 million property would either remediate the site before sale, or because of the necessity for expediting such transactions, the buyer and seller would obtain estimates for the entire cleanup process and lower the price by that amount.

Most of the remediation costs are now relatively well known; however, contingencies all too often arise during the cleanup process, particularly on groundwater contaminated sites, and it is in this area that most uncertainty lies. A number of real estate transactions are based on an estimate for cleanup and an adjustment in price based on the need for potential additional remediation. Often the additional cost is shared by both parties.

## Contingencies in Cleanups

The size of additional costs can vary greatly depending on a number of factors. The legal and real estate literature on contamination does not provide a rationale for modifying sales price based on the type, source, visibility, or other differing levels of risk characterizing various contamination situations. For instance, contamination with asbestos is used to ascertain the effect of contamination on value in the "Environmental Watch" newsletter. Estimating the cleanup costs for asbestos, even though the cost is significant, is a relatively certain process. The material is almost always visible, it was used in specific functional areas, and its removal costs are known. Contingencies in this case should be minimal. On the other hand, a leaking underground storage tank containing diesel fuels is a much more uncertain situation. Are there other tanks? What is the hydrological situation and how far has the contamination spread? Will the plume extend to off-site properties? How much of the aquifer will be affected? What methods should be used to inspect, remediate, and monitor the situation? Planning for contingencies by the purchaser or lessee of such a property is a considerable task.

Throughout the case studies and interviews we have noted that the element of surprise emerges as a consistent theme in dealing with contaminated groundwater sites. On one site in Pittsburgh, formerly a large steel mill, only a small and isolated amount of contamination was found. On another site, a sizable and dangerous source of contamination was found after phases 1 and 2 had been completed and the site deemed reasonably clean. An unattributed phone call located the specific area of pollution at the last minute. The material found caused years of delay and the project was completely replanned. If the same material was found today the project would not have been able to proceed due to more stringent state standards.

Contingencies then become an important addition to the negotiations for the purchase or leasing of a site. Factors include whether the contamination is above ground, in the soil, or underground; what type of contamination is present; how extensive it is; whether there is a chance that future legislation will affect levels remaining after remediation; and so on. Contingencies can be included in the terms of the contract, for instance, requiring the former and present owners to share in future costs of litigation and cleanup, or accounted for in the price of the property, or through monies held in escrow.

Though inspection, testing, remediation, and monitoring costs can be estimated, information from the interviews and case studies indicate that the methods used differ among consultants and that the cost and quality of these services can vary extensively. There may not be much correlation between cost estimates from contractors and the quality of their work. For instance, the City of Milwaukee contracts for these services as professional work which does not require a bidding process. The city feels that the qualifications of the contractor, not the cost, is a primary consideration for awarding such projects.

A number of interviewees stressed the variations in the skill and bidding by contractors in the hazardous substances remediation industry. This is not yet a professional industry, certification is not necessary, and care must be taken in choosing a contractor. The case studies reveal that some contractors have been terminated and others sued for negligence.

## **Methodology for Assessing the Value of Contaminated Sites**

Ragas and Argote (1991) present an important model for determining the effect of contamination on value. This case, which is based on asbestos in a midrise office building, is a comprehensive example which accounts for:

- inspection, testing, and remediation costs;
- costs of moving tenants to temporary quarters during remediation;
- costs of renewing the tenants' offices;
- time involved in rotating an entire office building full of tenants through this process;
- loss of income from the vacant "swing" space to house rotating tenants;
- present values of future costs to present a uniform and credible approach to understanding the present value of future costs since cleanup takes about a year.

The value calculated at the end of the cleanup process is the traditional value ascribed to the building by an appraiser using the income approach and then subtracting the present value of the costs of cleanup.

Ragas and Argote (1991) use asbestos as the example of contamination for this method. What they do not account for, however, are the contingencies and surprises often encountered with other types of contaminants.

## **WHO PAYS FOR THE CLEANUP?**

The CERCLA makes responsible parties individually and severely liable for cleanups. Since the cost of a Superfund cleanup is large only the largest organizations can actually fund such projects; thus, despite long lists of potentially responsible parties, large corporations have borne the brunt of cleanup costs. In addition, some parties responsible for contamination in the past may be out of business, insolvent, or too small to contribute to cleanup costs.

For instance, Wausau, Wisconsin has three corporations that have taken charge of cleanup costs. Sentry insurance is handling the SNE site (non-Superfund) and Weyerhaeuser and Mosinee Paper Companies are each responsible for a landfill. In the Milwaukee area Dupont Chemical has completed a major cleanup of a site that a subsidiary used in the 1950s. This was accomplished voluntarily and professionally and with very little publicity.

Another effective strategy is the basis for New Jersey's ECRA which is targeted on remediation at the time a transaction occurs. It is at this time that the large sums involved in such transactions might be used for cleanup. However, the strategy may encourage owners of contaminated sites, especially the most severely contaminated sites, not to sell because of potential losses. This is similar to building codes requiring upgrading of properties to current standards only when a certain level of remodeling is done. For the oldest, most dilapidated buildings this encourages retaining existing conditions due to the onerous cost of meeting current standards.

## **EFFECTS OF CONTAMINATION ON THE ECONOMIC VALUE OF RESIDENTIAL AND COMMERCIAL PROPERTY**

Our case studies, interviews, data collection, and literature review point towards very different results in how contamination affects the value of investment properties and single family homes. Almost any type of commercial property has been tainted with potential liability despite its location or use. In any contractual arrangement concerning these properties the potential effects of contamination are taken into account, and if present, values are adjusted. The opposite is true in the case of single family properties. Our findings indicate that such properties are deemed free of contamination and even if contamination exists, and is noted, the value of the property is not affected, or the effect is quite limited. As mentioned earlier, appraisers may make a cursory environmental survey of the site and lending institutions may require a minimum well test. However, even if contamination is found, minimal solutions at minimal cost -- e.g., a home water purification system -- usually are acceptable. Lenders in nitrate-affected areas may test for nitrates and, if found, apply the \$1,200 solution. This is a system serving only one sink and requiring periodic filter replacement; for rural areas this has proved acceptable.

For instance, many residential properties built before the 1970s -- most houses in the United States -- include asbestos containing materials. Though most of these materials are not friable, commonly used pipe and furnace insulation is a problem. In many communities or homes well water may be problematical. Approval for wells in most states requires only a test for the presence of bacteria. Analyses for nitrates, toxic metals, volatile organic compounds, etc., which are not detected by taste, are not conducted. If the residential properties were commercial or industrial properties with the same environmental conditions remediation would be necessary or the price of the property adjusted accordingly.

What is the cause of such discrepancies between commercial and single family properties? Perhaps it is the underlying circumstances between family properties? Perhaps the underlying circumstances between single family residential properties and commercial buildings and sites can explain this difference.

- The goal of the owners. Commercial properties are generally owned by knowledgeable investors; homeowners purchase a property in which to live.
- Risk. Investors in commercial property are aware that there are a number of risks involved in owning commercial property. Homeowners assume that there is no risk, i.e., the home is their future "nest egg."
- Return of property. Investors generally receive an annual return and remediation costs can be viewed as an operating expense, albeit a large one. The homeowner has the use of his/her property; the return is received on sale. However, the property may not be sold for some time and the proceeds are usually carried over to another home purchase.
- Assets. Investors have assets or can obtain funding to handle contaminated sites. Many investors are diversified and major problems with a single project will not lead to a ruinous situation. For homeowners with relatively few assets, with their home being by far their largest asset, the cost of removing contamination may be overwhelming.

- National confidence. Sixty-six percent of American households live in their own single family home. This lifestyle is a bastion of American culture and is encouraged in many ways. Imposing hardship and anxiety on this large segment of the population is not desirous or politically wise. Investors in commercial property, however, are risk oriented and losses in this area are acceptable.

In addition, the over \$500 billion in mortgage-backed securities and the millions of mortgages held by the banking system would be threatened, an unacceptable perturbation in the economic system. Where undue contamination of well water has posed threats to the health of homeowners various measures have been adopted to mitigate the costs involved. Wisconsin, for instance, has a funded program that will provide for most of the cost of an additional well for affected homes, based on qualifying income limits. For commercial properties, Wisconsin also has a fund which provides subsidies for remediation costs to the owners of a leaking underground storage tank.

## CASE STUDIES

### CASE STUDY 1

#### **Kroeger Building - 6th and National Avenue - Milwaukee, Wisconsin**

*Background and History.* The building was constructed in 1901 as the Kroeger Brothers Department Store and sold in 1919 to Clum Manufacturing which made automobile switches and controls. Chromium was used as part of the manufacturing operation. The building has not been in use for years. It is in a low income Hispanic neighborhood and is the largest structure in the area. The building is a 60,000 ft<sup>2</sup> steel frame building with concrete fireproofing. The floors are 4-inch reinforced concrete.

*Investigation and Remediation.* Inspection revealed numerous barrels on the site which held strong acids and cyanide. The building showed evidence of a number of chromium spills and asbestos was used as pipe insulation. There is also structural damage to the building from water entering through the leaking roof. Much of the concrete reinforcing mesh in the floors is exposed where the concrete has spalled off the structure and steel members are exposed.

*Costs in Money and Time.* It would cost \$75,000 to \$106,000 to remediate this building. The building is worth <\$180,000. Structural damage unrelated to the contamination is severe and may mean that the entire structure must be replaced while retaining the exterior walls. This is a building which would cost many times its real estate value to remediate and make whole. A grant of \$3.5 million is provided by the Federal Government to completely renovate the building.

### CASE STUDY 2

#### **Washington Landing Project - Herr's Island - Pittsburgh, Pennsylvania**

*Background and History.* A 44-acre industrial slum on an island is to be redeveloped into a mixed use project containing recreational facilities such as tennis courts, a rowing club, and light industrial buildings. Construction is now complete on a number of parcels. An existing bridge connects the island to Pittsburgh's south side. The City of Pittsburgh, a number of small firms, and a developer were the owners of the island. The city planning department did the master planning for this redevelopment area and the Pittsburgh Redevelopment Authority implemented the project. The city paid >\$9 million dollars to acquire the island properties.

*Investigation and Remediation.* The project was proposed in 1981 and initial environmental investigations indicated a "clean" site. After plans were completed and implementation had begun an anonymous late night, all in 1987, pinpointed a small but serious area of contamination. Polychlorinated biphenyls (PCBs) were present and were bound to the soil. This area tainted the entire site and the plans had to be redrafted. The PCBs were bound to the soil and had to be relocated; however, the closest landfill to take the soil was in Alabama and shipping costs were prohibitive. In the final plan the contaminated soils were moved to the north part of the island and placed in a giant "baggie" covered with 15 feet of fill and covered with tennis courts. The baggie was



designed to landfill standards and the bottom is above the watertable. Four monitoring wells surround the site of the contaminated soil.

*Costs in Money and Time.* The discovery of contamination had the effect of tainting the entire project. One building which had started construction was held up to 1 year and the mortgagee did not want to continue the project. Construction workers refused to work at this site. Replanning the project took >1 year. Cost of cleanup, originally estimated at about \$1 million, reached \$2.7 million and put the project on hold for 2 years. The former owner of the contaminated site shared in cleanup costs. Project administrators believe that the project could not be done today because of stricter regulations by the Pennsylvania Department of Environmental Protection (PDER).

### **CASE STUDY 3**

#### **Jones and Laughlin Site - Pittsburgh Research Park - Oakland, Pennsylvania**

*Background and History.* This is the site of the former Jones and Laughlin Steel plant located in Oakland, an area about 1 mile from downtown Pittsburgh, the University of Pittsburgh, a number of major hospitals and Carnegie Mellon University. The plant was abandoned and the Regional Industrial Development Corporation and the City intended to redevelop the site into a research park. A panel of the Urban Land Institute reviewed the site in 1985 and thought the project was feasible.

*Investigation and Remediation.* Many boring tests were conducted and the site was found free of contamination. However, an archeological investigation indicated that in 1860 industry was located at the site and could be the cause of undiscovered contamination. An area of 3.8 acres--in the middle of the site--was found to contain trace elements--an iron cyanide combination. The contamination was quite deep and isolated as well as being in a solid and stable condition. The environmental consultant indicated no problem with the site; however, the PDER indicated, while the soil does not have to be moved, buildings cannot be located over that area. A parking lot is planned for this area of the site.

*Costs in Money and Time.* The changes of plans and negotiations with the PDER caused a 1 year delay in implementing the project. Lenders are still skeptical about the contamination remaining on-site and the project is on hold for these and other reasons. The State of Pennsylvania has contributed \$28 million of the \$30 million to create this research center and its own agency (PDER) is the largest obstacle to its development.

### **CASE STUDY 4**

#### **Public Safety Building (New Jail) - CSX Site - Pittsburgh, Pennsylvania**

*Background and History.* The CSX Corporation (formerly Chesapeake Railroad) owns this former railroad yard site near the courthouse in downtown Pittsburgh. The city and county want to purchase it to construct a new jail (Public Safety Building). Dumping from trains onto the site may have occurred and there is a possibility of underground storage tanks. To expedite the process of acquiring the site the government did not want to go through condemnation procedures and wished to negotiate directly with CSX.

*Investigation and Remediation.* There was uncertainty about contamination on the site. The city performed extensive testing; about 25 borings were completed with the charges to be subtracted from the purchase price. One large underground storage tank leaking TPH was discovered. The contaminated soil was shipped to a landfill in Ohio, as landfills in Pennsylvania have more stringent criteria.

*Costs in Money and Time.* The CSX asking price for the site was \$11 million dollars. The final price for the site acquired in 1989, was \$7 million. The reduction from the asking price is because \$3 million was assigned to the investigation and remediation process.

## **CASE STUDY 5**

### **Commerce Center 2 - Oilfield - Santa Fe Springs, California**

*Background and History.* The subject is a 75-acre parcel located in Santa Fe Springs, California, 12 miles from Los Angeles and 18 miles from Anaheim along an industrial portion of Interstate 5. It is the only significant vacant parcel of land in the area. However, oilfield operations are on and surround the site and will continue to be present around the site for the next 60 years. Population pressures are increasing in the area and industrial uses are expanding. Santa Fe Energy put 121 acres on the market in 1988 and prequalified developers were selected based on their experience with similar difficult sites. Four were prequalified and MC and C won the bidding and named the development the MC and C Commerce Center. The development was ready for early occupants in 1991.

*Investigation and Remediation.* Many existing oilfield lines had to be relocated by meeting government regulations and the criteria set by the oilfield operator. After 18 months of working with the operator some oil rigs were allowed to remain on site and the developer cannot use land within 75 feet of a rig. The developer was required to clean up all contaminated soil between the surface and the water table. Typical remediation problems on former oilfields include remediation from methane gas which may explode, toxic metals used by drilling companies, and hydrocarbons. No hazardous wastes were found on the site because hydrocarbons are not defined as a hazard. However, a quarter million cubic yards of soil were contaminated with oils. The area in which these solids were found was pinpointed through the use of old aerial photographs of the site and constituted almost all the onsite problems. The aerial photographs also indicated the full extent of the ponds of hydrocarbons and these helped reduce the amount of soil needing treatment to 70,000 cubic feet. The soil was moved to onsite piles and remediated bacteriologically. The groundwater at this site contains many hydrocarbons which occur naturally in this oil rich area.

*Costs in Money and Time.* The bids and methods used by consultants were varied. A 15 to 1 range and choosing the remediation consultant was difficult. The consultant originally hired did not perform well and was replaced. It cost over \$3 million to remediate the site and the seller reduced the land cost by \$2 million to compensate for remediation. The biological method was critical to the solution because hauling the soil was not feasible. This is an example of one of the largest cleanups of this type in the country and was not achieved through regulatory actions; but by the normal development

process. Only one government agency was dealt with throughout the process, although there are 15 agencies that the developer works with.

The information in this case study was taken from "The Impact of Petroleum Contaminated Soils on In-fill Development: A Case Study" presented at a Urban Land Institute Conference.

## **CASE STUDY 6**

### **Badger Boiler & Burner - 6440 N 40th Street - Milwaukee, Wisconsin**

*Background and History.* This is a manufacturing site foreclosed by St. Francis Bank and sold in 1988 to the present owner who is trying to sell the facility. Chemical contamination was found in the groundwater and purchasers are reluctant to buy the site. Meanwhile, the lender on the property is ready to foreclose.

*Investigation and Remediation.* The present owner had a phase one audit conducted when purchasing the site and the existing underground tanks were removed and no contamination was found. In 1990 a potential purchaser used the same firm to do a phase one and two audit and methylene chloride was found (30 ppb) in the groundwater. It is 15 ppb above the limit considered minor and requires the owner not to generate activities using this product. No soil sample was found to be contaminated. There is no record of activities at this site which would have led to the contamination. However, an adjacent property is the site of a painting company and the contaminant is used as a paint stripper.

*Costs in Money and Time.* To date, \$10,000 to \$15,000 in testing costs have been expended, but the WDNR is too backlogged to clear this site which would provide the possibility of a sale. The lender may soon foreclose.

## **CASE STUDY 7**

### **Town of Stettin - Marathon County - Wisconsin**

*Background and History.* Approximately 700 homes in an area (770 parcels but some are vacant lots) served by Wausau city sewers and private wells were found to have groundwater contamination. The WDNR required that homeowners seek sources other than private wells to supply their water. The area is contiguous to the City of Wausau and the citizens of Stettin passed a referendum asking the city to annex them.

*Investigation and Remediation.* Sources of contamination were several and due to the heavy demand on the small aquifer the WDNR was unable to determine the source of the problem. Potential sources included a local dry cleaner and a gas station since the problem was volatile organic materials. No enforcement actions have been undertaken. The contamination is still present but the WDNR will not take further action because the wells have been abandoned and the area is connected to city water.

*Costs in Money and Time.* Costs associated with the water service extension were high. The property owner was responsible for a portion of the costs of the project which became a special

assessment against their property as well as the full cost of a lateral connection from the street to their homes. Each owner negotiated the cost of connection with a private contractor; those costs were unavailable. The cost of laterals is a function of the distance of the home from the main and the subsurface through which the laterals are trenched. A home located near the main, built on sandy soil will be relatively inexpensive to connect. Average costs were \$1,500 to \$4,000 per lateral. The cost that the city assessed to the project (exclusive of the laterals) was \$2.5 million.

The Victim Compensation Program (NR-123) is a WDNR program that shares the costs of replacing contaminated wells with the property owners. Only those owners whose wells were actually contaminated were compensated; those whose wells were at risk but not contaminated were not compensated. Local banks are not treating these properties any differently than any other home now that they are connected to public water.

## **CASE STUDY 8**

### **Barton Sites - Town of Barton near West Bend, Wisconsin**

*Background and History.* The Town of Barton is located adjacent to West Bend, Wisconsin (population 21,484). Until recently the town was not connected to the water supply of West Bend. A sanitary landfill operated by West Bend was closed in 1984 after 18 years of operation because it contaminated nearby residential properties.

*Investigation and Remediation.* One residential well was first affected by volatile organic compounds (VOCs) but monitoring revealed other homes as much as 0.5 miles away were also affected. Deeper, high quality wells for these residences were constructed but they also became contaminated. Further testing in the neighborhood revealed widespread contamination. In the interim, carbon filter water purifiers were used for the homes.

*Costs in Money and Time.* Though no official determination of fault was made, West Bend developed a plan to construct a municipal water line to serve the affected houses. Deep wells were ruled out as too costly (about \$20,000 each) and potentially ineffective. The municipal system will cost \$57,000 or about \$14,000 per house. The work is now complete and the municipal water supply to these residences is now acceptable.

## **CASE STUDY 9**

### **Town of Mosinee - Wisconsin**

*Background and History.* The Town of Mosinee is located 10 miles south of Wausau in Marathon County, Wisconsin. This entire area has severe groundwater problems because of a rock shield close to the surface, a high water table, sandy soil in which water moves quickly, and extensive use of pesticides.

*Investigation and Remediation.* A cluster of houses located close to an agricultural area have wells contaminated with aldicarb, a commonly used pesticide manufactured by Union Carbide, now Rhone

Poulene. The compound is a possible carcinogen. Union Carbide installed monitoring wells and is continuing to evaluate the problem.

*Costs in Money and Time.* Union Carbide has voluntarily paid for and supplied water purification systems using carbon filters to contaminated properties.

Note: The nearby Town of Whiting, adjacent to Stevens Point, Wisconsin also has a severe problem with aldicarb from agricultural uses. In this case the City of Stevens Point was able to supply Whiting with municipal water.

## **CASE STUDY 10**

### **The Gorski Landfill - Town of Mosinee, Wisconsin**

*Background and History.* The Town of Mosinee is located 10 miles south of the City of Wausau in Marathon County, in central Wisconsin. The Gorski landfill located in a rural area of the town is now inoperative.

*Investigation and Remediation.* The landfill has been the source of extensive VOC contamination. Houses were built nearby in the late 1970s and their wells are contaminated. Municipal water supply cannot be obtained and large water bladders are being used by some residents. Others are drinking the water.

*Costs in Money and Time.* The issue has not been resolved at this time.

## **CASE STUDY 11**

### **SNE - Sentry Insurance - Wausau, Wisconsin**

*Background and History.* Sentry Insurance Company, headquartered in Wausau, Wisconsin, owns a wood products manufacturing company named SNE. One part of the manufacturing process was dipping wood in tanks of the preservative, penta- or trichlorophenol. The tanks dripped constantly and the preservative permeated the soil. Sentry sold the business in 1987, but retained this plant and leased it to the purchaser.

*Investigation and Remediation.* The problems were discovered in the early 1980s. The plume from the pentachlorophenol has migrated off the SNE site to neighboring properties. There is a high concentration of pentachlorophenol contamination and Sentry is remediating the site. Barrier wells, leachbeds and many monitoring wells are in place. A biological process is being used to remediate the soil and groundwater. Vacuum extraction will be used to complete remediation at the site.

*Costs in Money and Time.* Approximately \$4,000,000 has been spent by Sentry thus far. Existing buildings on the site may have to be torn down to complete the cleanup process.

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